8467961

THE UNITED STATES OF AMERICA

TO ALL TO WHOM THESE PRESENTS SHALL COME:

UNITED STATES DEPARTMENT OF COMMERCE

United States Patent and Trademark Office

March 12, 2024

THIS IS TO CERTIFY THAT ANNEXED IS A TRUE COPY FROM THE RECORDS OF THIS OFFICE OF THE FILE WRAPPER AND CONTENTS OF:

APPLICATION NUMBER: ***10/426,928***
FILING DATE: ***April 30, 2003***
PATENT NUMBER: ***7724818***
ISSUE DATE: ***May 25, 2010***

UNITED STATES PATENT AND TRADEMARK OFFICE · DEPARTMENT OF COMMERCE

Certified by

Kathi

Performing the Functions and Duties of the
Under Secretary of Commerce
for Intellectual Property
and Director of the United States
Patent and Trademark Office

10426928 .043003

05-01-03

A

J1135 U.S. PTO
04/30/03

Practitioner's Docket No. 915-005.053 ***PATENT***

Jc821 U.S. PTO
10/426928
04/30/03

Preliminary Classification:

Proposed Class:

Subclass:

NOTE: "All applicants are requested to include a preliminary classification on newly filed patent applications. The preliminary classification, preferably class and subclass designations, should be identified in the upper right-hand corner of the letter of transmittal accompanying the application papers, for example 'Proposed Class 2, subclass 129.'" M.P.E.P. § 601, 7th ed.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Box PATENT APPLICATION
Commissioner for Patents
Washington, D.C. 20231

NEW APPLICATION TRANSMITTAL

Transmitted herewith for filing is the patent application of

Inventor(s): **Miska HANNUKSELA** and **Ye-Kui WANG**

WARNING: *37 C.F.R.§ 1.41(a)(1) points out:*

"(a) A patent is applied for in the name or names of the actual inventor or inventors.

"(1) The inventorship of a nonprovisional application is that inventorship set forth in the oath or declaration as prescribed by § 1.63, except as provided for in § 1.53(d)(4) and § 1.63(d). If an oath or declaration as prescribed by § 1.63 is not filed during the pendency of a nonprovisional application, the inventorship is that inventorship set forth in the application papers filed pursuant to § 1.53(b), unless a petition under this paragraph accompanied by the fee set forth in § 1.17(l) is filed supplying or changing the name or names of the inventor or inventors."

For (title): ***Method for Coding Sequences of Pictures***

CERTIFICATION UNDER 37 C.F.R. § 1.10*

*(Express Mail label number is **mandatory**)*
(Express Mail certification is optional.)

I hereby certify that this New Application Transmittal and the documents referred to as attached therein are being deposited with the United States Postal Service on this date, **April 30, 2003**, in an envelope as "Express Mail Post Office to Addressee," mailing Label Number **EV 252881045 US**, addressed to the Commissioner for Patents, Washington, D.C. 20231.

Margery B. Hood
(type or print name of person mailing paper)

Margery B. Hood
Signature of person mailing paper

WARNING: *Certificate of mailing (first class) or facsimile transmission procedures of 37 C.F.R. § 1.8 cannot be used to obtain a date of mailing or transmission for this correspondence.*

WARNING: *Each paper or fee filed by "Express Mail" **must** have the number of the "Express Mail" mailing label placed thereon prior to mailing. 37 C.F.R. § 1.10(b).*
*Since the filing of correspondence under § 1.10 without the Express Mail mailing label thereon is an oversight that can be avoided by the exercise of reasonable care, requests for waiver of this requirement will **not** be granted on petition." Notice of Oct. 24, 1996, 60 Fed. Reg. 56,439, at 56,442.*

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 2 of 431

1. Type of Application

This new application is for a(n)

(check one applicable item below)

☒ Original (nonprovisional)

☐ Design

☐ Plant

WARNING: *"**Do not** use this transmittal for a completion in the U.S. of an International Application under 35 U.S.C. § 37(c)(4), unless the International Application is being filed as a divisional, continuation or continuation-in-part application.*

WARNING: ***Do not** use this transmittal for the filing of a provisional application.*

NOTE: If one of the following 3 items apply, then complete and attach ADDED PAGES FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF A PRIOR U.S. APPLICATION CLAIMED and a NOTIFICATION IN PARENT APPLICATION OF THE FILING OF THIS CONTINUATION APPLICATION.

☐ Divisional
☐ Continuation
☐ Continuation-in-part (C-I-P)

2. Benefit of Prior U.S. Application(s) (35 U.S.C. §§ 119(e), 120, or 121)

NOTE: A nonprovisional application may claim an invention disclosed in one or more prior filed copending nonprovisional applications or copending international applications designating the United States of America. In order for a nonprovisional application to claim the benefit of a prior filed copending nonprovisional application or copending international application designating the United States of America, each prior application must name as an inventor at least one inventor named in the later filed nonprovisional application and disclose the named inventor's invention claimed in at least one claim of the later filed nonprovisional application in the manner provided by the first paragraph of 35 U.S.C. § 112. Each prior application must also be:

(i) An international application entitled to a filing date in accordance with PCT Article 11 and designated the United States of America; or

(ii) Complete as set forth in § 1.51(b); or

(iii) Entitled to a filing date as set forth in § 1.53(b) or § 1.53(d) and include the basic filing fee set forth in § 1.16; or

(iv) Entitled to a filing date as set forth in § 1.53(b) and have paid therein the processing and retention fee set forth in § 1.21(l) within the time period set forth in § 1.53(f).

37 C.F.R. § 1.78(a)(1).

NOTE: If the new application being transmitted is a divisional, continuation or a continuation-in-part of a parent case, or where the parent case is an International Application which designated the U.S., or benefit of a prior provisional application is claimed, then check the following item and complete and attach ADDED PAGES FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF PRIOR U.S. APPLICATION(S) CLAIMED.

WARNING: *If an application claims the benefit of the filing date of an earlier filed application under 35 U.S.C. §§ 120, 121 or 365(c), the 20-year term of that application will be based upon the filing date of the earliest U.S. application that the application makes reference to under 35 U.S.C. §§ 120,121 or 365(c). (35 U.S.C. § 154(a)(2) does not take into account, for the determination of the patent term, any application on which priority is claimed under 35 U.S.C. §§ 199, 365(a) or 365(b).) For a c-i-p application, applicant should review whether any claim in the patent that will issue is supported by an earlier application and, if not, the applicant should consider canceling the reference to the earlier filed application. The term of a patent is not based on a claim-by-claim approach. See Notice of April 14, 1995, 60 Fed. Reg. 20,195, at 20,205.*

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 3 of 431

WARNING: *When the last day of pendency of a provisional application falls on a Saturday, Sunday, or Federal holiday within the District of Columbia, any nonprovisional application claiming benefit of the provisional application* ***must*** *be filed prior to the Saturday, Sunday, or Federal holiday within the District of Columbia. See 37 C.F.R. § 1.78(a)(3).*

☐ The new application being transmitted claims the benefit of prior U.S. application(s). Enclosed are ADDED PAGES FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF PRIOR U.S. APPLICATION(S) CLAIMED.

3. Papers Enclosed

A. Required for filing date under 37 C.F.R. § 1.53(b) (Regular) or 37 C.F.R. § 1.153 (Design) Application

22 Pages of specification
7 Pages of claims
4 Sheets of drawings

WARNING: ***DO NOT*** *submit original drawings. A high quality copy of the drawings should be supplied when filing a patent application. The drawings that are submitted to the Office must be on strong, white, smooth, and non-shiny paper and meet the standards according to § 1.84. If corrections to the drawings are necessary, they should be made to the original drawing and a high-quality copy of the corrected original drawing then submitted to the Office. Only one copy is required or desired. For comments on proposed then-new 37 C.F.R. § 1.84, see Notice of March 9, 1988 (1990 O.G. 57-62).*

NOTE: "Identifying indicia, if provided, should include the application number or the title of the invention, inventor's name, docket number (if any), and the name and telephone number of a person to call if the Office is unable to match the drawings to the proper application. This information should be placed on the back of each sheet of drawing a minimum distance of 1.5 cm (5/8 inch) down from the top of the page . . ." 37 C.F.R. § 1.84(c)).

(complete the following, if applicable)

☐ The enclosed drawing(s) are photograph(s), and there is also attached a "PETITION TO ACCEPT PHOTOGRAPH(S) AS DRAWING(S)." 37 C.F.R. § 1.84(b).

☐ The enclosed drawing(s) are in color. Three (3) sets of color drawings and a "PETITION TO ACCEPT COLOR DRAWING(S)" are attached. 37 C.F.R. §§ 1.84(a)(2) and 1.84(b).

☒ formal
☐ informal

B. Other Papers Enclosed

0 Pages of declaration and power of attorney
1 Pages of abstract
0 Other _____

4. Additional papers enclosed

☐ Amendment to claims

☐ Cancel in this application claims _____ before calculating the filing fee. (At least one original independent claim must be retained for filing purposes.)

☐ Add the claims shown on the attached amendment. (Claims added have been numbered consecutively following the highest numbered original claims.)

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 4 of 431

- ☐ Preliminary Amendment
- ☐ Information Disclosure Statement (37 C.F.R. § 1.98)
- ☐ Form PTO-1449 (PTO/SB/08A and 08B)
- ☐ Citations
- ☐ Declaration of Biological Deposit
- ☐ Submission of "Sequence Listing," computer readable copy and/or amendment pertaining thereto for biotechnology invention containing nucleotide and/or amino acid sequence
- ☐ Authorization of Attorney(s) to Accept and Follow Instructions from Representative
- ☐ Special Comments
- ☐ Other

5. Declaration or oath (including power of attorney)

NOTE: A newly executed declaration is not required in a continuation or divisional application provided that the prior nonprovisional application contained a declaration as required, the application being filed is by all or fewer than all the inventors named in the prior application, there is no new matter in the application being filed, and a copy of the executed declaration filed in the prior application (showing the signature or an indication thereon that it was signed) is submitted. The copy must be accompanied by a statement requesting deletion of the names of person(s) who are not inventors of the application being filed. If the declaration in the prior application was filed under § 1.47, then a copy of that declaration must be filed accompanied by a copy of the decision granting § 1.47 status or, if a nonsigning person under § 1.47 has subsequently joined in a prior application, then a copy of the subsequently executed declaration must be filed. See 37 C.F.R. §§ 1.63(d)(1)-(3).

NOTE: A declaration filed to complete an application must be executed, identify the specification to which it is directed, identify each inventor by full name including family name and at least one given name, without abbreviation together with any other given name or initial, and the residence, post office address and country or citizenship of each inventor, and state whether the inventor is a sole or joint inventor. 37 C.F.R. § 1.63(a)(1)-(4).

NOTE: "The inventorship of a nonprovisional application is that inventorship set forth in the oath or declaration as prescribed by § 1.62, except as provided for in § 1.53(d)(4) and § 1.63(d). If an oath or declaration as prescribed by § 1.63 is not filed during the pendency of a nonprovisional application, the inventorship is that inventorship set forth in the application papers filed pursuant to § 1.53(b), unless a petition under this paragraph accompanied by the fee set forth in § 1.17(l) is filed supplying or changing the name or names of the inventor or inventors." 37 C.F.R. § 1.41(a)(1).

☐ Enclosed

Executed by

(check **all** applicable boxes)

- ☐ inventor(s).
- ☐ legal representative of inventor(s). 37 C.F.R. §§ 1.42 or 1.43.
- ☐ joint inventor or person showing a proprietary interest on behalf of inventor who refused to sign or cannot be reached.
- ☐ This is the petition required by 37 C.F.R. § 1.47 and the statement required by 37 C.F. R. § 1.47 is also attached. *See* item 13 below for fee.

☒ Not Enclosed

NOTE: Where the filing is a completion in the U.S. of an International Application or where the completion of the U.S. application contains subject matter in addition to the International Application, the application may be treated as a continuation or continuation-in-part, as the case may be, utilizing ADDED PAGE FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF PRIOR U.S. APPLICATION CLAIMED.

☐ Application is made by a person authorized under 37 C.F.R. § 1.41(c) on behalf of *all* the above named inventor(s).

(The declaration or oath, along with the surcharge required by 37 C.F.R. § 1.16(e) can be filed subsequently).

☐ Showing that the filing is authorized.
(not required unless called into question. 37 C.F.R. § 1.41(d))

6. Inventorship Statement

WARNING: *If the named inventors are each not the inventors of all the claims an explanation, including the ownership of the various claims at the time the last claimed invention was made, should be submitted.*

The inventorship for all the claims in this application is:

☐ The same.

or

☐ Not the same. An explanation, including the ownership of the various claims at the time the last claimed invention was made,

☐ is submitted.

☐ will be submitted

7. Language

NOTE: An application including a signed oath or declaration may be filed in a language other than English. An English translation of the non-English language application and the processing fee of $130.00 required by 37 C.F.R. § 1.17(k) is required to be filed with the application, or within such time as may be set by the Office. 37 C.F.R. § 1.52(d).

☒ English
☐ Non English

☐ The attached translation includes a statement that the translation is accurate. 37 C.F.R. § 1.52(d).

8. Assignment

☒ An assignment of the invention to **Nokia Corporation**

☐ is attached. A separate ☐ "COVER SHEET FOR ASSIGNMENT (DOCUMENT) ACCOMPANYING NEW PATENT APPLICATION" or ☐ FORM PTO 1595 is also attached.

☒ will follow.

NOTE: "If an assignment is submitted with a new application, send two separate letters-one for the application and one for the assignment." Notice of May 4, 1990 (1114 O.G. 77-78).

WARNING: *A newly executed "CERTIFICATE UNDER 37 C.F.R. § 3.73(b)" must be filed when a continuation-in-part application is filed by an assignee. Notice of April 30, 1993, 1150 OG 62-64.*

☐ This is a ☐ continuation ☐ divisional application and the assignment document for the parent application 0 / _____ was filed on _____.

Reel _____

Frame _____

9. Certified Copy

Certified copy(ies) of application(s)

Country	Appln. No.	Filed
Country	Appln. No.	Filed

from which priority is claimed:

☐ is (are) attached.
☐ will follow.

NOTE: The foreign application forming the basis for the claim for priority must be referred to in the oath or declaration. 37 C.F.R. § 1.55(a) and 1.63.

NOTE: This item is for any foreign priority for which the application being filed directly relates. If any parent U.S. application or International Application from which this application claims benefit under 35 U.S.C. § 120 is itself entitled to priority from a prior foreign application, then complete item 18 on the ADDED PAGES FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF PRIOR U.S. APPLICATION(S) CLAIMED.

10. Fee Calculation (37 C.F.R. § 1.16)

A. ☒ Regular application

CLAIMS AS FILED

Number filed	Number Extra	Rate	Basic Fee 37 C.F.R. § 1.16(a) $750.00
Total Claims (37 C.F.R. § 1.16(c)) **23** -20 =	3	x $18.00 =	54.00
Independent Claims (37 C.F.R. § 1.16(b)) **12** - 3 =	9	x $84.00 =	756.00
Multiple dependent claim(s), if any (37 C.F.R. § 1.16(d))		+ $280.00	

☐ Amendment canceling extra claims is enclosed.
☐ Amendment deleting multiple-dependencies is enclosed.
☒ Fee for extra claims is not being paid at this time.

NOTE: If the fees for extra claims are not paid on filing, they must be paid or the claims canceled by amendment, prior to the expiration of the time period set for response by the Patent and Trademark Office in any notice of fee deficiency. 37 C.F.R. § 1.16(d).

Filing Fee Calculation $ **1,560.00**

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 7 of 431

B. ☐ Design application
($310.00 – 37 C.F.R. § 1.16(f))

Filing Fee Calculation $_____

C. ☐ Plant application

($480.00 - 37 C.F.R. § 1.16(g))

Filing Fee Calculation $_____

11. Small Entity Statement(s)

☐ Statement(s) that this is a filing by a small entity under 37 C.F.R. §§ 1.9 and 1.27 is (are) attached.

WARNING: *"Status as a small entity must be specifically established in each application or patent in which the status is available and desired. Status as a small entity in one application or patent does not affect any other application or patent, including applications or patents which are directly or indirectly dependent upon the application or patent in which the status has been established. The refiling of an application under § 1.53 as a continuation, division, or continuation-in-part (including a continued prosecution application under § 1.53(d)), or the filing of a reissue application requires a new determination as to continued entitlement to small entity status for the continuing or reissue application. A nonprovisional application claiming benefit under 35 U.S.C. § 119(e), 120, 121, or 365(c) of a prior application, or a reissue application may rely on a statement filed in the prior application or in the patent if the nonprovisional application or the reissue application includes a reference to the statement in the prior application or in the patent or includes a copy of the statement in the prior application or in the patent and status as a small entity is still proper and desired. The payment of the small entity basic statutory filing fee will be treated as such a reference for purposes of this section." 37 C.F.R. § 1.28(a)(2).*

WARNING: *"Small entity status must not be established when the person or persons signing the. . . statement can **unequivocally** make the required self-certification." M.P.E.P., § 509.03, 6th ed., rev. 2, July 1996 (emphasis added).*

(complete the following, if applicable)

☐ Status as a small entity was claimed in prior application

_____/_____, filed on _____, from which benefit is being claimed for this application under:

35 U.S.C. § ☐ 119(e),
☐ 120,
☐ 121,
☐ 365(c),

and which status as a small entity is still proper and desired.

☐ A copy of the statement in the prior application is included.

Filing Fee Calculation (50% of **A**, **B**, or **C** above)

$_____

NOTE: *Any excess of the full fee paid will be refunded if a small entity statement and a refund request are filed within 2 months of the date of timely payment of a full fee. The two-month period is not extendable under § 1.136: 37 C.F.R. § 1.28(a).*

12. Request for International-Type Search (37 C.F.R. § 1.104(d))

(complete, if applicable)

☐ Please prepare an international-type search report for this application at the time when national examination on the merits takes place.

13. Fee Payment Being Made at This Time

☒ Not Enclosed

☒ No filing fee is to be paid at this time.
(This and the surcharge required by 37 C.F.R. § 1.16(e) can be paid subsequently.)

☐ Enclosed

☐ Filing fee $_____

☐ Recording assignment
($40.00 – 37 C.F.R. § 1.21(h))
(See attached "COVER SHEET FOR ASSIGNMENT ACCOMPANYING NEW APPLICATION.") $_____

☐ Petition fee for filing by other than all the inventors or person on behalf of the inventor where inventor refused to sign or cannot be reached.
($130.00 – 37 C.F.R. §§ 1.47 and 1.17(i)) $_____

☐ For processing an application with a specification in a non-English language
($130.00; 37 C.F.R. §§ 1.52(d) and 1.17(k)) $_____

☐ Processing and retention fee
($130.00, 37 C.F.R. §§ 1.52(d) and 1.21(l)) $_____

☐ Fee for international-type search report
($40.00; 37 C.F.R. § 1.21(e)) $_____

NOTE: 37 C.F.R. § 1.21(l) establishes a fee for processing and retaining any application that is abandoned for failing to complete the application pursuant to 37 C.F.R. § 1.53(f) and this, as well as the changes to 37 C.F.R. §§ 1.53 and 1.78(a)(1), indicate that in order to obtain the benefit of a prior U.S. application, either the basic filing fee must be paid, or the processing and retention fee of § 1.21(l) must be paid, within 1 year from the notification under § 53(f).

Total fees enclosed **$_____**

14. Method of Payment of Fees

☐ Attached is a ☐ check ☐ money order in the amount of $_____

☐ Authorization if hereby made to charge the amount of $_____

☐ to Deposit Account No. _____

☐ to credit card as shown on the attached credit card information authorization form PTO-2038

☐ Charge any additional fees required by this paper or credit any overpayment in the manner authorized above. A duplicate of this transmittal is attached.

NOTE: Fees should be itemized in such a manner that it is clear for which purpose the fees are paid. 37 C.F.R. § 1.22(b).

15. Authorization to Charge Additional Fees

WARNING: *If no fees are to be paid on filing, the following items should not be completed.*

WARNING: *Accurately count claims, especially multiple dependent claims, to avoid unexpected high charges, if extra claim charges are authorized.*

☐ The Commissioner is hereby authorized to charge the following additional fees by this paper and during the entire pendency of this application to Account No._____.

☐ 37 C.F.R. § 1.16(a), (f), or (g) (filing fees)
☐ 37 C.F.R. § 1.16(b), (c), and (d) (presentation of extra claims)

NOTE: *Because additional fees for excess or multiple dependent claims not paid on filing or on later presentation must only be paid or these claims canceled by amendment prior to the expiration of the time period set for response by the P.T.O. in any notice of fee deficiency (37 C.F.R. § 1.16(d)), it might be best not to authorize the P.T.O. to charge additional claim fees, except possibly when dealing with amendments after final action.*

☐ 37 C.F.R. § 1.16(e) (surcharge for filing the basic filing fee and/or declaration on a date later than the filing date of the application)

☐ 37 C.F.R. § 1.17(a)(1)-(5) (extension fees pursuant to § 1.136(a))

☐ 37 C.F.R. § 1.17 (application processing fees)

WARNING: *"...A written request may be submitted in an application that is an authorization to treat any concurrent or future reply, requiring a petition for an extension of time under this paragraph for its timely submission, as incorporating a petition for extension of time for the appropriate length of time. An authorization to charge all required fees, fees under § 1.17, or all required extension of time fees will be treated as a constructive petition for an extension of time in any concurrent or future reply requiring a petition for an extension of time under this paragraph for its timely submission. Submission of the fee set forth in § 1.17(a) will also be treated as a constructive petition for an extension of time in any concurrent reply requiring a petition for an extension of time under this paragraph for its timely submission." 37 C.F.R. § 1.136(a)(3).*

☐ 37 C.F.R. § 1.18 (issue fee at or before mailing of Notice of Allowance, pursuant to 37 C.F.R. § 1.311(b))

NOTE: *Where an authorization to charge the issue fee to a deposit account has been filed before the mailing of a Notice of Allowance, the issue fee will be automatically charged to the deposit account at the time of mailing the Notice of Allowance. 37 C.F.R. § 1.311(b).*

NOTE: *37 C.F.R. § 1.28(b) requires "Notification of any change in status resulting in loss of entitlement to small entity status must be filed in the application . . . prior to paying, or at the time of paying, . . . issue fee." From the wording of 37 C.F.R. § 1.28(b), (a) notification of change of status must be made even if the fee is paid as "other than a small entity" and (b) no notification is required if the change is to another small entity.*

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 10 of 431

16. Instructions as to Overpayment

NOTE: "...Amounts of twenty-five dollars or less will not be returned unless specifically requested within a reasonable time, nor will the payer be notified of such amounts; amounts over twenty-five dollars may be returned by check or, if requested, by credit to a deposit account." 37 C.F.R. § 1.26(a).

☐ Credit Account No._____

☐ Refund

Date: **April 30, 2003**

Reg. No. **27,550**

Tel. No. **(203) 261-1234**

SIGNATURE OF PRACTITIONER

Alfred A. Fressola
(type or print name of practitioner

Ware, Fressola, Van Der Sluys & Adolphson, LLP
P.O. (Correspondence) Address

Building Five, Bradford Green
755 Main Street, P.O. Box 224
Monroe, CT 06468

Customer No. **004955**

☐ **Incorporation by reference of added pages**

(check the following item if the application in this transmittal claims the benefit of prior U.S. application(s) (including an international application entering the U.S. stage as a continuation, divisional or C-I-P application) and complete and attach the ADDED PAGES FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF PRIOR U.S. APPLICATION(S) CLAIMED.)

☐ Plus Added Pages for New Application Transmittal Where Benefit of Prior U.S. Application(s) Claimed

Number of pages added _____

☐ Plus Added Pages for Papers Referred to in Item 4 Above

Number of pages added _____

☐ Plus added pages deleting names of inventor(s) named in prior application(s) who is/are no longer inventor(s) of the subject matter claimed in this application.

Number of pages added _____

☐ Plus "Assignment Cover Letter Accompanying New Application"

Number of pages added _____

☒ **Statement Where No Further Pages Added**

(if no further pages form a part of this Transmittal, then end this Transmittal with this page and check the following item.

☒ This transmittal ends with this page.

10426928 .043003

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Practitioner's Docket No. 915-005.053 ***PATENT***

Jc821 U.S. PTO
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Commissioner for Patents
Washington, D.C. 20231

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Inventor(s): **Miska HANNUKSELA** and **Ye-Kui WANG**

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Margery B. Hood
(type or print name of person mailing paper)

Margery B. Hood
Signature of person mailing paper

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Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 13 of 431

1. Type of Application

This new application is for a(n)

(check one applicable item below)

☒ Original (nonprovisional)

☐ Design

☐ Plant

WARNING: *"**Do not** use this transmittal for a completion in the U.S. of an International Application under 35 U.S.C. § 37(c)(4), unless the International Application is being filed as a divisional, continuation or continuation-in-part application.*

WARNING: ***Do not** use this transmittal for the filing of a provisional application.*

NOTE: If one of the following 3 items apply, then complete and attach ADDED PAGES FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF A PRIOR U.S. APPLICATION CLAIMED and a NOTIFICATION IN PARENT APPLICATION OF THE FILING OF THIS CONTINUATION APPLICATION.

☐ Divisional
☐ Continuation
☐ Continuation-in-part (C-I-P)

2. Benefit of Prior U.S. Application(s) (35 U.S.C. §§ 119(e), 120, or 121)

NOTE: A nonprovisional application may claim an invention disclosed in one or more prior filed copending nonprovisional applications or copending international applications designating the United States of America. In order for a nonprovisional application to claim the benefit of a prior filed copending nonprovisional application or copending international application designating the United States of America, each prior application must name as an inventor at least one inventor named in the later filed nonprovisional application and disclose the named inventor's invention claimed in at least one claim of the later filed nonprovisional application in the manner provided by the first paragraph of 35 U.S.C. § 112. Each prior application must also be:

(i) An international application entitled to a filing date in accordance with PCT Article 11 and designated the United States of America; or

(ii) Complete as set forth in § 1.51(b); or

(iii) Entitled to a filing date as set forth in § 1.53(b) or § 1.53(d) and include the basic filing fee set forth in § 1.16; or

(iv) Entitled to a filing date as set forth in § 1.53(b) and have paid therein the processing and retention fee set forth in § 1.21(l) within the time period set forth in § 1.53(f).

37 C.F.R. § 1.78(a)(1).

NOTE: If the new application being transmitted is a divisional, continuation or a continuation-in-part of a parent case, or where the parent case is an International Application which designated the U.S., or benefit of a prior provisional application is claimed, then check the following item and complete and attach ADDED PAGES FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF PRIOR U.S. APPLICATION(S) CLAIMED.

WARNING: *If an application claims the benefit of the filing date of an earlier filed application under 35 U.S.C. §§ 120, 121 or 365(c), the 20-year term of that application will be based upon the filing date of the earliest U.S. application that the application makes reference to under 35 U.S.C. §§ 120,121 or 365(c). (35 U.S.C. § 154(a)(2) does not take into account, for the determination of the patent term, any application on which priority is claimed under 35 U.S.C. §§ 199, 365(a) or 365(b).) For a c-i-p application, applicant should review whether any claim in the patent that will issue is supported by an earlier application and, if not, the applicant should consider canceling the reference to the earlier filed application. The term of a patent is not based on a claim-by-claim approach. See Notice of April 14, 1995, 60 Fed. Reg. 20,195, at 20,205.*

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 14 of 431

WARNING: *When the last day of pendency of a provisional application falls on a Saturday, Sunday, or Federal holiday within the District of Columbia, any nonprovisional application claiming benefit of the provisional application* ***must*** *be filed prior to the Saturday, Sunday, or Federal holiday within the District of Columbia. See 37 C.F.R. § 1.78(a)(3).*

☐ The new application being transmitted claims the benefit of prior U.S. application(s). Enclosed are ADDED PAGES FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF PRIOR U.S. APPLICATION(S) CLAIMED.

3. Papers Enclosed

A. Required for filing date under 37 C.F.R. § 1.53(b) (Regular) or 37 C.F.R. § 1.153 (Design) Application

22 Pages of specification
7 Pages of claims
4 Sheets of drawings

WARNING: ***DO NOT*** *submit original drawings. A high quality copy of the drawings should be supplied when filing a patent application. The drawings that are submitted to the Office must be on strong, white, smooth, and non-shiny paper and meet the standards according to § 1.84. If corrections to the drawings are necessary, they should be made to the original drawing and a high-quality copy of the corrected original drawing then submitted to the Office. Only one copy is required or desired. For comments on proposed then-new 37 C.F.R. § 1.84, see Notice of March 9, 1988 (1990 O.G. 57-62).*

NOTE: "Identifying indicia, if provided, should include the application number or the title of the invention, inventor's name, docket number (if any), and the name and telephone number of a person to call if the Office is unable to match the drawings to the proper application. This information should be placed on the back of each sheet of drawing a minimum distance of 1.5 cm (5/8 inch) down from the top of the page . . ." 37 C.F.R. § 1.84(c)).

(complete the following, if applicable)

☐ The enclosed drawing(s) are photograph(s), and there is also attached a "PETITION TO ACCEPT PHOTOGRAPH(S) AS DRAWING(S)." 37 C.F.R. § 1.84(b).

☐ The enclosed drawing(s) are in color. Three (3) sets of color drawings and a "PETITION TO ACCEPT COLOR DRAWING(S)" are attached. 37 C.F.R. §§ 1.84(a)(2) and 1.84(b).

☒ formal
☐ informal

B. Other Papers Enclosed

0 Pages of declaration and power of attorney
1 Pages of abstract
0 Other _____

4. Additional papers enclosed

☐ Amendment to claims

☐ Cancel in this application claims _____ before calculating the filing fee. (At least one original independent claim must be retained for filing purposes.)

☐ Add the claims shown on the attached amendment. (Claims added have been numbered consecutively following the highest numbered original claims.)

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 15 of 431

- ☐ Preliminary Amendment
- ☐ Information Disclosure Statement (37 C.F.R. § 1.98)
- ☐ Form PTO-1449 (PTO/SB/08A and 08B)
- ☐ Citations
- ☐ Declaration of Biological Deposit
- ☐ Submission of "Sequence Listing," computer readable copy and/or amendment pertaining thereto for biotechnology invention containing nucleotide and/or amino acid sequence
- ☐ Authorization of Attorney(s) to Accept and Follow Instructions from Representative
- ☐ Special Comments
- ☐ Other

5. Declaration or oath (including power of attorney)

NOTE: A newly executed declaration is not required in a continuation or divisional application provided that the prior nonprovisional application contained a declaration as required, the application being filed is by all or fewer than all the inventors named in the prior application, there is no new matter in the application being filed, and a copy of the executed declaration filed in the prior application (showing the signature or an indication thereon that it was signed) is submitted. The copy must be accompanied by a statement requesting deletion of the names of person(s) who are not inventors of the application being filed. If the declaration in the prior application was filed under § 1.47, then a copy of that declaration must be filed accompanied by a copy of the decision granting § 1.47 status or, if a nonsigning person under § 1.47 has subsequently joined in a prior application, then a copy of the subsequently executed declaration must be filed. See 37 C.F.R. §§ 1.63(d)(1)-(3).

NOTE: A declaration filed to complete an application must be executed, identify the specification to which it is directed, identify each inventor by full name including family name and at least one given name, without abbreviation together with any other given name or initial, and the residence, post office address and country or citizenship of each inventor, and state whether the inventor is a sole or joint inventor. 37 C.F.R. § 1.63(a)(1)-(4).

NOTE: "The inventorship of a nonprovisional application is that inventorship set forth in the oath or declaration as prescribed by § 1.62, except as provided for in § 1.53(d)(4) and § 1.63(d). If an oath or declaration as prescribed by § 1.63 is not filed during the pendency of a nonprovisional application, the inventorship is that inventorship set forth in the application papers filed pursuant to § 1.53(b), unless a petition under this paragraph accompanied by the fee set forth in § 1.17(l) is filed supplying or changing the name or names of the inventor or inventors." 37 C.F.R. § 1.41(a)(1).

☐ Enclosed

Executed by

(check **all** applicable boxes)

- ☐ inventor(s).
- ☐ legal representative of inventor(s). 37 C.F.R. §§ 1.42 or 1.43.
- ☐ joint inventor or person showing a proprietary interest on behalf of inventor who refused to sign or cannot be reached.
- ☐ This is the petition required by 37 C.F.R. § 1.47 and the statement required by 37 C.F. R. § 1.47 is also attached. *See* item 13 below for fee.

☒ Not Enclosed

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 16 of 431

NOTE: Where the filing is a completion in the U.S. of an International Application or where the completion of the U.S. application contains subject matter in addition to the International Application, the application may be treated as a continuation or continuation-in-part, as the case may be, utilizing ADDED PAGE FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF PRIOR U.S. APPLICATION CLAIMED.

☐ Application is made by a person authorized under 37 C.F.R. § 1.41(c) on behalf of *all* the above named inventor(s).

(The declaration or oath, along with the surcharge required by 37 C.F.R. § 1.16(e) can be filed subsequently).

☐ Showing that the filing is authorized.
(not required unless called into question. 37 C.F.R. § 1.41(d))

6. Inventorship Statement

WARNING: *If the named inventors are each not the inventors of all the claims an explanation, including the ownership of the various claims at the time the last claimed invention was made, should be submitted.*

The inventorship for all the claims in this application is:

☐ The same.

or

☐ Not the same. An explanation, including the ownership of the various claims at the time the last claimed invention was made,

☐ is submitted.

☐ will be submitted

7. Language

NOTE: An application including a signed oath or declaration may be filed in a language other than English. An English translation of the non-English language application and the processing fee of $130.00 required by 37 C.F.R. § 1.17(k) is required to be filed with the application, or within such time as may be set by the Office. 37 C.F.R. § 1.52(d).

☒ English
☐ Non English

☐ The attached translation includes a statement that the translation is accurate. 37 C.F.R. § 1.52(d).

8. Assignment

☒ An assignment of the invention to **Nokia Corporation**

☐ is attached. A separate ☐ "COVER SHEET FOR ASSIGNMENT (DOCUMENT) ACCOMPANYING NEW PATENT APPLICATION" or ☐ FORM PTO 1595 is also attached.

☒ will follow.

NOTE: "If an assignment is submitted with a new application, send two separate letters-one for the application and one for the assignment." Notice of May 4, 1990 (1114 O.G. 77-78).

WARNING: *A newly executed "CERTIFICATE UNDER 37 C.F.R. § 3.73(b)" must be filed when a continuation-in-part application is filed by an assignee. Notice of April 30, 1993, 1150 OG 62-64.*

☐ This is a ☐ continuation ☐ divisional application and the assignment document for the parent application 0 / _____ was filed on _____.

Reel _____

Frame _____

9. Certified Copy

Certified copy(ies) of application(s)

Country	Appln. No.	Filed
Country	Appln. No.	Filed

from which priority is claimed:

☐ is (are) attached.
☐ will follow.

NOTE: The foreign application forming the basis for the claim for priority must be referred to in the oath or declaration. 37 C.F.R. § 1.55(a) and 1.63.

NOTE: This item is for any foreign priority for which the application being filed directly relates. If any parent U.S. application or International Application from which this application claims benefit under 35 U.S.C. § 120 is itself entitled to priority from a prior foreign application, then complete item 18 on the ADDED PAGES FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF PRIOR U.S. APPLICATION(S) CLAIMED.

10. Fee Calculation (37 C.F.R. § 1.16)

A. ☒ Regular application

CLAIMS AS FILED

Number filed	Number Extra	Rate	Basic Fee 37 C.F.R. § 1.16(a) $750.00
Total Claims (37 C.F.R. § 1.16(c)) **23** -20 =	3	x $18.00 =	54.00
Independent Claims (37 C.F.R. § 1.16(b)) **12** - 3 =	9	x $84.00 =	756.00
Multiple dependent claim(s), if any (37 C.F.R. § 1.16(d))		+ $280.00	

☐ Amendment canceling extra claims is enclosed.
☐ Amendment deleting multiple-dependencies is enclosed.
☒ Fee for extra claims is not being paid at this time.

NOTE: If the fees for extra claims are not paid on filing, they must be paid or the claims canceled by amendment, prior to the expiration of the time period set for response by the Patent and Trademark Office in any notice of fee deficiency. 37 C.F.R. § 1.16(d).

Filing Fee Calculation $ **1,560.00**

B. ☐ Design application
($310.00 – 37 C.F.R. § 1.16(f))

Filing Fee Calculation $_____

C. ☐ Plant application

($480.00 - 37 C.F.R. § 1.16(g))

Filing Fee Calculation $_____

11. Small Entity Statement(s)

☐ Statement(s) that this is a filing by a small entity under 37 C.F.R. §§ 1.9 and 1.27 is (are) attached.

WARNING: *"Status as a small entity must be specifically established in each application or patent in which the status is available and desired. Status as a small entity in one application or patent does not affect any other application or patent, including applications or patents which are directly or indirectly dependent upon the application or patent in which the status has been established. The refiling of an application under § 1.53 as a continuation, division, or continuation-in-part (including a continued prosecution application under § 1.53(d)), or the filing of a reissue application requires a new determination as to continued entitlement to small entity status for the continuing or reissue application. A nonprovisional application claiming benefit under 35 U.S.C. § 119(e), 120, 121, or 365(c) of a prior application, or a reissue application may rely on a statement filed in the prior application or in the patent if the nonprovisional application or the reissue application includes a reference to the statement in the prior application or in the patent or includes a copy of the statement in the prior application or in the patent and status as a small entity is still proper and desired. The payment of the small entity basic statutory filing fee will be treated as such a reference for purposes of this section." 37 C.F.R. § 1.28(a)(2).*

WARNING: *"Small entity status must not be established when the person or persons signing the. . . statement can **unequivocally** make the required self-certification." M.P.E.P., § 509.03, 6th ed., rev. 2, July 1996 (emphasis added).*

(complete the following, if applicable)

☐ Status as a small entity was claimed in prior application

_____/_____, filed on _____, from which benefit is being claimed for this application under:

35 U.S.C. § ☐ 119(e),
☐ 120,
☐ 121,
☐ 365(c),

and which status as a small entity is still proper and desired.

☐ A copy of the statement in the prior application is included.

Filing Fee Calculation (50% of **A**, **B**, or **C** above)

$_____

NOTE: Any excess of the full fee paid will be refunded if a small entity statement and a refund request are filed within 2 months of the date of timely payment of a full fee. The two-month period is not extendable under § 1.136: 37 C.F.R. § 1.28(a).

12. Request for International-Type Search (37 C.F.R. § 1.104(d))

(complete, if applicable)

☐ Please prepare an international-type search report for this application at the time when national examination on the merits takes place.

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 19 of 431

13. Fee Payment Being Made at This Time

☒ Not Enclosed

☒ No filing fee is to be paid at this time.
(This and the surcharge required by 37 C.F.R. § 1.16(e) can be paid subsequently.)

☐ Enclosed

☐ Filing fee $_____

☐ Recording assignment
($40.00 – 37 C.F.R. § 1.21(h))
(See attached "COVER SHEET FOR ASSIGNMENT ACCOMPANYING NEW APPLICATION.") $_____

☐ Petition fee for filing by other than all the inventors or person on behalf of the inventor where inventor refused to sign or cannot be reached.
($130.00 – 37 C.F.R. §§ 1.47 and 1.17(i)) $_____

☐ For processing an application with a specification in a non-English language
($130.00; 37 C.F.R. §§ 1.52(d) and 1.17(k)) $_____

☐ Processing and retention fee
($130.00, 37 C.F.R. §§ 1.52(d) and 1.21(l)) $_____

☐ Fee for international-type search report
($40.00; 37 C.F.R. § 1.21(e)) $_____

NOTE: 37 C.F.R. § 1.21(l) establishes a fee for processing and retaining any application that is abandoned for failing to complete the application pursuant to 37 C.F.R. § 1.53(f) and this, as well as the changes to 37 C.F.R. §§ 1.53 and 1.78(a)(1), indicate that in order to obtain the benefit of a prior U.S. application, either the basic filing fee must be paid, or the processing and retention fee of § 1.21(l) must be paid, within 1 year from the notification under § 53(f).

Total fees enclosed **$_____**

14. Method of Payment of Fees

☐ Attached is a ☐ check ☐ money order in the amount of $_____

☐ Authorization if hereby made to charge the amount of $_____

☐ to Deposit Account No. _____

☐ to credit card as shown on the attached credit card information authorization form PTO-2038

☐ Charge any additional fees required by this paper or credit any overpayment in the manner authorized above. A duplicate of this transmittal is attached.

NOTE: Fees should be itemized in such a manner that it is clear for which purpose the fees are paid. 37 C.F.R. § 1.22(b).

15. Authorization to Charge Additional Fees

WARNING: *If no fees are to be paid on filing, the following items should not be completed.*

WARNING: *Accurately count claims, especially multiple dependent claims, to avoid unexpected high charges, if extra claim charges are authorized.*

☐ The Commissioner is hereby authorized to charge the following additional fees by this paper and during the entire pendency of this application to Account No._____.

☐ 37 C.F.R. § 1.16(a), (f), or (g) (filing fees)
☐ 37 C.F.R. § 1.16(b), (c), and (d) (presentation of extra claims)

NOTE: *Because additional fees for excess or multiple dependent claims not paid on filing or on later presentation must only be paid or these claims canceled by amendment prior to the expiration of the time period set for response by the P.T.O. in any notice of fee deficiency (37 C.F.R. § 1.16(d)), it might be best not to authorize the P.T.O. to charge additional claim fees, except possibly when dealing with amendments after final action.*

☐ 37 C.F.R. § 1.16(e) (surcharge for filing the basic filing fee and/or declaration on a date later than the filing date of the application)

☐ 37 C.F.R. § 1.17(a)(1)-(5) (extension fees pursuant to § 1.136(a))

☐ 37 C.F.R. § 1.17 (application processing fees)

WARNING: *"...A written request may be submitted in an application that is an authorization to treat any concurrent or future reply, requiring a petition for an extension of time under this paragraph for its timely submission, as incorporating a petition for extension of time for the appropriate length of time. An authorization to charge all required fees, fees under § 1.17, or all required extension of time fees will be treated as a constructive petition for an extension of time in any concurrent or future reply requiring a petition for an extension of time under this paragraph for its timely submission. Submission of the fee set forth in § 1.17(a) will also be treated as a constructive petition for an extension of time in any concurrent reply requiring a petition for an extension of time under this paragraph for its timely submission." 37 C.F.R. § 1.136(a)(3).*

☐ 37 C.F.R. § 1.18 (issue fee at or before mailing of Notice of Allowance, pursuant to 37 C.F.R. § 1.311(b))

NOTE: *Where an authorization to charge the issue fee to a deposit account has been filed before the mailing of a Notice of Allowance, the issue fee will be automatically charged to the deposit account at the time of mailing the Notice of Allowance. 37 C.F.R. § 1.311(b).*

NOTE: *37 C.F.R. § 1.28(b) requires "Notification of any change in status resulting in loss of entitlement to small entity status must be filed in the application . . . prior to paying, or at the time of paying, . . . issue fee." From the wording of 37 C.F.R. § 1.28(b), (a) notification of change of status must be made even if the fee is paid as "other than a small entity" and (b) no notification is required if the change is to another small entity.*

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 21 of 431

16. Instructions as to Overpayment

NOTE: "...Amounts of twenty-five dollars or less will not be returned unless specifically requested within a reasonable time, nor will the payer be notified of such amounts; amounts over twenty-five dollars may be returned by check or, if requested, by credit to a deposit account." 37 C.F.R. § 1.26(a).

☐ Credit Account No._____

☐ Refund

Date: **April 30, 2003**

Reg. No. **27,550**

Tel. No. **(203) 261-1234**

SIGNATURE OF PRACTITIONER

Alfred A. Fressola
(type or print name of practitioner

Ware, Fressola, Van Der Sluys & Adolphson, LLP
P.O. (Correspondence) Address

Building Five, Bradford Green
755 Main Street, P.O. Box 224
Monroe, CT 06468

Customer No. **004955**

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 22 of 431

☐ **Incorporation by reference of added pages**

(check the following item if the application in this transmittal claims the benefit of prior U.S. application(s) (including an international application entering the U.S. stage as a continuation, divisional or C-I-P application) and complete and attach the ADDED PAGES FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF PRIOR U.S. APPLICATION(S) CLAIMED.)

☐ Plus Added Pages for New Application Transmittal Where Benefit of Prior U.S. Application(s) Claimed

Number of pages added _____

☐ Plus Added Pages for Papers Referred to in Item 4 Above

Number of pages added _____

☐ Plus added pages deleting names of inventor(s) named in prior application(s) who is/are no longer inventor(s) of the subject matter claimed in this application.

Number of pages added _____

☐ Plus "Assignment Cover Letter Accompanying New Application"

Number of pages added _____

☒ **Statement Where No Further Pages Added**

(if no further pages form a part of this Transmittal, then end this Transmittal with this page and check the following item.

☒ This transmittal ends with this page.

METHOD FOR CODING SEQUENCES OF PICTURES

Field of the Invention

The present invention relates to a method for coding sequences of pictures into a bitstream, wherein parameters are defined in a parameter set and each picture comprises information of one or more slices. The invention further relates to a method for decoding sequences of pictures from a bitstream, wherein parameters are defined in a parameter set and each picture comprises information of one or more slices. The invention also relates to a system, transmitting device, receiving device, an encoder, a decoder, an electronic device, a software program, a storage medium, and a bitstream.

Background of the Invention

Published video coding standards include ITU-T H.261, ITU-T H.263, ISO/IEC MPEG-1, ISO/IEC MPEG-2, and ISO/IEC MPEG-4 Part 2. These standards are herein referred to as conventional video coding standards.

There is a standardization effort going on in a Joint Video Team (JVT) of ITU-T and ISO/IEC. The work of JVT is based on an earlier standardization project in ITU-T called H.26L. The goal of the JVT standardization is to release the same standard text as ITU-T Recommendation H.264 and ISO/IEC International Standard 14496-10 (MPEG-4 Part 10). The draft standard is referred to as the JVT coding standard in this application, and the codec according to the draft standard is referred to as the JVT codec.

Video Communication Systems

Video communication systems can be divided into conversational and non-conversational systems. Conversational systems include video conferencing

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Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 24 of 431

and video telephony. Examples of such systems include ITU-T Recommendations H.320, H.323, and H.324 that specify a video conferencing/telephony system operating in ISDN, IP, and PSTN networks respectively. Conversational systems are characterized by the intent to minimize the end-to-end delay (from audio-video capture to the far-end audio-video presentation) in order to improve the user experience.

Non-conversational systems include playback of stored content, such as Digital Versatile Disks (DVDs) or video files stored in a mass memory of a playback device, digital TV, and streaming.

In the following, some terms relating to video information are defined for clarity. A frame contains an array of luma samples and two corresponding arrays of chroma samples. A frame consists of two fields, a top field and a bottom field. A field is an assembly of alternate rows of a frame. A picture is either a frame or a field. A coded picture is either a coded field or a coded frame. In the JVT coding standard, a coded picture consists of one or more slices. A slice consists of an integer number of macroblocks, and a decoded macroblock corresponds to a 16x16 block of luma samples and two corresponding blocks of chroma samples. In the JVT coding standard, a slice is coded according to one of the following coding types: I (intra), P (predicted), B (bi-predictive), SI (switching intra), SP (switching predicted). A coded picture is allowed to contain slices of different types. All types of pictures can be used as reference pictures for P, B, and SP slices. The instantaneous decoder refresh (IDR) picture is a particular type of a coded picture including only slices with I or SI slice types. No subsequent picture can refer to pictures that are earlier than the IDR picture in decoding order. In some video coding standards, a coded video sequence is an entity containing all pictures in the bitstream before the end of a sequence mark. In the JVT coding standard, a coded video sequence is an entity containing all coded pictures from an IDR picture (inclusive) to the next IDR picture (exclusive) in decoding order. In

other words, a coded video sequence according to the JVT coding standard corresponds to a closed group of pictures (GOP) according to MPEG-2 video.

Conventional video coding standards have specified a structure for an elementary bitstream, i.e., a self-containing bitstream that decoders can parse. The bitstream has consisted of several layers, typically including several of the following: a sequence layer, a group of pictures (GOP) layer, a picture layer, a slice layer, a macroblock layer, and a block layer. The bitstream for each layer typically comprises a header and associated data.

The codec specification itself distinguishes conceptually between a video coding layer (VCL), and the network abstraction layer (NAL). The VCL contains the signal processing functionality of the codec, things such as transform, quantization, motion search/compensation, and the loop filter. It follows the general concept of most of today's video codecs, a macroblock-based coder that utilizes inter picture prediction with motion compensation, and transform coding of the residual signal. The output of the VCL are slices: a bit string that contains the macroblock data of an integer number of macroblocks, and the information of the slice header (containing the spatial address of the first macroblock in the slice, the initial quantization parameter, and similar). Macroblocks in slices are ordered in scan order unless a different macroblock allocation is specified, using the so-called Flexible Macroblock Ordering syntax. In-picture prediction is used only within a slice.

The NAL encapsulates the slice output of the VCL into Network Abstraction Layer Units (NALUs), which are suitable for the transmission over packet networks or the use in packet oriented multiplex environments. All NAL units relating to a certain picture form an access unit. JVT's Annex B defines an encapsulation process to transmit such NALUs over byte-stream oriented networks. A stream of NAL units does not form an elementary bitstream as such because there are no start codes in NAL units, but rather NAL units have

to be framed with start codes according to Annex B of the JVT coding standard to form an elementary bitstream.

The optional reference picture selection mode of H.263 and the NEWPRED coding tool of MPEG-4 Part 2 enable selection of the reference frame for motion compensation per each picture segment, e.g., per each slice in H.263. Furthermore, the optional Enhanced Reference Picture Selection mode of H.263 and the JVT coding standard enable selection of the reference frame for each macroblock separately.

Parameter Set Concept

The JVT coding standard contains headers at slice layer and below, but it does not include picture, GOP, or sequence headers. Instead, a concept of a parameter set, introduced in ITU-T document VCEG-N55, replaces such headers. An instance of a parameter set includes all picture, GOP, and sequence level data such as picture size, display window, optional coding modes employed, macroblock allocation map, and others. Each parameter set instance includes a unique identifier. Each slice header includes a reference to a parameter set identifier, and the parameter values of the referred parameter set are used when decoding the slice. Parameter sets decouple the transmission and decoding order of infrequently changing picture, GOP, and sequence level data from sequence, GOP, and picture boundaries. Parameter sets can be transmitted out-of-band using a reliable transmission protocol as long as they are decoded before they are referred. If parameter sets are transmitted in-band, they can be repeated multiple times to improve error resilience compared to conventional video coding schemes. Preferably the parameter sets are transmitted at a session set-up time. However, in some systems, mainly broadcast ones, reliable out-of-band transmission of parameter sets is not feasible, but rather parameter sets are conveyed in-band in Parameter Set NAL units.

In order to be able to change picture parameters (such as the picture size), without having the need to transmit Parameter Set updates synchronously to the slice packet stream, the encoder and decoder can maintain a list of more than one Parameter Set. Each slice header contains a codeword that indicates the Parameter Set to be used.

This mechanism allows decoupling of the transmission of the Parameter Sets from the packet stream, and transmit them by external means, e.g. as a side effect of the capability exchange, or through a (reliable or unreliable) control protocol. It may even be possible that they are never transmitted but are fixed by an application design specification.

There are some disadvantages with pre-defined parameter sets. First, if there is a need to transmit many parameter set instances in the beginning of a session, the out-of-band method may become overburdened or the beginning latency of the session will be too long. Second, in systems lacking feasible mechanisms for reliable out-of-band transmission of parameter sets, in-band transport of Parameter Set NAL units is not reliable. Third, for broadcast applications, since the parameter sets information should be transmitted frequently to allow new users join during the broadcast process, redundant transmission of all the active parameter set instances is costly from bit-rate point of view.

Transmission of Multimedia Streams

A multimedia streaming system consists of a streaming server and a number of players, which access the server via a network. The network is typically packet-oriented and provides little or no means to guarantee quality of service. The players fetch either pre-stored or live multimedia content from the server and play it back in real-time while the content is being downloaded.

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 28 of 431

The type of communication can be either point-to-point or multicast. In point-to-point streaming, the server provides a separate connection for each player. In multicast streaming, the server transmits a single data stream to a number of players, and network elements duplicate the stream only if it is necessary.

When a player has established a connection to a server and requested for a multimedia stream, the server begins to transmit the desired stream. The player does not start playing the stream back immediately, but rather it typically buffers the incoming data for a few seconds. Herein, this buffering is referred to as initial buffering. Initial buffering helps to maintain pauseless playback, because, in case of occasional increased transmission delays or network throughput drops, the player can decode and play buffered data.

Summary of the Invention

One aim of the present invention is to avoid the problems of prior art and provide a more efficient method to transmit parameters relating to picture information. According to an advantageous embodiment of the present invention, the following method for parameter set signalling is provided:

A relatively large number of frequently used parameter set instances and their IDs are pre-defined and stored both in an encoding device and in a decoding device. When the communication starts, these pre-defined parameter sets need not be transmitted. Only the parameter sets not included in the pre-defined ones have to be transmitted, preferably at the session beginning, or transmitted in parameter set NAL units later if necessary. The system could include a definition of default parameter sets for each profile and level.

According to the invention, there exist at least two kinds of parameter sets: one for the sequence (sequence parameter set) and one for the pictures (picture parameter set).

For applications without feedback channels (digital TV) or with feedback channels of very limited use (e.g. multicast streaming with a huge number of receivers), the set of pre-defined parameter sets should be as complete as possible, from the point of view of possible systems and application scenarios. Therefore, it may be possible that no parameter sets need to be transmitted. Once a parameter set NAL unit is needed, it should be transmitted multiple times to ensure that it is correctly received.

Another inventive concept of the present invention splits the parameter set structure to multiple parameter set structures according to the persistency and target of parameters. In particular, the invention includes the concepts of sequence parameter set and picture parameter set. The selection of a correct parameter set for each parameter depends on the probable and allowed changing rate of the parameter. Parameters whose value may change in every slice or whose value is likely to change in every picture, are included in the slice header. If it is probable that a parameter remains unchanged in multiple pictures but is allowed to change in every picture, such parameter is included in a picture parameter set. Such parameters which are not allowed to change in a coded video sequence are included in the sequence parameter set. Some non-restrictive examples of such parameters are picture order count, frame number and identifier of an independently decodable picture.

In the following description the invention is described by using encoder-decoder based system, but it is obvious that the invention can also be implemented in systems in which the video signals are stored. The stored video signals can be either uncoded signals stored before encoding, encoded signals stored after encoding, or decoded signals stored after encoding and decoding process. For example, an encoder produces bitstreams. A file system receives audio and/or video bitstreams which are encapsulated *e.g.* in decoding order and stored as a file.

The encoding method according to the present invention is primarily characterized in that the method comprises:

- defining parameters in a sequence parameter set;
- defining parameters in a picture parameter set; and
- defining at least one picture parameter in a slice header, the picture parameter remaining unchanged at least in all slice headers of one picture.

The decoding method according to the present invention is primarily characterized in that the method comprises:

- recognizing a sequence parameter set and forming at least one sequence parameter pertaining to a sequence using the parameter set;
- recognizing a picture parameter set and forming at least one first picture parameter pertaining to a picture using the parameter set; and
- forming at least one second picture parameter using information of a slice header, the at least one second picture parameter remaining unchanged at least in all slice headers of one picture
- using the at least one second picture parameter in decoding.

The encoder according to the present invention is primarily characterized in that it comprises:

- means for defining parameters in a sequence parameter set;
- means for defining parameters in a picture parameter set; and
- means for defining at least one picture parameter in a slice header, the picture parameter remaining unchanged at least in all slice headers of one picture.

The decoder according to the present invention is primarily characterized in that the it comprises:

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 31 of 431

- means for recognizing a sequence parameter set and forming at least one sequence parameter pertaining to a sequence using the parameter set;
- means for recognizing a picture parameter set and forming at least one first picture parameter pertaining to a picture using the parameter set;
- means for forming at least one second picture parameter using information of a slice header, the at least one second picture parameter remaining unchanged at least in all slice headers of one picture; and
- means for using the at least one second picture parameter in decoding.

The system according to the present invention is primarily characterized in that the encoder comprises:

- means for defining parameters in a sequence parameter set;
- means for defining parameters in a picture parameter set; and
- means for defining at least one picture parameter in a slice header, the picture parameter remaining unchanged at least in all slice headers of one picture;

and the decoder comprises:

- means for recognizing a sequence parameter set and forming at least one sequence parameter pertaining to a sequence using the parameter set;
- means for recognizing a picture parameter set and forming at least one first picture parameter pertaining to a picture using the parameter set;
- means for forming at least one second picture parameter using information of a slice header, the at least one second picture parameter remaining unchanged at least in all slice headers of one picture; and
- means for using the at least one second picture parameter in decoding.

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 32 of 431

The transmitting device according to the present invention is primarily characterized in that the encoder comprises:

- means for defining parameters in a sequence parameter set;
- means for defining parameters in a picture parameter set; and
- means for defining at least one picture parameter in a slice header, the picture parameter remaining unchanged at least in all slice headers of one picture.

The receiving device according to the present invention is primarily characterized in that the decoder comprises:

- means for recognizing a sequence parameter set and forming at least one sequence parameter pertaining to a sequence using the parameter set;
- means for recognizing a picture parameter set and forming at least one first picture parameter pertaining to a picture using the parameter set;
- means for forming at least one second picture parameter using information of a slice header, the at least one second picture parameter remaining unchanged at least in all slice headers of one picture; and
- means for using the at least one second picture parameter in decoding.

The bitstream according to the present invention is primarily characterized in that it comprises:

- encoded pictures;
- sequence parameters in a sequence parameter set;
- picture parameters in a picture parameter set;
- information of a slice comprising a slice header; and
- at least one picture parameter in the slice header, the picture parameter remaining unchanged at least in all slice headers of one encoded picture.

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 33 of 431

The software program for encoding according to the present invention is primarily characterized in that the software program comprises:

- defining parameters in a sequence parameter set;
- defining parameters in a picture parameter set; and
- defining at least one picture parameter in a slice header, the picture parameter remaining unchanged at least in all slice headers of one picture.

The software program for decoding according to the present invention is primarily characterized in that the software program comprises:
the software program comprising:

- recognizing a sequence parameter set and forming at least one sequence parameter pertaining to a sequence using the parameter set;
- recognizing a picture parameter set and forming at least one first picture parameter pertaining to a picture using the parameter set;
- forming at least one second picture parameter using information of a slice header, the at least one second picture parameter remaining unchanged at least in all slice headers of one picture; and
- using the at least one second picture parameter in decoding.

The storage medium including the software program for encoding according to the present invention is primarily characterized in that the software program comprises machine executable steps for:

- defining parameters in a sequence parameter set;
- defining parameters in a picture parameter set; and
- defining at least one picture parameter in a slice header, the picture parameter remaining unchanged at least in all slice headers of one picture.

The storage medium including the software program for decoding according to the present invention is primarily characterized in that the software program comprises machine executable steps for:

- recognizing a sequence parameter set and forming at least one sequence parameter pertaining to a sequence using the parameter set;
- recognizing a picture parameter set and forming at least one first picture parameter pertaining to a picture using the parameter set;
- forming at least one second picture parameter using information of a slice header, the at least one second picture parameter remaining unchanged at least in all slice headers of one picture; and
- using the at least one second picture parameter in decoding.

The present invention improves compression efficiency. It is likely that the number of picture parameter sets is larger than the number of sequence parameter sets and the frequency of updating picture parameter sets is higher than the frequency of updating sequence parameter sets. Thus, if there were a single parameter set structure, many sequence-level parameters that remained unchanged in the previous picture parameter set (in decoding order) should be repeated. Including picture and sequence level parameters in different syntax structures helps to avoid this problem.

The present invention clarifies the persistency rules of parameter values. Certain parameter values, such as the picture size, shall remain unchanged within the sequence. Other parameter values may change from picture to picture. If there were a single parameter set structure, there should be semantic restrictions, which parameter values must not change within a sequence even though the referred parameter set may change within the sequence. Now that the sequence parameter set structure is specified, it is clear that all picture parameter sets that are referred to within a sequence must refer to the same sequence parameter set. Moreover, it is clear that all slices of a picture must refer to the same picture parameter set.

Description of the Drawings

Fig. 1 presents an illustration of dependencies between NAL packets and parameter set instances,

Fig. 2 depicts an advantageous embodiment of the system according to the present invention,

Fig. 3 depicts an advantageous embodiment of the encoder according to the present invention, and

Fig. 4 depicts an advantageous embodiment of the decoder according to the present invention.

Detailed Description of the Invention

In an advantageous embodiment of the present invention four parameter ser structures are defined: an independent GOP parameter set or a sequence parameter set, a picture parameter set, a slice parameter set, and, optionally, a presentation parameter set. Some reasons for the definition of the different parameter sets are as follows:

First, certain parameter values must remain unchanged throughout an independent GOP or within a picture. For example, the number of picture "slots" in a multi-picture buffer must not be changed during an independent GOP. Otherwise, it would be unclear how the multi-picture buffering process operates. A decoder implementation has to ensure that all the slices of a particular picture refer to the same picture parameter set. Similarly, all the slices of an independent GOP must refer to the same independent GOP parameter set. Otherwise, decoders should infer data loss or corruption.

Obtaining the same functionality with one joint parameter set requires that the decoder checks that individual parameter values remain the same within a picture or within an independent GOP.

Second, a compact syntax for parameter sets is advantageous to save bits in Parameter set NAL units. Thus, it makes sense to separate independent GOP and picture parameter sets from more frequently updated slice parameter sets.

Third, display-related parameter values do not affect decoding of a coded video stream.

Figure 1 presents an illustration of dependencies between NAL packets and parameter set instances. An arrow indicates a reference based on a parameter set identifier. The starting point of an arrow is the entity, which refers to the parameter set instance where the arrow points. The ending point of an arrow is the owner of the parameter set identifier. A slice (or a Single slice, SSP) 101, slice data partition, and IDR NAL units (IDE RP) (or independent decoder refresh NAL packets) 102 always refer to a slice parameter set 103. A slice parameter set 103 refers to a picture parameter set 104, and a picture parameter set 104 refers to both an independent GOP parameter set 105 and a presentation parameter set 106, or to a sequence parameter set. All the slices of a picture should refer to the same picture parameter set and all the slices of a sequence should refer to the same sequence parameter set.

Next, the different parameter sets according to an advantageous embodiment of the present invention will be described in more detail.

Independent GOP Parameter Set

The start of an independent GOP is identified by an Instantaneous Decoder Refresh NAL packet (IDERP). An advantageous syntax of the packet is presented in Table 1.

Independent GOP Parameter Set:
parameter_set_id
Profile
Level
Version
log2_max_picture_number_minus_4
number_of_reference_picture_buffers_minus_1
required_picture_number_update_behavior

Table 1

The meaning of the fields of the packet will now be explained. The profile field defines the coding profile in use; the level field defines the level in use within the profile; the version field defines the version in use within the profile and the level. The next field, log2_max_picture_number_minus_4, specifies the MAX_PN constant used in picture number related arithmetic. MAX_PN is calculated by raising 2 to the power of the value of this field (log2_max_picture_number_minus_4) and decrementing the calculated power of 2 by 1. The field number_of_reference_picture_buffers_minus_1 defines the total number of short- and long-term picture buffers in the multi-picture buffer. If the value of the required_picture_number_update_behavior field is 1, a specific decoder behavior in case of missing picture numbers is mandated. However, this is outside the scope of the present invention wherein it is not described in this application.

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 38 of 431

Profile, level, and version are very likely to remain unchanged in an independent GOP. Therefore, they are included in the independent GOP parameter set.

A change in reference picture buffering controls, i.e., MAX_PN, number of reference picture buffers, and required picture number update behavior, would cause an undefined decoder state. A change of these parameters in the middle of an independent GOP would not bring any benefits. Hence, the number of reference picture buffers is informed in the independent GOP parameter set. A range from 0 to 15 is considered to be a practical minimum for a picture number, and therefore smaller values are should be avoided.

Picture Parameter Set

The picture parameter set includes the fields presented in Table 2.

Picture Parameter Set
parameter_set_id of a picture_parameter_set
parameter_set_id of an independent GOP parameter set
parameter_set_id of a presentation parameter set
picture_width_in_MBs_minus_1
picture_height_in_MBs_minus_1

Table 2

The first parameter_set_id field indicates the picture_parameter_set in question. The other two parameter sets indicate the independent GOP parameter set and the presentation parameter set which will be used together with the picture parameter set in encoding and decoding of the slices referring to the picture parameter set. More than one picture parameter sets can refer to the same independent GOP parameter set and/or to the same presentation

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 39 of 431

parameter set. The picture_width_in_MBs_minus_1 field and the picture_height_in_MBs_minus_1 field define the size of the picture.

In some embodiments the picture_width_in_MBs_minus_1 field and picture_height_in_MBs_minus_1 field could reside in the independent GOP parameter set as well.

The presentation parameter set is referred to in picture level, as it is necessary to allow changes in the presentation parameters on picture-by-picture basis. For example, the presentation parameter set signals the display rectangle of the reconstructed pictures, which is directly related to the coded picture size signaled in the picture parameter set.

Slice Parameter Set

The slice parameter set includes the fields presented in Table 3.

Slice Parameter Set
parameter_set_id of a slice parameter set
parameter_set_id of a picture parameter set
entropy_coding
motion_resolution
constrained_intra_prediction_flag
multiple_prediction_frames_flag

Table 3

The entropy_coding field indicates the VLC coding type of WD2. If the value of the entropy_coding field equals to zero it indicates that non-arithmetic VLC coding of WD2 is used, whereas value one indicates that arithmetic coding VLC coding of WD2 is used.

The motion_resolution field gives information on motion resolution. If the value of the motion_resolution field equals to zero a ¼-sample motion resolution is in use, and if the value equals to one a 1/8-sample motion resolution is in use.

The constrained_intra_prediction_flag is used to provide information on prediction mode. If the constrained_intra_prediction_flag equals to zero normal intra prediction is used, whereas one stands for the constrained intra prediction. In the constrained intra prediction mode, no intra prediction is done from inter macroblocks.

The multiple_prediction_frames_flag gives information on reference picture usage for motion compensation. The multiple_prediction_frames_flag equal to zero signals that only the previous coded picture in coding order is used as a reference picture for motion compensation in P- and SP-frames and the most recent previous decoded and subsequent decoded pictures are used for motion compensation in B-frames. Otherwise, the reference picture(s) for prediction must be signaled for each macroblock.

The selected parameters for the slice parameter set were such that no reason to restrict their values to be unchanged in an entire independent GOP was found. Instead, it might be advantageous to allow changes in parameter values even within a picture. Examples of possible advantages include:

- Use of multiple reference pictures. It may make sense to restrict the number of reference pictures to one for certain parts of the picture. For example, in wireline video conferencing equipment, the encoder may treat the center of the picture better than the edges.
- Entropy coding type. It may be possible to mix multiple coded video streams to one without decoding the streams. This can be beneficial in a multi-point control unit (MCU) of a video conferencing system, for example. One endpoint may use a different entropy coding method than

another one. Thus, the "mixed" stream would contain multiple entropy coding types in a same "mixed" coded picture.

Presentation Parameter Set

The presentation parameter set includes the fields presented in Table 4.

Presentation Parameter Set
parameter_set_id of a presentation parameter set
pixel_aspect_ratio_width
pixel_aspect_ratio_height
display_rectangle_offset_top
display_rectangle_offset_left
display_rectangle_offset_bottom
display_rectangle_offset_right

Table 4

The displayed pixel aspect ratio should be pixel_aspect_ratio_width:pixel_aspect_ratio_height. The parameter values shall be relatively prime. Value 0 is preferably forbidden. The display_rectangle_offset_top field, display_rectangle_offset_left field, display_rectangle_offset_bottom field, and display_rectangle_offset_right field define the rectangle to be displayed from the coded picture. Sample units are used.

Parameter set NAL units can be used to update values of parameter sets for a video stream. The parameter update packets can be transmitted as Network Abstraction Layer Packets (NALP). A NALP consists of a NALP header (NALPH) and a NALP payload (NALPP). The NALPH is the first byte of the NALP. The NALPH itself distinguishes different NALP types and includes one bit (EI flag) indicating the presence of errors in the NALPP following the

NALPH. EI flag set to 0 means that there is no known error in the following payload whereas a 1 indicates a corrupted payload and/or a corrupted NALP type.

A Parameter set NAL unit becomes valid synchronously with the decoding process according to the specific type of the parameter set NAL unit as follows: An update of an independent GOP parameter set takes place just before the first slice of the next independent GOP (i.e., the next IDERP NAL packet) is decoded. An update of picture and presentation parameter sets takes place just before the first slice of the next picture is decoded. An update of a slice parameter set takes place substantially immediately if at least one of the contained parameters is changed. However, slice parameter set identifier used in a picture may not be redefined with different parameter values within the same coded picture.

For certain broadcast applications, such as digital TV and multicast streaming with a huge number of possible receivers, new independent GOP parameter sets, which fall out of the scope of the pre-defined ones, are likely to be updated before each independent GOP is decoded, regardless of whether or not some of the contained parameters are changed, to enable decoding in terminals that just started receiving the coded data. Other parameter sets are updated before they are referred to in the coded data.

An advantageous embodiment of a system in which the present invention can be implemented is presented in Fig. 2. The pictures to be encoded can be, for example, pictures of a video stream from a video source 3, *e.g.* a camera, a video recorder, etc. The pictures (frames) of the video stream can be divided into smaller portions such as slices. The slices can further be divided into macroblocks and blocks. The encoder 1 selects proper parameter sets for use with the encoding process and sends the selected parameter sets to the

decoder 2. The decoder stores the parameter sets to memory 2.3 (Fig. 4). If the decoder already has a correct parameter set, it is not necessary to transmit such parameter set to the decoder 2 but only an indication of the correct parameter set.

In the encoder 1 the video stream is encoded to reduce the information to be transmitted via a transmission channel 4, or to a storage media (not shown). Pictures of the video stream are input to the encoder 1. The encoder has an encoding buffer 1.1 (Fig. 3) for temporarily storing some of the pictures to be encoded. The encoder 1 also includes a memory 1.3 and a processor 1.2 in which the encoding tasks according to the invention can be applied. The memory 1.3 and the processor 1.2 can be common with the transmitting device 6 or the transmitting device 6 can have another processor and/or memory (not shown) for other functions of the transmitting device 6. The encoder 1 performs motion estimation and/or some other tasks to compress the video stream. In motion estimation similarities between the picture to be encoded (the current picture) and a previous and/or latter picture are searched. If similarities are found the compared picture or part of it can be used as a reference picture for the picture to be encoded. In the JVT coding standard the display order and the decoding order of the pictures are not necessarily the same, wherein the reference picture has to be stored in a buffer (*e.g.* in the encoding buffer 1.1) as long as it is used as a reference picture. The encoder 1 may also insert information on display order of the pictures into the bitstream.

From the encoding process the encoded pictures are moved to an encoded picture buffer 5.2, if necessary. The encoded pictures are transmitted from the encoder 1 to the decoder 2 via the transmission channel 4. In the decoder 2 the encoded pictures are decoded to form uncompressed pictures corresponding as much as possible to the encoded pictures. Each decoded picture is buffered in the DPB 2.1 of the decoder 2 unless it is displayed

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 44 of 431

substantially immediately after the decoding and is not used as a reference picture. Preferably both the reference picture buffering and the display picture buffering are combined and they use the same decoded picture buffer 2.1. This eliminates the need for storing the same pictures in two different places thus reducing the memory requirements of the decoder 2.

The decoder 2 also includes a memory 2.3 and a processor 2.2 in which the decoding tasks according to the invention can be applied. The memory 2.3 and the processor 2.2 can be common with the receiving device 8 or the receiving device 8 can have another processor and/or memory (not shown) for other functions of the receiving device 8.

It is obvious that the present invention is not limited solely to the above described embodiments but it can be modified within the scope of the appended claims.

Claims:

1. A method for encoding sequences of pictures into a bitstream, wherein parameters are defined in a parameter set and each picture comprises information of one or more slices, the method comprising:

- defining parameters in a sequence parameter set;
- defining parameters in a picture parameter set; and
- defining at least one picture parameter in a slice header, the picture parameter remaining unchanged at least in all slice headers of one picture.

2. The method according to claim 1, wherein the slice header is included with a reference to a picture parameter set.

3. The method according to claim 1, wherein the picture parameter set is included with a reference to a sequence parameter set.

4. The method according to claim 1, wherein the picture parameter is selected from a group of information of a picture order count, a frame number and an identifier of an independently decodable picture.

5. The method according to claim 1, wherein the sequence parameter set and picture parameter set are transmitted less often than once per each picture.

6. A method for decoding sequences of pictures from a bitstream, wherein parameters are defined in a parameter set and each picture comprises information of one or more slices, the method comprising:

- recognizing a sequence parameter set and forming at least one sequence parameter pertaining to a sequence using the parameter set;

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 46 of 431

- recognizing a picture parameter set and forming at least one first picture parameter pertaining to a picture using the parameter set;
- forming at least one second picture parameter using information of a slice header, the at least one second picture parameter remaining unchanged at least in all slice headers of one picture; and
- using the at least one second picture parameter in decoding.

7. The method according to claim 6, wherein the slice header is included with a reference to a picture parameter set.

8. The method according to claim 6, wherein the picture parameter set is included with a reference to a sequence parameter set.

9. The method according to claim 6, wherein the second picture parameter is selected from a group of information of a picture order count, a frame number and an identifier of an independently decodable picture.

10. An encoder for encoding sequences of pictures into a bitstream, wherein parameters are defined in a parameter set and each picture comprises information of one or more slices, the encoder comprising:

- means for defining parameters in a sequence parameter set;
- means for defining parameters in a picture parameter set; and
- means for defining at least one picture parameter in a slice header, the picture parameter remaining unchanged at least in all slice headers of one picture.

11. A decoder for decoding sequences of pictures from a bitstream, wherein parameters are defined in a parameter set and each picture comprises information of one or more slices, the decoder comprising:

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 47 of 431

- means for recognizing a sequence parameter set and forming at least one sequence parameter pertaining to a sequence using the parameter set;
- means for recognizing a picture parameter set and forming at least one first picture parameter pertaining to a picture using the parameter set;
- means for forming at least one second picture parameter using information of a slice header, the at least one second picture parameter remaining unchanged at least in all slice headers of one picture; and
- means for using the at least one second picture parameter in decoding.

12. A system comprising an encoder for encoding sequences of pictures into a bitstream, a decoder for decoding sequences of pictures from the bitstream, wherein parameters are defined in a parameter set and each picture comprises information of one or more slices, the encoder comprising:

- means for defining parameters in a sequence parameter set;
- means for defining parameters in a picture parameter set; and
- means for defining at least one picture parameter in a slice header, the picture parameter remaining unchanged at least in all slice headers of one picture;

and the decoder comprising

- means for recognizing a sequence parameter set and forming at least one sequence parameter pertaining to a sequence using the parameter set;
- means for recognizing a picture parameter set and forming at least one first picture parameter pertaining to a picture using the parameter set;
- means for forming at least one second picture parameter using information of a slice header, the at least one second picture parameter remaining unchanged at least in all slice headers of one picture; and

- means for using the at least one second picture parameter in decoding.

13. The system according to claim 12, wherein a parameter set is stored in both the encoder and the decoder.

14. A transmitting device comprising an encoder for encoding sequences of pictures into a bitstream, wherein parameters are defined in a parameter set and each picture comprises information of one or more slices, the encoder comprising:

- means for defining parameters in a sequence parameter set;
- means for defining parameters in a picture parameter set; and
- means for defining at least one picture parameter in a slice header, the picture parameter remaining unchanged at least in all slice headers of one picture.

15. A receiving device comprising a decoder for decoding sequences of pictures from a bitstream, wherein parameters are defined in a parameter set and each picture comprises information of one or more slices, the decoder comprising:

- means for recognizing a sequence parameter set and forming at least one sequence parameter pertaining to a sequence using the parameter set;
- means for recognizing a picture parameter set and forming at least one first picture parameter pertaining to a picture using the parameter set;
- means for forming at least one second picture parameter using information of a slice header, the at least one second picture parameter remaining unchanged at least in all slice headers of one picture; and
- means for using the at least one second picture parameter in decoding.

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 49 of 431

16. A bitstream comprising:

- encoded pictures;
- sequence parameters in a sequence parameter set;
- picture parameters in a picture parameter set;
- information of a slice comprising a slice header; and
- at least one picture parameter in the slice header, the picture parameter remaining unchanged at least in all slice headers of one encoded picture.

17. The bitstream according to claim 16, wherein the slice header is included with a reference to a picture parameter set.

18. The bitstream according to claim 16, wherein the picture parameter set is included with a reference to a sequence parameter set.

19. The bitstream according to claim 16, wherein the picture parameter is selected from a group of information of a picture order count, a frame number and an identifier of an independently decodable picture.

20. A software program comprising machine executable steps for encoding sequences of pictures into a bitstream, wherein parameters are defined in a parameter set and each picture comprises information of one or more slices, the software program comprising:

- defining parameters in a sequence parameter set;
- defining parameters in a picture parameter set; and
- defining at least one picture parameter in a slice header, the picture parameter remaining unchanged at least in all slice headers of one picture.

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 50 of 431

21. A software program comprising machine executable steps for decoding sequences of pictures from a bitstream, wherein parameters are defined in a parameter set and each picture comprises information of one or more slices, the software program comprising:

- recognizing a sequence parameter set and forming at least one sequence parameter pertaining to a sequence using the parameter set;
- recognizing a picture parameter set and forming at least one first picture parameter pertaining to a picture using the parameter set;
- forming at least one second picture parameter using information of a slice header, the at least one second picture parameter remaining unchanged at least in all slice headers of one picture; and
- using the at least one second picture parameter in decoding.

22. A storage medium including a software program comprising machine executable steps for encoding sequences of pictures into a bitstream, wherein parameters are defined in a parameter set and each picture comprises information of one or more slices, the software program comprising machine executable steps for:

- defining parameters in a sequence parameter set;
- defining parameters in a picture parameter set; and
- defining at least one picture parameter in a slice header, the picture parameter remaining unchanged at least in all slice headers of one picture.

23. A storage medium including a software program comprising machine executable steps for decoding sequences of pictures from a bitstream, wherein parameters are defined in a parameter set and each picture comprises information of one or more slices, the software program comprising machine executable steps for:

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 51 of 431

- recognizing a sequence parameter set and forming at least one sequence parameter pertaining to a sequence using the parameter set;
- recognizing a picture parameter set and forming at least one first picture parameter pertaining to a picture using the parameter set;
- forming at least one second picture parameter using information of a slice header, the at least one second picture parameter remaining unchanged at least in all slice headers of one picture; and
- using the at least one second picture parameter in decoding.

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 52 of 431

Abstract of the Disclosure

The invention relates to method for encoding sequences of pictures into a bitstream, wherein parameters are defined in a parameter set and each picture comprises information of one or more slices. The method comprises defining parameters in a sequence parameter set; defining parameters in a picture parameter set; and defining at least one picture parameter in a slice header. The picture parameter remains unchanged at least in all slice headers of one picture.

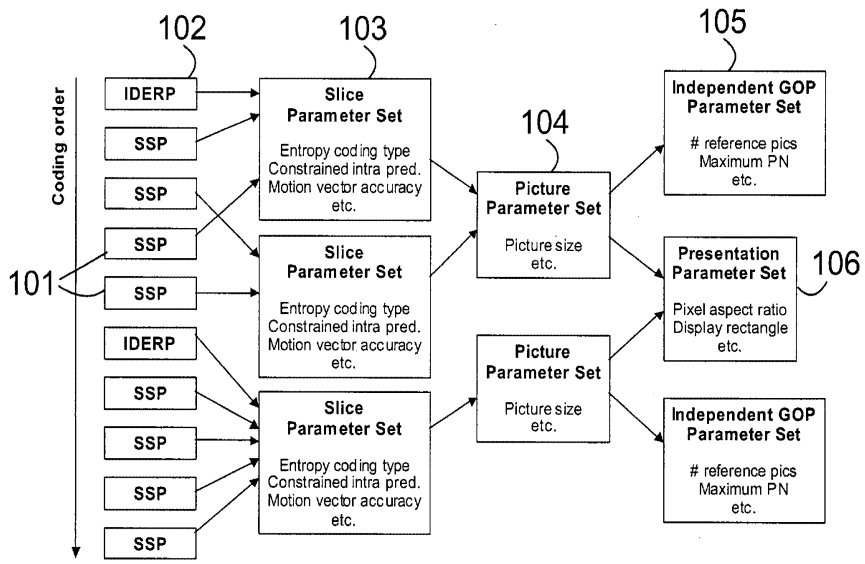


Fig. 1

Attorney Docket No. 915-005.053
Express Mail No. EV 252881045 US
Inventors: M. HANNUKSELA et al.
Sheet 1 of 4

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 54 of 431

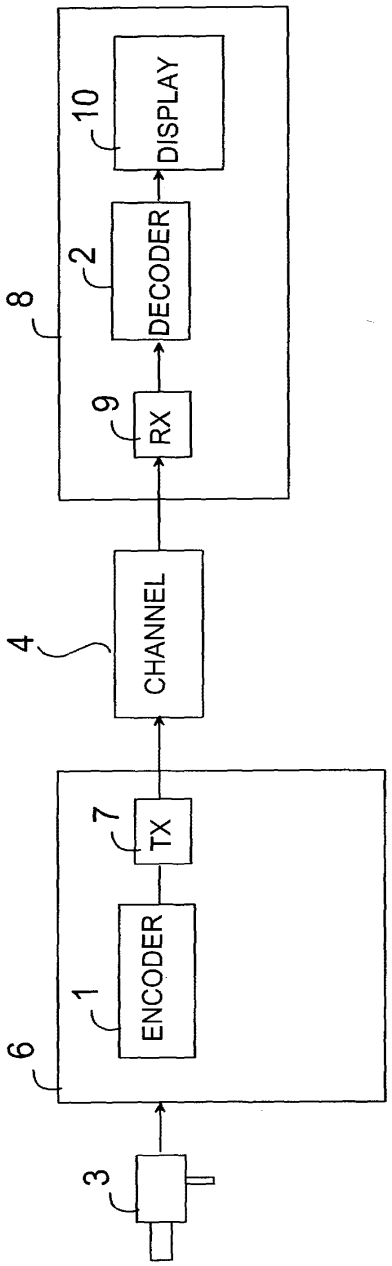


Fig. 2

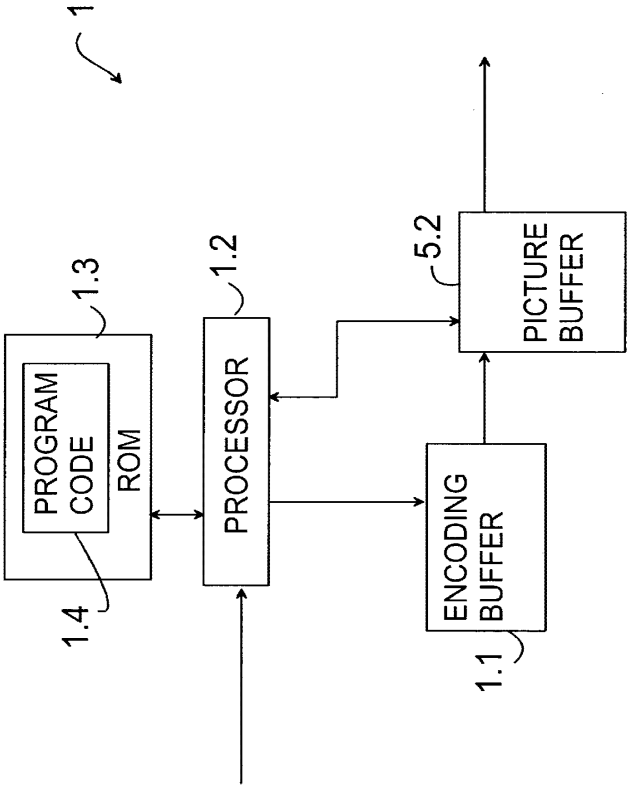

1
1.3
PROGRAM CODE
ROM
1.4
1.2
PROCESSOR
5.2
PICTURE BUFFER
ENCODING BUFFER
1.1

Fig. 3

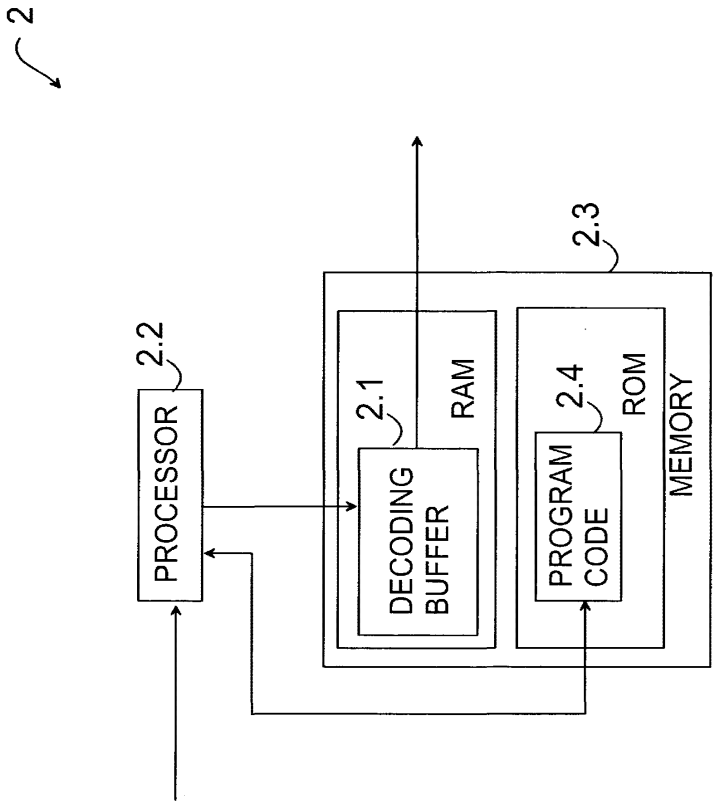

2
2.3
2.2
2.1
RAM
2.4
ROM
PROCESSOR
DECODING BUFFER
PROGRAM CODE
MEMORY

Fig. 4

Special Instructions for Evidence
Copy Box Identification

Documents in this patent application scanned prior to the scan date of this document may not have a box number present in the database. The documents are in the same box as this paper. If the patent application documents that do not have a box number are stored in more than one box, a copy of this form is placed in each box. Check the database box number for each copy of this form to identify all of the evidence copy box numbers for documents that do not have a box number.

☑ **The documents stored in this box are original application papers scanned and endorsed by PACR and imported into IFW.**

☐ **The documents stored in this box were scanned into the IFW prototype for GAU 1634, 2827, or 2834.**

Indexer, place an X in only one box above to indicate the documents placed in this box that were previously scanned in PACR or IFW and will not be scanned again.

PATENT APPLICATION FEE DETERMINATION RECORD
Effective January 1, 2003

Application or Docket Number: 10/736,978

CLAIMS AS FILED - PART I

	(Column 1)	(Column 2)
TOTAL CLAIMS	23	
FOR	NUMBER FILED	NUMBER EXTRA
TOTAL CHARGEABLE CLAIMS	23 minus 20=	* 3
INDEPENDENT CLAIMS	12 minus 3 =	* 9
MULTIPLE DEPENDENT CLAIM PRESENT		☐

* If the difference in column 1 is less than zero, enter "0" in column 2

SMALL ENTITY TYPE ☐		OR	OTHER THAN SMALL ENTITY	
RATE	FEE		RATE	FEE
BASIC FEE	375.00	OR	BASIC FEE	750.00
X$ 9=		OR	X$18=	54
X42=		OR	X84=	756
+140=		OR	+280=	
TOTAL		OR	TOTAL	1560

CLAIMS AS AMENDED - PART II

AMENDMENT A

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA
Total	*	Minus	**	=
Independent	*	Minus	***	=
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM				☐

SMALL ENTITY		OR	OTHER THAN SMALL ENTITY	
RATE	ADDITIONAL FEE		RATE	ADDITIONAL FEE
X$ 9=		OR	X$18=	
X42=		OR	X84=	
+140=		OR	+280=	
TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	

AMENDMENT B

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA
Total	*	Minus	**	=
Independent	*	Minus	***	=
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM				☐

RATE	ADDITIONAL FEE		RATE	ADDITIONAL FEE
X$ 9=		OR	X$18=	
X42=		OR	X84=	
+140=		OR	+280=	
TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	

AMENDMENT C

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA
Total	*	Minus	**	=
Independent	*	Minus	***	=
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM				☐

RATE	ADDITIONAL FEE		RATE	ADDITIONAL FEE
X$ 9=		OR	X$18=	
X42=		OR	X84=	
+140=		OR	+280=	
TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20."
***If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3."
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

FORM PTO-875 (Rev. 12/02) *U.S. Government Printing Office: 2003 — 498-278/69151 Patent and Trademark Office, U.S. DEPARTMENT OF COMMERCE

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER OF PATENTS AND TRADEMARKS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING/RECEIPT DATE	FIRST NAMED APPLICANT	ATTORNEY DOCKET NUMBER
10/426,928	04/30/2003	Miska Hannuksela	915-005.053

CONFIRMATION NO. 6259

Ware, Fressola, Van Der Sluys & Adolphson, LLP
Building Five, Bradford Green
755 Main Street
P.O. Box 224
Monroe, CT 06468

FORMALITIES LETTER

OC000000010332599

Date Mailed: 06/24/2003

NOTICE TO FILE MISSING PARTS OF NONPROVISIONAL APPLICATION

FILED UNDER 37 CFR 1.53(b)

Filing Date Granted

Items Required To Avoid Abandonment:

An application number and filing date have been accorded to this application. The item(s) indicated below, however, are missing. Applicant is given **TWO MONTHS** from the date of this Notice within which to file all required items and pay any fees required below to avoid abandonment. Extensions of time may be obtained by filing a petition accompanied by the extension fee under the provisions of 37 CFR 1.136(a).

- The statutory basic filing fee is missing.
  Applicant must submit $ **750** *to complete the basic filing fee for a non-small entity. If appropriate, applicant may make a written assertion of entitlement to small entity status and pay the small entity filing fee (37 CFR 1.27).*
- The oath or declaration is missing.
  A properly signed oath or declaration in compliance with 37 CFR 1.63, identifying the application by the above Application Number and Filing Date, is required.
- To avoid abandonment, a late filing fee or oath or declaration surcharge as set forth in 37 CFR 1.16(e) of $130 for a non-small entity, must be submitted with the missing items identified in this letter.

Items Required To Avoid Processing Delays:

The item(s) indicated below are also required and should be submitted with any reply to this notice to avoid further processing delays.

- Additional claim fees of **$726** as a non-small entity, including any required multiple dependent claim fee, are required. Applicant must submit the additional claim fees or cancel the additional claims for which fees are due.

SUMMARY OF FEES DUE:

Total additional fee(s) required for this application is **$1606** for a Large Entity

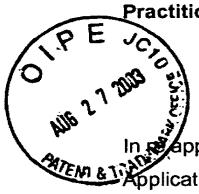
- **$750** Statutory basic filing fee.
- **$130** Late oath or declaration Surcharge.
- Total additional claim fee(s) for this application is **$726**
  - **$54** for **3** total claims over 20 .
  - **$672** for **8** independent claims over 3 .

A copy of this notice MUST be returned with the reply.

I Sequeira

Customer Service Center
Initial Patent Examination Division (703) 308-1202
PART 3 - OFFICE COPY

Practitioner's Docket No. 915-005.053 *PATENT*



IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of: **M. HANNUKSELA et al.**
Application No.: **10/426,928** Group No.: **2613**
Filed: **April 30, 2003** Examiner: **Not Yet Assigned**
For: ***Method for Coding Sequences of Pictures***

Commissioner for Patents
Mail Stop MISSING PARTS
P.O. Box 1450
Alexandria, VA 22313-1450

COMPLETION OF FILING REQUIREMENTS
- NONPROVISIONAL APPLICATION

(check and complete this item, if applicable)

I. ☒ This replies to the Notice to File Missing Parts of Application (PTO-1533) mailed **June 24, 2003**.

NOTE: If these papers are filed before the office letter issues, adequate identification of the original papers should be made, e.g., in addition to the name of the inventor and title of invention, the filing date based on the "Express Mail" procedure, the serial number from the return post card or the attorney's docket number added.

☒ A copy of the Notice to File Missing Parts of Application – Filing Date Granted (Form PTO-1533) is enclosed.

NOTE: The PTO requires that a copy of Form PTO-1533 be returned with the response to the notice to file missing parts to the application.

CERTIFICATE OF MAILING/TRANSMISSION (37 C.F.R. § 1.8(a))

I hereby certify that this correspondence is, on the date shown below, being:

MAILING

☒ deposited with the United States Postal Service with sufficient postage as first-class mail in an envelope addressed to the Assistant Commissioner for Patents, Washington, D.C. 20231.

FACSIMILE

☐ transmitted by facsimile to the Patent and Trademark Office.

Annemarie Maher
Signature

Date: **August 25, 2003**

Annemarie Maher
(type or print name of person certifying)

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 62 of 431

DECLARATION OR OATH

II. ☒ No declaration or oath was filed. Enclosed is the original declaration or oath for this application.

NOTE: If the correct inventor or inventors are not named on filing a nonprovisional application under § 1.53(b) without an executed oath or declaration under § 1.63, the later submission of an executed oath or declaration under § 1.63 during the pendency of the application will act to correct the earlier identification of inventorship. 37 C.F.R. § 1.48(f)(1).

OR

☐ The declaration or oath that was filed was determined to be defective. A new original oath or declaration is attached.

NOTE: For surcharge fee for filing declaration after filing date complete item VI(3) below.

NOTE: "The following combinations of information supplied in an oath or declaration filed after the filing date are acceptable as minimums for identifying a specification and compliance with any one of the items below will be accepted as complying with the identification requirement of 37 C.F.R. § 1.63:

"(A) application number (consisting of the series code and the serial number, e.g., 08/123,456;

"(B) serial number and filing date;

"(C) attorney docket number which was on the specification as filed;

"(D) title which was on the specification as filed and reference to an attached specification which is both attached to the oath or declaration at the time of execution and submitted with the oath or declaration; or

"(E) title which was on the specification as filed and accompanied by a cover letter accurately identifying the application for which it was intended by either the application number (consisting of the series code and the serial number, e.g., 08/123,456), or serial number and filing date. Absent any statement(s) to the contrary, it will be presumed that the application filed in the PTO is the application which the inventor(s) executed by signing the oath or declaration."

M.P.E.P. § 601.01(a) 7th Ed.

NOTE: Another minimum found acceptable in the declaration is the filing date (i.e., date of express mail) and the express mail number, useful where the serial number is not yet known. But note the practice where the express mail deposit is a Saturday, Sunday or holiday within the District of Columbia. 37 C.F.R. § 1.10(c).

(complete (c) or (d), if applicable)

Attached is a

(c) ☐ Statement by a registered attorney that the application filed in the PTO is the application that the inventor executed by signing the declaration.

(d) ☐ Statement that the "attached" specification is a copy of the specification and any amendments thereto that were filed in the PTO to obtain the filing date.

AMENDMENT CANCELLING CLAIMS

III. ☐ Cancel claims _____ inclusive.

TRANSMITTAL OF ENGLISH TRANSLATION OF NON-ENGLISH LANGUAGE PAPERS

IV. ☐ Submitted herewith is an English translation of the non-English language application papers as originally filed. Also submitted herewith is a statement by the translator of the accuracy of the translation. It is requested that this translation be used as the copy for examination purposes in the PTO.

NOTE: For fee processing a non-English application, complete item VI(5) below.

NOTE: a non-English oath or declaration in the form provided by the PTO need not be translated. 37 C.F.R. § 1.69(b).

SMALL ENTITY STATUS

V. ☐ A statement that this filing is by a small entity

(check and complete applicable items)

☐ is attached.

☐ A separate refund request accompanies this paper.

☐ was filed on _____ (original).

COMPLETION FEES

VI.

WARNING: *Failure to submit the surcharge fees where required will cause the application to become abandoned. 37 C.F.R. § 1.53.*

NOTE: For effect on fees of failure to establish status, or change status, as a small entity, see 37 C.F.R. § 1.28(a).

1. Filing fee

☒ original patent application
(37 C.F.R. § 1.16(a) - $750.00; small entity - $375.00) $ 750.00

☐ design application
(37 C.F.R. § 1.16(f) - $330.00; small entity - $165.00) $_____

2. Fees for claims

☒ each independent claim in excess of 3
(37 C.F.R. § 1.16(b) - $84.00; small entity - $42.00) $ 756.00

☒ each claim in excess of 20
(37 C.F.R. § 1.16(c) - $18.00; small entity - $9.00) $ 54.00

☐ multiple dependent claim(s)
(37 C.F.R. § 1.16(d) - $280.00; small entity - $140.00) $_____

3. Surcharge Fees

☒ late payment of filing fee and/or late filing of original declaration or oath (37 C.F.R. § 1.16(e) - $130.00); $ 130.00

NOTE: Even where a facsimile declaration or oath signed by the inventor(s) was part of the originally filed papers, the surcharge fee is required.

NOTE: If both the filing fee and declaration or oath were missing from the original papers, the Office practice under C.F.R. §1.16(e) is that only one surcharge Fee need be paid whether the later filed oath or declaration and/or the filing fee are submitted afterwards at the same time or at different times.

4. ☐ Petition and fee for filing by other than all the inventors or a person not the inventor

(37 C.F.R. §§ 1.17(i) and 1.47 - $130.00) $_____

☐ Fee for processing an application filed with a specification in a non-English language
(37 C.F.R. §§ 1.17(k) and 1.52(d) - $130.00) $_____

☐ Fee for processing and retention of application
(37 C.F.R. §§ 1.21(l) and 1.53(d) - $130.00) $_____

☒ Assignment (See "ASSIGNMENT COVER SHEET".) $ 40.00

NOTE: 37 C.F.R. § 1.21(l) establishes a fee for processing and retaining any application which is abandoned for failing to complete the application pursuant to 37 C.F.R. § 1.53(f) and this, as well as the changes to 37 C.F.R. §§ 1.53 and 1.78, indicate that in order to obtain the benefit of a prior U.S. application, either the basic filing fee or the processing and retention fee of § 1.21(l) within 1 year of notification under § 1.53(f) must be paid.

Total completion fees $ **1,730.00**

VII. EXTENSION OF TIME

(complete (a) or (b), as applicable)

The proceedings herein are for a patent application, and the provisions of 37 C.F.R. § 1.136(a) apply.

(a) ☐ Applicant petitions for an extension of time, the fees for which are set out in 37 C.F.R. §1.17(a)(1)-(4), for the total number of months checked below:

Extension (months)	Fee for other than small entity	Fee for small entity
☐ one month	$ 110.00	$ 55.00
☐ two months	$ 400.00	$ 200.00
☐ three months	$ 920.00	$ 460.00
☐ four months	$1,440.00	$ 720.00

Fee: $_____

If an additional extension of time is required, please consider this a petition therefor.

(check and complete the next item, if applicable)

☐ An extension for ____ months has already been secured, and the fee paid therefor of $____ is deducted from the total fee due for the total months of extension now requested.

Extension fee due with this request $_____

OR

(b) ☒ Applicant believes that no extension of term is required. However, this conditional petition is being made to provide for the possibility that applicant has inadvertently overlooked the need for a petition and fee for extension of time.

VIII. TOTAL FEE DUE

The total fee due is

Completion fee(s) $ **1,730.00**

Extension fee (if any) $ **0.00**

Total Fee Due $ **1,730.00**

IX. PAYMENT OF FEES

☒ Enclosed is a check in the amount of $**1,730.00**

☐ Authorization is hereby made to charge the amount of $ _____

☐ to Deposit Account No. _____

☐ to credit card as shown on the attached credit card information authorization Form PTO-2038.

*WARNING: Credit card information should **not** be included on this form as it may become public.*

☐ Charge any additional fees required by this paper or credit any overpayment in the manner authorized above. A duplicate of this request is attached.

X. AUTHORIZATION TO CHARGE ADDITIONAL FEES

WARNING: *Accurately count claims, especially multiple dependant claims, to avoid unexpected high charges if extra claims are authorized.*

NOTE: "Amounts of twenty-five dollars or less will not be returned unless specifically requested within a reasonable time, nor will the payer be notified of such amounts; amounts over twenty-five dollars may be returned by check or, if requested, by credit to a deposit account." 37 C.F.R. § 1.26(a).

☒ The Commissioner is hereby authorized to charge the following additional fees that may be required by this paper and during the pendency of this application to Account No. **23-0442**.

☒ 37 C.F.R. § 1.16(a), (f) or (g) (filing fees)

☒ 37 C.F.R. § 1.16(b), (c) and (d) (presentation of extra claims)

NOTE: Because additional fees for excess or multiple dependent claims not paid on filing or on later presentation must only be paid or these claims cancelled by amendment prior to the expiration of the time period set for response by the PTO in any notice of fee deficiency (37 C.F.R. § 1.16(d)), it might be best not to authorize the PTO to charge additional claim fees, except possibly when dealing with amendments after final action.

☐ 37 C.F.R. §1.16(e) (surcharge for filing the basic filing fee and/or declaration on a date later than the filing date of the application)

☒ 37 C.F.R. §1.17(a)(1)-(5) (extension fees pursuant to §1.136(a))

☐ 37 C.F.R. §1.17 (application processing fees)

NOTE: "A written request may be submitted in an application that is an authorization to treat any concurrent or future reply, requiring a petition for an extension of time under this paragraph for its timely submission, as incorporating a petition for extension of time for the appropriate length of time. An authorization to charge all required fees, fees under §1.17, or all required extension of time fees will be treated as a constructive petition for an extension of time in any concurrent or future reply requiring a petition for an extension of time under this paragraph for its timely submission. Submission of the fee set forth in §1.17(a) will also be treated as a constructive petition for an extension of time in any concurrent reply requiring a petition for an extension of time under this paragraph for its timely submission." 37 C.F.R. §1.136(a)(3).

☐ 37 C.F.R. §1.18 (issue fee at or before mailing of Notice of Allowance, pursuant to 37 C.F.R. §1.311(b))

NOTE: Where an authorization to charge the issue fee to a deposit account has been filed before the mailing of a Notice of Allowance, the issue fee will be automatically charged to the deposit account at the time of mailing the notice of allowance. 37 C.F.R. §1.311(b).

NOTE: 37 C.F.R. §1.28(b) requires "Notification of any change in loss of entitlement to small entity status must be filed in the application...prior to paying, or at the time of paying...issue fee..." From the wording of 37 C.F.R. §1.28(b): (a) notification of change of status must be made even if the fee is paid as "other than a small entity" and (b) no notification is required if the change is to another small entity.

SIGNATURE OF PRACTITIONER

Reg. No. **27,550**

Alfred A. Fressola
(type or print name of practitioner)

Tel. No.: **(203) 261-1234**

WARE, FRESSOLA, VAN DER SLUYS & ADOLPHSON LLP
Bradford Green, Bldg. Five
755 Main St., P.O. Box 224
Monroe, CT 06468

Customer No. **004955**

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 67 of 431

M.S

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER OF PATENTS AND TRADEMARKS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING/RECEIPT DATE	FIRST NAMED APPLICANT	ATTORNEY DOCKET NUMBER
10/426,928	04/30/2003	Miska Hannuksela	915-005.053

CONFIRMATION NO. 6259

FORMALITIES LETTER

OC0000000010332599

Ware, Fressola, Van Der Sluys & Adolphson, LLP
Building Five, Bradford Green
755 Main Street
P.O. Box 224
Monroe, CT 06468



Date Mailed: 06/24/2003

NOTICE TO FILE MISSING PARTS OF NONPROVISIONAL APPLICATION

08/28/2003 GWORDOF1 00000033 10426928

01 FC:1001	750.00 OP	**FILED UNDER 37 CFR 1.53(b)**
02 FC:1201	756.00 OP	
03 FC:1202	54.00 OP	
04 FC:1051	130.00 OP	***Filing Date Granted***

Items Required To Avoid Abandonment:

An application number and filing date have been accorded to this application. The item(s) indicated below, however, are missing. Applicant is given **TWO MONTHS** from the date of this Notice within which to file all required items and pay any fees required below to avoid abandonment. Extensions of time may be obtained by filing a petition accompanied by the extension fee under the provisions of 37 CFR 1.136(a).

- The statutory basic filing fee is missing.
  Applicant must submit $ **750** *to complete the basic filing fee for a non-small entity. If appropriate, applicant may make a written assertion of entitlement to small entity status and pay the small entity filing fee (37 CFR 1.27).*
- The oath or declaration is missing.
  A properly signed oath or declaration in compliance with 37 CFR 1.63, identifying the application by the above Application Number and Filing Date, is required.
- To avoid abandonment, a late filing fee or oath or declaration surcharge as set forth in 37 CFR 1.16(e) of $130 for a non-small entity, must be submitted with the missing items identified in this letter.

Items Required To Avoid Processing Delays:

The item(s) indicated below are also required and should be submitted with any reply to this notice to avoid further processing delays.

- Additional claim fees of **$726** as a non-small entity, including any required multiple dependent claim fee, are required. Applicant must submit the additional claim fees or cancel the additional claims for which fees are due.

SUMMARY OF FEES DUE:

Total additional fee(s) required for this application is **$1606** for a Large Entity

- **$750** Statutory basic filing fee.
- **$130** Late oath or declaration Surcharge.
- Total additional claim fee(s) for this application is **$726**
  - **$54** for **3** total claims over 20 .
  - **$672** for **8** independent claims over 3 .

A copy of this notice MUST be returned with the reply.

TSeyerel

Customer Service Center
Initial Patent Examination Division (703) 308-1202
PART 2 - COPY TO BE RETURNED WITH RESPONSE

#3



COMBINED DECLARATION AND POWER OF ATTORNEY **915-005.053**
(Docket Number)

As a below named inventor, I hereby declare that:

- my residence, post office address and citizenship are as stated below next to my name;
- I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled: **METHOD FOR CODING SEQUENCES OF PICTURES,**
- the specification of which is attached hereto unless the following box is checked: ☒. If the box is checked,

  the application was filed on **April 30, 2003**
  as U.S. Application Number **10/426,928**
  or PCT International Application Number
  and was amended on (if applicable).

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR §1.56.

I hereby claim foreign priority benefits under 35 U.S.C. §119(a)-(d) or §365(b) of any foreign application(s) for patent or inventor's certificate, or §365(a) of any PCT International application which designated at least one country other than the United States, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate, or PCT International application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application			Priority Not Claimed
(Application Number)	(Country)	(Day/Month/Year Filed)	☐
(Application Number)	(Country)	(Day/Month/Year Filed)	☐

To the extent permitted by rule or law, I hereby incorporate by reference the Prior Foreign Application(s) listed above.

I hereby claim the benefits under 35 U.S.C. §119(e) of any United States provisional application(s) listed below:

(Provisional Application Number)	(Day/Month/Year Filed)
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(Application Number)	(Day/Month/Year Filed)	(Status--patented, pending, abandoned)
(Application Number)	(Day/Month/Year Filed)	(Status--patented, pending, abandoned)

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 70 of 431

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Miska HANNUKSELA Full name of sole or first inventor (given name, middle initial, FAMILY NAME(S) IN UPPER CASE)	
Inventor's Signature	12 August 2003 Date
Tampere, Finland Residence	**Finland** Citizenship
Post Office Address: **Kukkaniitynkatu 4 B, FIN-33710 Tampere, Finland**	

Ye-Kui WANG Full name of second inventor (given name, middle initial, FAMILY NAME(S) IN UPPER CASE)	
Inventor's Signature	Date
Tampere, Finland Residence	**China** Citizenship
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Full name of third inventor (given name, middle initial, FAMILY NAME(S) IN UPPER CASE)	
Inventor's Signature	Date
Residence	Citizenship
Post Office Address:	

☐ Additional inventors are being named on separately numbered sheets attached hereto.

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 71 of 431

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Miska HANNUKSELA Full name of sole or first inventor (given name, middle initial, FAMILY NAME(S) IN UPPER CASE)	
Inventor's Signature	Date
Tampere, Finland Residence	**Finland** Citizenship
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Ye-Kui WANG Full name of second inventor (given name, middle initial, FAMILY NAME(S) IN UPPER CASE)	
Inventor's Signature	06. Aug. 2003 Date
Tampere, Finland Residence	**China** Citizenship
Post Office Address: **Ruovedenkatu 16, FIN-33720 Tampere, Finland**	

Full name of third inventor (given name, middle initial, FAMILY NAME(S) IN UPPER CASE)	
Inventor's Signature	Date
Residence	Citizenship
Post Office Address:	

☐ Additional inventors are being named on separately numbered sheets attached hereto.

Snap - Exhibit 1002
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Page 72 of 431

Receipt

IPE JC42 DEC 10 2003 PATENT & TRADEMARK OFFICE

Practitioner's Docket No. 915-005.053

FILE COPY

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of: M. HANNUKSELA et al.

Application No.: 10/ 426,928 Group No.: 2613

Filed: April 30, 2003 Examiner: To Be Assigned

For: Method for Coding Sequences of Pictures

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1.	☐ Applicant's name	1.
2.	☒ Applicant's address	2. address of inventor #2, Ye-Kui
3.	☐ Title	3. Wang, should be Tampere, **FINLAND**,
4.	☐ Filing Date	4. not Tampere, Japan.
5.	☐ Application Number	5.
6.	☐ Foreign/PCT Application Re:	6.
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Alfred A. Fressola

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APPL NO.	FILING OR 371 (c) DATE	ART UNIT	FIL FEE REC'D	ATTY.DOCKET NO	DRAWINGS	TOT CLMS	IND CLMS
10/426,928	04/30/2003	2613	1690	915-005.053	4	23	12

CONFIRMATION NO. 6259

UPDATED FILING RECEIPT

OC000000011167454

Ware, Fressola, Van Der Sluys & Adolphson, LLP
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P.O. Box 224
Monroe, CT 06468

Date Mailed: 11/03/2003

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Applicant(s)

Miska Hannuksela, Tampere, FINLAND;
Ye-Kui Wang, Tampere, ~~JAPAN;~~ FINLAND

Assignment For Published Patent Application

Nokia Corporation;

Domestic Priority data as claimed by applicant

Foreign Applications

If Required, Foreign Filing License Granted: 06/23/2003

Projected Publication Date: 11/04/2004

Non-Publication Request: No

Early Publication Request: No

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FILE 915.005.53
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Title

Method for coding sequences of pictures

Preliminary Class
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2613

PATENT
Attorney Docket No. 915-005.053 JFW



IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In Re Application of: :

Miska HANNUKSELA, et al.

Serial No.: **10/426,928** : Group/Art Unit: **2613**

Filed: **April 30, 2003** : Examiner: **Not Yet Assigned**

For: ***Method for Coding Sequences of Pictures***

Director of the U.S. Patent and Trademark Office
P.O. Box 1450
Alexandria, VA 22313-1450

INFORMATION DISCLOSURE STATEMENT

Sir:

Applicants submit herewith references of which they are aware, which they believe may be material to the examination of this application and in respect of which they may have a duty to disclose in accordance with 37 CFR §1.56.

While this Information Disclosure Statement (IDS) may be "material" pursuant to 37 CFR §1.56(b), it is not intended to constitute an admission that any document referred to herein is "prior art" for this invention unless specifically designated as such.

I hereby certify that this correspondence is being deposited with the United States Postal Service on this date, **September 30, 2004**, in an envelope with sufficient postage as first-class mail addressed to the Commissioner of Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

Lissette Ramos

In accordance with 37 CFR §1.97(g), the filing of this IDS shall not be construed to mean that a search has been made or that no other material information as defined under 37 CFR §1.56(a) exists.

Enclosed is a Swedish Patent Office Search Report dated September 17, 2004 issued in International Patent Application No. PCT/FI2004/050051, a Finnish counterpart to the present application. The relevance of each reference is either specifically explained in the Search Report or in the application specification.

Also enclosed is a Form PTO-1449 listing the cited references. Copies of the cited non-US references are also enclosed herewith (pursuant to the USPTO waiver of the requirement to submit copies of US references). The abstract of each reference provides a concise explanation thereof.

This IDS is being submitted within three months of the date of the foreign Search Report in this matter; therefore, the undersigned respectfully submits that no fee is due for filing this IDS. The Commissioner is hereby authorized to charge to deposit account 23-0442 any fee deficiency required to submit this IDS.

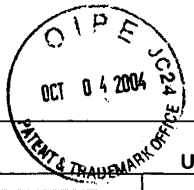
Respectfully submitted,

Dated: September 30, 2004

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FORM PTO-1449 INFORMATION DISCLOSURE STATEMENT	ATTY DOCKET NO. 915-005.053	SERIAL NO. 10/426,928
	APPLICANT: **M. HANNUKSELA, et al.**	
	FILING DATE: April 30, 2003	ART UNIT: 2631



UNITED STATES PATENT DOCUMENTS

EXAM. INITIAL		DOCUMENT NUMBER	DATE	INVENTOR/ASSIGNEE	CLASS	SUBCLASS	FILING DATE IF APPROPRIATE
		5,838,265	Nov. 17, 1998	*Adolph*			
		20040008786	Jan. 15, 2004	*Boyce*			
		6,646,578	Nov. 11, 2003	*Au*			
		20040008766	Jan. 15, 2004	*Wang, et al.*			
		20040013202	Jan. 22, 2004	*Lainema*			

FOREIGN PATENT DOCUMENTS

		DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES/NO
		EP 0322123	June 28, 1989	Europe			

OTHER DOCUMENTS (INCLUDING AUTHOR, TITLE, DATE, PERTINENT PAGES, ETC.)

Examiner (To be assigned)	Date: September 30, 2004

(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 322 123**
A2

(12) **EUROPEAN PATENT APPLICATION**

(21) Application number: **88311277.3**

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(84) Designated Contracting States:
BE CH DE ES FR GB IT LI NL SE

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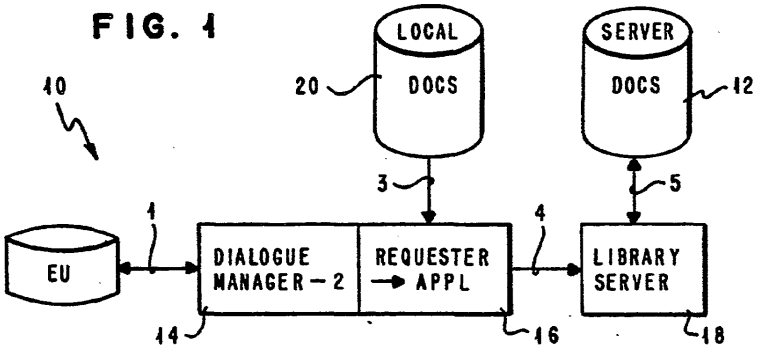
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(54) **A method of operating an electronic information processing system for managing documents therein.**

(57) A method of generating a folder, which is comprising a plurality of documents, in an information processing system. An end user indicates the documents to be included in the folder, any search criteria, access control information, the logical relationship of the documents and the identification of the end user and/or the principal. The system then creates the folder and includes the specified documents therein in the order specified by the end user. Thereafter, when the folder can be requested, the documents will be transmitted therewith in the order established.

FIG. 1



EP 0 322 123 A2

Xerox Copy Centre

A METHOD OF OPERATING AN ELECTRONIC INFORMATION PROCESSING SYSTEM FOR MANAGING DOCUMENTS THEREIN

This invention relates to methods of managing documents in an electronic information processing system and more particularly, to a method of organising documents within the system.

In recent time, automation of offices is rapidly becoming a reality for an increasing number of organisations. Office automation helps the organisations integrate data files with text, store and retrieve correspondence and reports electronically, distribute documents electronically and support the day-to-day activities of administrative personnel, professionals and managers.

While some of the benefits of electronic document processing can be realized from a single, stand-alone office system, a network which connects office systems in various locations in the organisation increases the productivity of the organisation. Physically, a network is a combination of interconnected pieces of equipment and programs used for moving information between points where it may be generated, processed, stored and used. From the viewpoint of an user of the network, the network is a collection of services which are useful in creating, revising, distributing, filing and retrieving documents.

In today's electronic office, documents are physically grouped using one of two following techniques: partition data sets and directories. Partition data sets are storage areas on a disk or other form of storage medium. Documents stored in a partition data set only exist in that storage area and a partition data can not be deleted until all of the documents included therein have been removed. Generally, the documents are filed in the partition data set in the order created and there is no other relationship regarding the order to the documents.

Directories are similar to partition data sets in that they are physical storage areas for documents for files. Documents can not exist in more that one physical storage area. The documents contained in a directory are not logically organised.

In regards to both the partition data sets and the directories, if one filed a group of documents which are related to a general topic and one wanted to review the group of documents, one would have to first locate the partition data set or sets or the directory or directories containing the documents. Moreover, in partition data sets and directories, documents have to be deleted from the bottom up. Additionally, it is very difficult to rearrange documents stored using these two schemes. In order to arrange, the documents have to be copied and then deleted. This type of retrieval technique reduces the efficiency of the electronic office.

Consequently, what is needed is a technique for storing documents have a logical order wherein all of the documents can be operated on with a single command and in the logical order stored.

According to the invention, there is provided a method of operating an electronic information processing system for organising data, in the form of documents, within the system, comprising the steps of identifying a plurality of documents stored in the system; establishing order criteria for the identified documents; and creating and storing a folder comprising said identified documents positioned in accordance with said order criteria.

An embodiment of the invention will now be described, by way of example, with reference to the accompanying drawings, in which:

Fig. 1 is a block diagram of an information processing system;

Fig. 2 is a model of a document showing the various objects associated with a document stored in the system of Fig. 1;

Figs. 3 to 6 are object structures which are employed in generating a folder document; and

Figs. 7 to 17 are various flow charts illustrating detailed steps of a method embodying the present invention.

Fig. 1 shows a document management system 10 for controlling the creation, retrieval, editing and distribution of documents within an information processing system. Moreover, the document management system 10 enables an end user (EU) to store a collection of documents as a folder. In essence, the folder, which is also a document, is created and the documents which are to be stored therein are identified. The end user also specifies the order which the documents will be stored within the folder. Thus, the EU creates the folder and files it into a library 12. Subsequent operations involving the folder created can be performed on the entire folder without retrieving all of the individual documents stored therein. The EU interacts with a dialog manager application 14 which provides all of th data or screens necessary to create the folder with the documents. For example, the dialog manager application will present a screen which request the EU to

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 81 of 431

enter any access control for the folder, any contextual-search characteristics, the identification of a requester/principle of the folder, and the definition of the folder. The definition of the folder includes an ordering criteria for the documents to be included in the folder, an indication that a document is included in a particular folder, any document-in-folder attributes of the document to be filed including whether or not history is to be maintained on the document and any pointers or addresses of the physical location of all of the documents to be filed in the folder. These documents can be directly accessible to a requester application program 16 or accessible to the requester's library server 18. After the dialogue manager application 14 has gather the above-identified information, it transmits the information to the requester application program 16.

The requester application application program 16, in response to input from the dialogue manager application 14, builds a request in the form of a file and transmits the request to the library server 18. The requester application program 16 makes a copy of each of the documents identified by the EU which are accessible in a local storage medium 20. The copies of the documents are transmitted to the library server 18 along with the request. Additionally, the requester application program 16 transmits pointers to the physical location of all of the documents to be filed. All of the documents in the local storage medium 20 will be transmitted with the request. The requester application program 16 also transmits pointers to other documents to be filed which are accessible to the library server 18 on the server storage medium or library 12.

The library server 18 files the folder into the server storage medium 12 as specified by the EU. Access control will be established and any contextual-search characteristics will be enabled as specified. The documents transmitted with the folder request will be filed with the appropriate access control and contextual-search characteristics. Data objects associated with the folder document will be established to reflect the ordering criteria and the order of the documents filed in the folder. The history attributes for the folder document will be established and any history attributes for any of the documents filed therein will be established. Thereafter, the data objects associated with the documents contained in the folder document will be set to reflect that the document is contained within the folder document.

The document management system 10 shown in Fig. 1 utilizes a uniform structure for exchanging information within the system. This structure includes an encoding scheme which is designed to convey any document, irrespective of it content, from one type of office system to another and to communicate the intent of the person creating or transmitting a document as to the method of processing thereof. One type of structure which meets all of these requirements is the Document Interchange Architecture (DIA) which is a part of a DISOSS office system marketed by the International Business Machines Corporation.

DIA is a program-to-program communication architecture which defines the protocols and data structures that enable programs to interchange information such as documents and messages in a consistent and predictable manner. DIA is independent of the type of information managed by DIA services. DIA includes documents objects which contain parameters or descriptors that describe the contents of the information being transmitted. The descriptors contained in the objects include the name under which the information is to be filed, the authors, the subject of the information and the date the information was filed in the document history. These descriptors enable a document to be searched in a storage medium such as the server library 12.

The server library 12 performs various services for the system 10. These services are used for storing and retrieving documents electronically. Whenever a document is filed in the server library 12, a set of descriptors called a document profile is filed with it. The profile contains the descriptors noted above. Document profiles are used in searching for documents in the library 12. For purposes of illustration and not limitation, a EU can ask the system 10 to search for all documents regarding a particular subject and by a certain author which was filed in the library 12 between any two dates. Upon completing the search, the system presents the EU with a list of the documents which meet the search criteria. The EU could then ask the system 10 to retrieve a copy of a specific document on the list from the library an deliver the copy the EU for printing or viewing.

The server library 12 also provides the following services: file documents in and retrieve or delete documents from the library; update work in progress documents in the library; specify a security level to associate with the document that is being filed; allow authorized end users other than the EU who filed the document to retrieve the document from the library and perform searches for and retrieve documents in the library for other end users. The server library 12 assigns each new document filed in therein a unique name called a library-assigned document name (LADN). This name is returned to the requester and can be used to uniquely identify the document at some later time.

Referring to Fig. 2, each document stored in the server library 12 includes the objects shown therein. All of the objects shown in Fig. 2 are created in response to the processing a FILE command. A document

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 82 of 431

model object contains information concerning ownership and attributes of a specific document. This object controls the access to the document during its life in the library.

An original owner object contains or points to information used by an owner of the document to control access to the document as filed.

A document content object provides for the storage of the document content and for saving information relating to the actual size of the filed document.

A document relation object describes the logical relationships between the document and other documents. If the document is a folder, each of the documents contained therein has a pointer or LADN entry in this object. If this document is in one or more folders, then each folder has a pointer or LADN entry in this object. Enter and remove history may be maintained for the document either as a folder or as a document in other folders.

An access control model object is created when the document owner authorizes other users to access the document.

Structures for all of the above-identified objects except document relations object are a part of the DISOSS office system and will not be described herein. Fig. 3 shows the structure of the document relation object which consists of the following: an attribute parameter set and a folder document section, a document-within-a-folder section.

The attribute parameter set indicates whether or not the document associated with the document relation object is a folder or whether or not the document is a 'folder-only' document. Fig. 4 illustrates the structure for the attribute parameter set.

The folder attribute indicates whether or not the document associated with the document relation object is a folder. If the document is a folder, then a folder section parameter set is required. A DIF (document in folder) attribute indicates whether or not the document is contained within any folders. A folder-only attribute indicates whether or not the document can be viewed as existing on its own when it is included within a folder. Documents are viewed as folder-only when both the DIF and Folder-only attributes are positively set.

A physical document in a physical folder is a folder-only document. In essence, the physical document exists in the folder and can not stand on its own. However, electronic documents can logically exist in multiple places at the same time. Therefore, a document can appear to be in more than one folder and standing on its own all at the same time. Whether or not the document can stand on its own when it is also in a folder is indicated by the folder-only attribute. Folder-only documents are viewed as stand-alone when they are not contained by any folders.

The folder document section includes the following sections: folder attributes and entered document parameters set. The folder attributes indicates the folder characteristics such as ordering criteria and history. Each document entered into the folder document associated with the document relation object will have an entered document parameter set. Fig. 5 illustrates the structure for the folder document section. The attributes parameter allows for the specification of an open option and the history option. The folder is open so that documents can be entered into or removed from the folder after it has been filed in the server library 12. As documents are entered into and removed from the open folder, the history option is specified by an entered document parameter. The entered document parameter is deleted when a document is removed from the folder and is created when the same document is reentered into the folder. The removal date and time and the requester's ID are added to the entered document parameter set. When the document is re-entered into the folder, the date and time and the requester's ID is added to the entered document parameter set. Thus, the attribute parameter specifies the following folder characteristics: open or closed and history or no history. Folders with the option can have documents entered and removed. Folders with the closed option can not have documents entered or removed. Open folders with the history option will have a history in the Entered Document parameter set for those documents subsequently removed from or re-entered into the folder. Open folders with "no history" option have the Entered Document parameter set deleted when the document is removed from the folder and created when the document is subsequently re-entered.

The sequence option specifies how the documents within a folder are to be ordered and the manner the order is to be maintained as documents are entered into the folder. When a folder is distributed or retrieved, the order in which the contained documents are sent is the order specified by the sequence parameter set. The contained documents can be ordered by the user by position when filed and entered or by profile parameters either in ascending or descending order.

Fig. 6 shows the structure for the Entered Document parameter. The Entered Document parameter includes a LADN of each document entered into the folder, the user-assigned document name of the document entered into the folder, and the date and time that the document was entered into the folder or removed from the folder.

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 83 of 431

Fig. 7 shows a structure for a file command used by the present invention in creating the folder in the information processing system. The file command includes a file command section and at least one document unit section. The file command section includes information relating to any access and search criteria entered by the EU. For purposes of illustration and not limitation, the file command structure includes two document unit sections. Each of the document unit sections is associated with respective documents to be included in the folder. Thus, the number of the documents unit sections will vary depending on the number of documents to be included in the folder. Similarly, the file command section includes two identified data (IDD) operands. An IDD1 operand is associated with the first document, the folder, specified by the EU. The IDD1 operand includes a unique identifier for the folder within the context of the command and a physical pointer which points to document unit 1. An IDD2 operand is associated with the second document specified by the EU to be included in the folder. Similarly, the IDD2 operand includes a unique identifier for the second document within the context of the command, an indicator that the second document is to be entered into the folder document represented by IDD1 and a physical pointer which points to document unit 2. Document unit 1 includes a document relation object (DRO). The DRO includes any relation attributes, folder attributes, a folder table-of-contents framework which is empty if the folder is being created, and a document-in-folder table-of-contents framework which is also empty if the folder is being created. Document unit 1 further includes an interchange document profile (IDP) which contains descriptive information regarding the document. Document unit 2 includes also a DRO and an IDP. The DRO associated with document unit 2 includes relation attributes and a document-in-folder table-of-contents framework.

Set out below is an illustration of an application program useable by the requestor application in filing a folder in the information processing system. The program is in program design language from which source code and machine code are derivable.

```
REQUESTER PROC
    INPUT
        ACCESS CONTROL INFORMATION
        CONTEXTUAL-SEARCH CHARACTERISTICS
        DO FOR EACH DOCUMENT SPECIFIED IN THIS
            REQUEST
```


Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 84 of 431

```
                A POINTER TO THE PHYSICAL DOCUMENT
                (PPTR) WHICH WILL BE THE LOCAL POINTER
                OR THE LIBRARY IDENTIFIER.

                A UNIQUE IDENTIFIER FOR THIS DOCUMENT
                WITHIN THE SCOPE OF THIS REQUEST (DID).

                A REFERENCE IDENTIFIER FOR EACH FOLDER
                CONTAINING THIS DOCUMENT, IF THIS
                DOCUMENT IS TO BE INCLUDED WITHIN A
                FOLDER (RID).

                A POSITION INDICATOR FOR THE POSITION
                THIS DOCUMENT WILL TAKE IN THE
                REFERENCED FOLDER, IF THIS DOCUMENT IS
                TO BE INCLUDED WITHIN A FOLDER (POS).

                ATTRIBUTES FOR THE DOCUMENT (HISTORY).

                ATTRIBUTES FOR THE FOLDER (HISTORY,
                ORDER, OPEN), IF THE DOCUMENT IS A
                FOLDER.
          ENDDO
     PROCESS
          SET THE ACCESS CONTROL
          SET THE CONTEXTUAL-SEARCH CHARACTERISTICS
          SET THE REQUESTER AND PRINCIPAL IDENTIFIERS
          DO FOR EACH DOCUMENT (IDD OR RDD) EXPLICITLY
               SPECIFIED IN THE REQUEST
                    IF THE DOCUMENT DOES NOT EXIST IN
                         THE LIBRARY,
                              THEN
                                   COPY THE DOCUMENT.

                                   SET THE DOCUMENT
```


Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 85 of 431

ADDRESS TO POINT TO THE POSITION OF THE DOCUMENT IN THE REQUEST UNIT.

SET UP THE DATA OBJECT (DRO) WHICH WILL CONTAIN THE UNIQUE LIBRARY IDENTIFIER FOR THE FOLDERS WHICH CONTAIN THIS DOCUMENT.

SET THE DOCUMENT-IN-FOLDER ATTRIBUTES (HISTORY) IN THE DRO AS SPECIFIED.

IF THE DOCUMENT IS A FOLDER,
THEN

SET THE FOLDER ATTRIBUTES (HISTORY, ORDER, OPEN) IN THE DRO AS SPECIFIED.

SET UP THE DATA OBJECT WHICH WILL CONTAIN THE UNIQUE LIBRARY IDENTIFIERS FOR THE DOCUMENTS CONTAINED WITHIN THIS FOLDER.

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 86 of 431

```
                    ENDIF
               ENDIF
               SET SPECIFIED IDENTIFIER FOR THIS
                    DOCUMENT
               DO FOR EACH FOLDER (RID)
                    CONTAINING THIS DOCUMENT
                    SET THE RID FOR THIS FOLDER
                    FOR THIS IDD OR RDD.

                    IF A POSITION IS EXPLICITLY
                         SPECIFIED FOR THIS
                         DOCUMENT WITHIN THIS
                         FOLDER,
                         THEN
                              SET SPECIFIED
                              POSITION (POS) FOR
                              THIS DOCUMENT
                              CORRESPONDING TO
                              THIS RID.
                    ENDIF
               ENDDO
          ENDDO
     END REQUESTER PROC
```

When the requester application program 16 receives data from the dialogue manager 14, it builds operands specifying the access contextual-search characteristics, requester and principal identifiers for all of the documents filed with this request. For each document passed with the request, the IDD operand is built. If the document presently exist in the library 12, only the RDD operand is built. Both operands include the following: a pointer (PPTR) to the physical location of the document wherein the RDD will contain a library pointer and the IDD will contain a pointer to the local storage medium 20 contained within the request; a unique document identifier within the scope of the command (DID); references to the folder or folders containing each of the documents (RID = DID of the folder); and positions (POS) for each of the documents within the referenced RID folders. The requester application program 16 then builds the IDD operand for each new document. Data areas associated with each of the documents are then built and included in the DRO. A document-in-folder table of contents (DIFTOC) contains the data for the documents contained in the folder. Additionally, the DRO contains the history attribute for the documents contained within the folder.

Set out below is an illustration of an application program useable by the library server 18 in filing a folder in the information processing system. The program is in program design language from which source code and machine code are derivable.

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 87 of 431

```
BEGIN LIBRARY SERVER PROC
   INPUT
        ACCESS CONTROL INFORMATION FROM REQUESTER
        APPLICATION.
        CONTEXTUAL-SEARCH INFORMATION
        REQUESTER/PRINCIPLE IDENTIFIERS.
        DO FOR EACH DOCUMENT SPECIFIED IN THIS
             REQUEST AN IDD OR A RDD OPERAND WHICH
             INCLUDES:
             A POINTER TO THE PHYSICAL DOCUMENT
             (PPTR) WHICH WILL BE EITHER THE LOCAL
             POINTER (IDD OPERAND) OR THE LIBRARY
             IDENTIFIER (RDD OPERAND).

             AN UNIQUE IDENTIFIER FOR THIS DOCUMENT
             WITHIN THE SCOPE OF THIS REQUEST (DID).

             A REFERENCE IDENTIFIER FOR EACH FOLDER
             CONTAINING THIS DOCUMENT, IF THIS
             DOCUMENT IS TO BE CONTAINED WITHIN A
             FOLDER (RID).
```


Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 88 of 431

```
                    A POSITION INDICATOR FOR THE POSITION
                    THIS DOCUMENT WILL TAKE IN THE
                    REFERENCED FOLDER, IF THIS DOCUMENT IS
                    TO BE CONTAINED WITHIN A FOLDER (POS).

                    A DOCUMENT RELATION OBJECT (DRO)
                    CONTAINING THE FOLLOWING:
                         DOCUMENT RELATION ATTRIBUTE.
                         ORDERING CRITERIA AND OTHER FOLDER
                         ATTRIBUTES, IF THE SPECIFIED
                         DOCUMENT IS A FOLDER TO BE CREATED
                         WITH THIS REQUEST.
                         DOCUMENT-IN-FOLDER ATTRIBUTES.
                         A DOCUMENT-IN-FOLDER
                         TABLE-OF-CONTENTS (DIFTOC) AREA
                         WHICH WILL BE SET UP BUT WILL NOT
                         CONTAIN ANY ENTRIES.
                         A FOLDER TABLE-OF-CONTENTS (FTOC)
                         AREA WHICH WILL BE SET UP BUT WILL
                         NOT CONTAIN ANY ENTRIES.
               ENDDO
          PROCESS
               CALL BUILD TABLE PROC FOR DID/LADN AND
               RID/DID TABLES.
               DO FOR EVERY FOLDER (RID ENTRY):
                    DO FOR EVERY DOCUMENT (DID) TO BE
                         PLACED IN THIS FOLDER
                         FIND THE ENTRY POSITION FOR THIS
                         DID ACCORDING TO THIS FOLDER'S
                         ORDERING CRITERIA IN THE FOLDER'S
                         TABLE-OF-CONTENTS.
                         ENTER THE LADN ASSOCIATED WITH
                         THIS DID IN THE FOLDER'S
                         TABLE-OF-CONTENTS.
```


Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 89 of 431

```
                    IF HISTORY IS SPECIFIED FOR THIS
                    FOLDER,
                      THEN
                         SET THE REQUESTER'S ID IN THE
                         HISTORY PORTION OF THE ENTRY.
                         SET THE PRINCIPLE'S ID IN THE
                         HISTORY PORTION OF THE ENTRY.
                         SET THE CURRENT DATE AND TIME
                         IN THE HISTORY PORTION OF THE
                         ENTRY.
                    ENDIF
                    ENTER THE LADN ASSOCIATED WITH
                    THIS FOLDER (RID) IN THE
                    DOCUMENT-IN-FOLDER
                    TABLE-OF-CONTENTS.
                    IF HISTORY IS SPECIFIED FOR THIS
                    DOCUMENT,
                      THEN
                         SET THE REQUESTER'S ID IN THE
                         HISTORY PORTION OF THE ENTRY.
                         SET THE PRINCIPLE'S ID IN THE
                         HISTORY PORTION OF THE ENTRY.
                         SET THE CURRENT DATE AND TIME
                         IN THE HISTORY PORTION OF THE
                         ENTRY.
                    ENDIF
               ENDDO
          ENDDO
     END PROCESS
END LIBRARY SERVER PROC
```

As noted above, each document operand (RDD or IDD) has the unique identifier (DID) assigned thereto. The library server 18 then gets a LADN for every document explicitly specified in the request. A BUILD TABLE PROC is called to build a temporary table to match every DID to an associated LADN. Moreover, each document operands which corresponds to a document that will be placed into the folder includes a reference (RID) to the folder's unique document identifier DID. The RID with the document operand is set to the value of the folder operand's DID. The library server 18 then facilitates the building of a temporary table containing an entry for every folder referenced. Each folder entry will contain a list of DIDs representing the documents which are included within the folder. Each DID will be associated with an operand number (OPN) and a position (POS) in the folder. OPN is calculated by the library server since the original order of the operands may be used to determine the position of the documents within the folder if the POS value is not explicitly set by the requester application program 16.

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 90 of 431

For purposes of illustration and set forth in the table below, a folder with a DID of 1 contains two documents with DIDs of 2 and 3 in that order. A folder with DID of 4 contains two documents with DIDs of 2 and 5 in that order. The document operand for the DID = 2 document contains 2 RIDs. One for the folder defined with the document operand associated with DID = 1 and another for the folder associated with DID = 4. Additionally, the document operands are in the same order as the DID specification.

RID	DID/POS/OPNs	
1	2/1/2	3/2/3
4	2/1/2	5/2/5

Set out below is an illustration of an application program useable by the library server 18 in building the DID/LADN and RID/DID tables. The program is in program design language from which source code and machine code are derivable.

```
BEGIN BUILD TABLES PROC
    SET OPN TO A VALUE OF 1
    DO FOR EACH DOCUMENT SPECIFIED IN THE REQUEST:
        IF THE DOCUMENT DOES NOT EXIST IN THE
```


Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 91 of 431

```
                    LIBRARY,
                      THEN
                         COPY THE DOCUMENT AND ITS RELATED
                         OBJECTS INTO THE LIBRARY.
                         ASSIGN A UNIQUE LIBRARY IDENTIFIER TO
                         THIS DOCUMENT (LADN).
                           ELSE
                              OBTAIN THE UNIQUE LIBRARY
                              IDENTIFIER FOR THIS DOCUMENT
                              (LADN).
                    ENDIF
                    SAVE THE UNIQUE IDENTIFIER FOR THE REQUEST
                    (DID) WITH THE UNIQUE LIBRARY IDENTIFIER
                    (LADN) IN DID/LADN TABLE.
                    DO FOR EACH FOLDER REFERENCED (RID) BY THIS
                      DOCUMENT OPERAND:
                         IF THERE IS NO ENTRY IN THE RID/DID
                           TABLE,
                             THEN CREATE AN ENTRY FOR THIS RID
                         ENDIF
                         SET DID IN RID/DID TABLE
                         IF POS IS SET, THEN
                              SET POS IN RID/DID TABLE
                                ELSE, SET POS = HIGHEST POSSIBLE
                                   VALUE + 1 IN RID/DID TABLE
                         ENDIF
                         SET OPN IN RID/DID TABLE
                    ENDDO
                    SET OPN TO OPN + 1
               ENDDO
          END BUILD TABLE PROC
```

The library server 18 must keep track of the order in which document operands are specified. In positionally ordered folders wherein the position is not specified, the original operand order is the order in which the documents are placed in the folder. The library server 18 then builds an entry in the temporary table for every document specified in the IDD or RDD operand. Each entry matches a DID to a LADN. In addition, if the current document operand references a folder in which it will be included, the RID/DID temporary table is updated. The library server 18 then process the IDD if the document does not exist in the library 12. The document is then filed in the library 22 along with its associated data areas which includes the DRO and assigns a new LADN to the document. Thereafter, the library server 18 process the RID if the document does exist in the library 12 and builds the DID/LADN and the RID/DID entries in the temporary table. Document operands without a POS set that are placed in positionally ordered folders, go

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 92 of 431

into the folder after the last document currently in the folder. The OPN is then updated for the next operand.

Figs 7, 8 and 9 show a flow chart for the requester application program 18 in filing a folder in the information processing system. First, the application program 18 in step 100 interfaces with the dialogue manager to get the request. The access information, identifiers and search parameters are set in step 101. In steps 102 and 103, a determination is made whether each of the documents specified in the request exist in the library 12. If the documents do not exist in the library 12, a copy of the document and its related objects is made in steps 104 and 105. If the documents exist in the library 12, the library address is set in step 106. Step 107 determines whether each of the specified documents is a folder. Step 108 sets the folder order criteria and other folder attributes and the DID is set to a specified value in step 109. If a specified document in step 107 is not a folder, the DID is set to a specified value in step 109. In step 110, a determination is made whether each of the documents are included in an existing folder. If the document id a folder, the RIDs and POS are set in step 111 otherwise, control is transferred to step 112. In step 112, a determination is made whether the document is the last document specified in the request. If there are other documents to be processed, control is transferred to step 102. Otherwise, the requester application program 16 transmits the complete request to the library server 18 in step 113.

Referring to Figs. 10 to 13, there is illustrated a flow chart for the library server 18 in filing the folder in the library 12. In step 125, the library 18 server call the build tables routine to build the DID/LADN and RID/DID tables. In steps 126, 127 and 128, for each folder RID and each document DID in the RID/DID table, find folder table-of-contents entry position and set the LADN for this document. In step 129, if a folder history is to be maintained, the IDs of the requester and principal and the current date and time are set in step 130. The folder LADN are entered in the document-in-folder table-of-contents in step 131. In step 132, a determination is made as to whether a document history is to be maintained. The requester's ID and principal's ID and the date and time are set in step 133 if the document history is to be maintained. Step 134 determines if the last document entry has been processed for the RID. If there are other document entries to be processed, control is transferred to step 127. Otherwise, step 135 determines if the last RID in the RID/DID table has been processed. If there are other RIDs to process, control is transferred to step 126.

Referring to Figs. 14 to 17, there is illustrated a flow chart for the build table routine in generating the RID/DID and DID/LADN tables. As noted above, the build table routine is called by the library server 18. In step 140, the OPN is set to a value of one. For each DID in the call, a determination is made in steps 141 and 142 whether the document associated with each respective DID exists in the library 12. If the document is not in the library, a copy of the document and its related objects is made in step 143 and a LADN is assigned in step 144. Otherwise, the LADN for the document filed in the library 12 is fetched in step 145. For each folder RID referenced by the document, in steps 146 and 147, a determination is made as to whether an entry has to be made in the RID/DID table. An entry is made in the RID/DID table in step 148 if required. The DID is entered in the RID/DID table in step 149 and a determination is made in set 150 as whether the position indicator (POS) has been set. The POS is set to a value of one plus the highest possible value in the RID/DID table in step 151. If the POS has been previously specified, POS is set to the value specified in step 152. The document operand OPN is then set in the RID/DID table in step 153. In step 154, a determination is made whether the last folder has been processed. Control is transferred from step 154 to step 146 to process any remaining folders. Otherwise, OPN is incremented by a value of one in step 155. Step 156 determines whether the last DID has been processed. Control is transferred from step 156 to step 141 to process any remaining DIDs.

In summary, what has been described is a method of generating a folder in an information processing system for managing a group of documents included in the folder. An end user indicates the documents to be included in the folder, any search criteria, access control information, the logical relationship of the documents and the identification of the end user and/or the principal. The system then creates the folder and includes the specified documents therein in the order specified by the end user. Thereafter, when the folder can be requested, the documents will be transmitted therewith in the order established.

Claims

1. A method of operating an electronic information processing system for organising data, in the form of documents, within the system, comprising the steps of:
identifying a plurality of documents stored in the system;
establishing order criteria for the identified documents; and
creating and storing a folder comprising said identified documents positioned in accordance with said order criteria.

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 93 of 431

2. A method according to claim 1 including the further step of:
establishing a plurality of document attributes for each document included in the folder.

3. A method according to claim 2 including the step of:
invoking a history option for each document included in the folder.

4. A method according to claim 2 or claim 3 including the step of:
maintaining a log in the system for recording each document entry into, or removal from, a folder.

5. A method according to any one of the previous claims in which the system includes a first and a second data storage medium, and including the further step of:
determining whether a document to be included in a folder is stored in the first medium; and, if so,
copying the document and its associated identifier data into the folder in the second storage medium.

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 94 of 431

FIG. 1

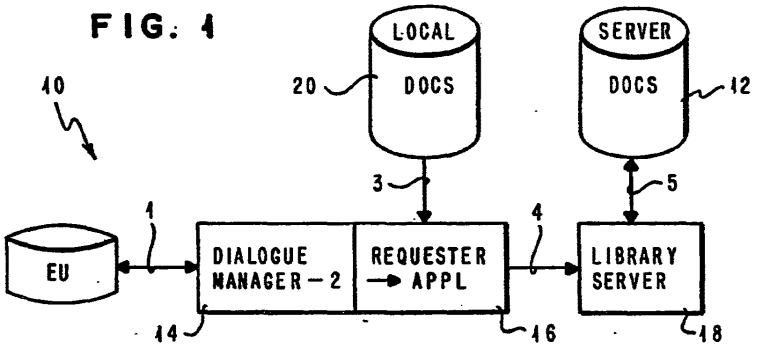
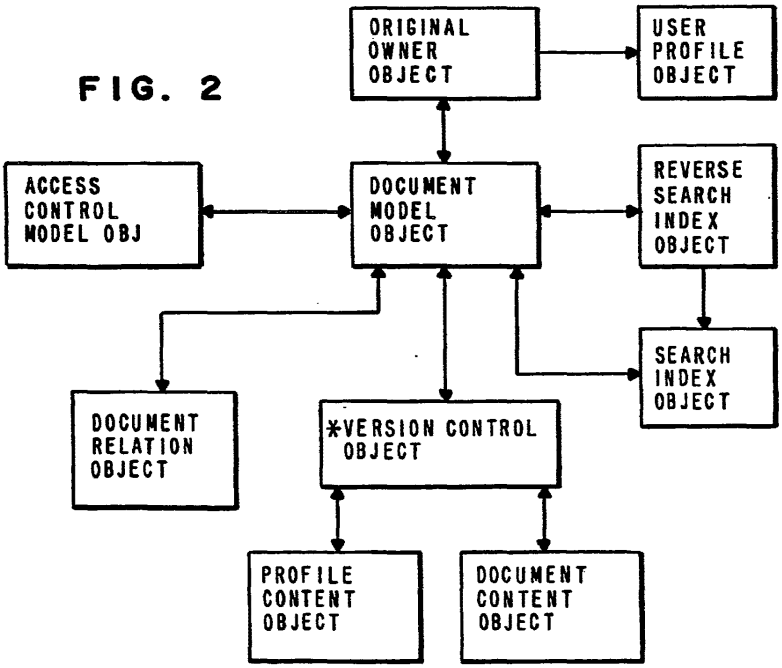

LOCAL
DOCS
20
SERVER
DOCS
12
40
3
5
1
4
EU
DIALOGUE MANAGER – 2
REQUESTER → APPL
LIBRARY SERVER
14
16
18

FIG. 2


ORIGINAL OWNER OBJECT
USER PROFILE OBJECT
ACCESS CONTROL MODEL OBJ
DOCUMENT MODEL OBJECT
REVERSE SEARCH INDEX OBJECT
SEARCH INDEX OBJECT
DOCUMENT RELATION OBJECT
*VERSION CONTROL OBJECT
PROFILE CONTENT OBJECT
DOCUMENT CONTENT OBJECT

PARAMETER	OCCURRENCE			
ATTRIBUTE PARAMETER SET	REQUIRED			
FOLDER PARAMETER SET	CONDITIONAL			
DIF PARAMETER SET	CONDITIONAL			

FIG. 3

PARAMETER	OCCURRENCE	MODIFY	SYSTEM	
FOLDER ATTRIBUTE	REQUIRED	NO	SET	
DIF ATTRIBUTE	REQUIRED	NO	SET	
FOLDER - ONLY ATTRIBUTE	REQUIRED	YES	—	

FIG. 4

PARAMETER	OCCURRENCE	MODIFY	SYSTEM	
ATTRIBUTES	REQUIRED	SET	—	
SEQUENCE	REQUIRED	SET	—	
ENTERED DOCUMENT	CONDITIONAL	—	SET	

FIG. 5

PARAMETER	OCCURRENCE	OWNER	SYSTEM	
LADN	CONDITIONAL	—	SET	
DOCUMENT NAME	CONDITIONAL	—	SET	
ENTER DATE TIME	CONDITIONAL	—	SET	

FIG. 6

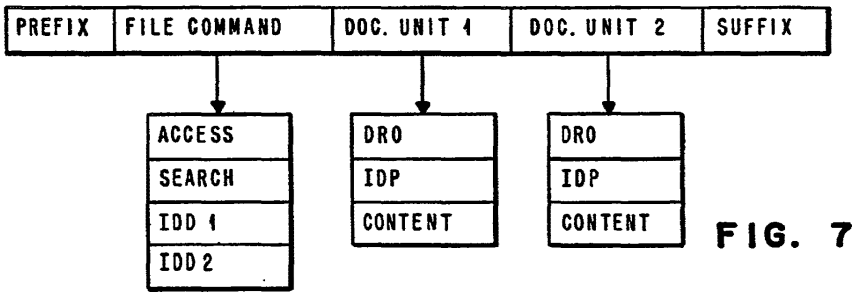


FIG. 7

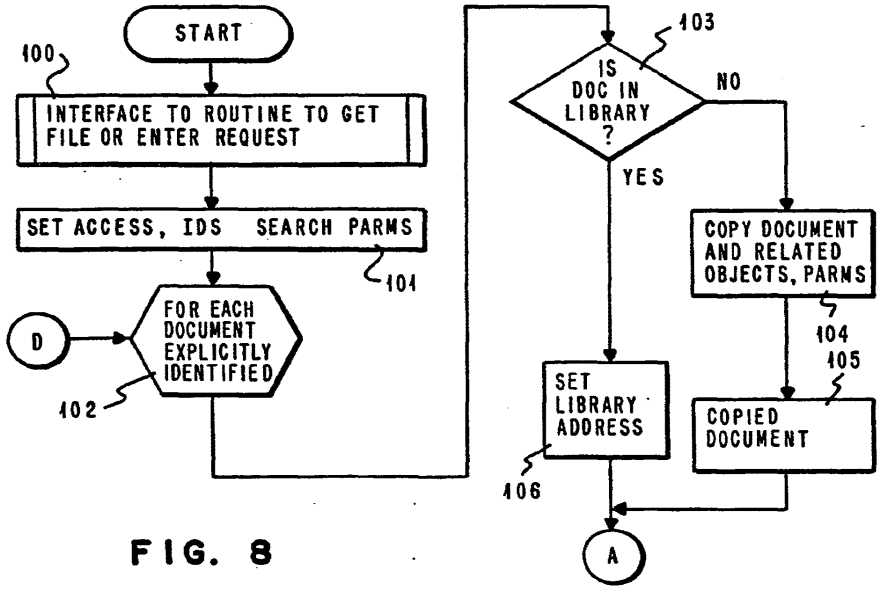


FIG. 8

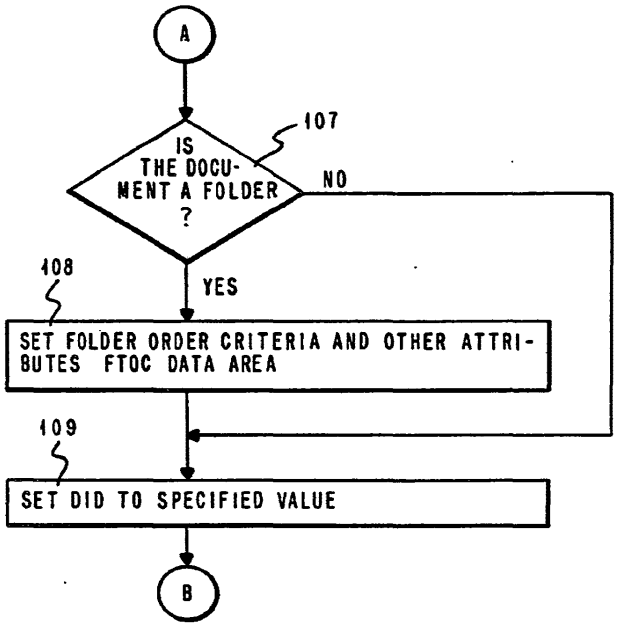

A
107
IS THE DOCU-MENT A FOLDER ?
NO
YES
108
SET FOLDER ORDER CRITERIA AND OTHER ATTRI-BUTES FTOC DATA AREA
109
SET DID TO SPECIFIED VALUE
B

FIG. 9

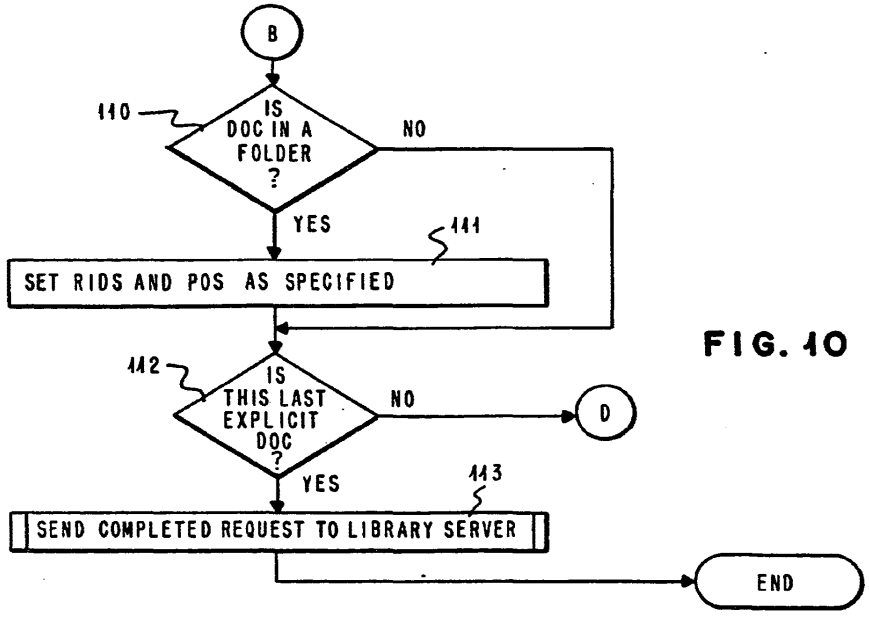

B
110
IS DOC IN A FOLDER ?
NO
YES
111
SET RIDS AND POS AS SPECIFIED
112
IS THIS LAST EXPLICIT DOC ?
NO
D
YES
113
SEND COMPLETED REQUEST TO LIBRARY SERVER
END

FIG. 10

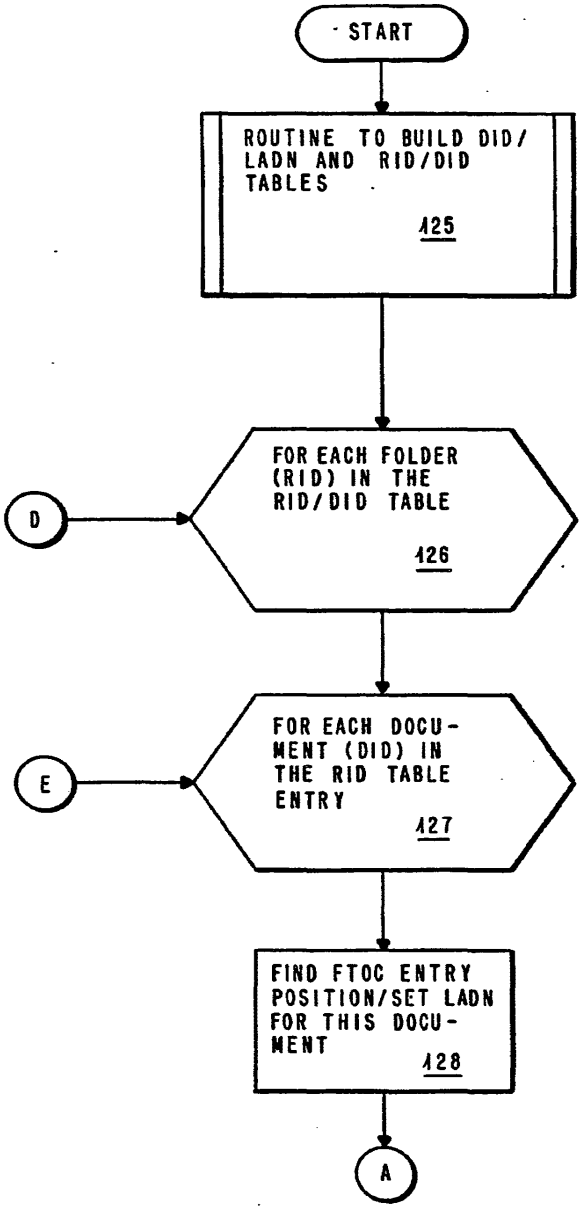

START
ROUTINE TO BUILD DID/ LADN AND RID/DID TABLES
125
FOR EACH FOLDER (RID) IN THE RID/DID TABLE
126
D
FOR EACH DOCU- MENT (DID) IN THE RID TABLE ENTRY
127
E
FIND FTOC ENTRY POSITION/SET LADN FOR THIS DOCU- MENT
128
A

FIG. 11

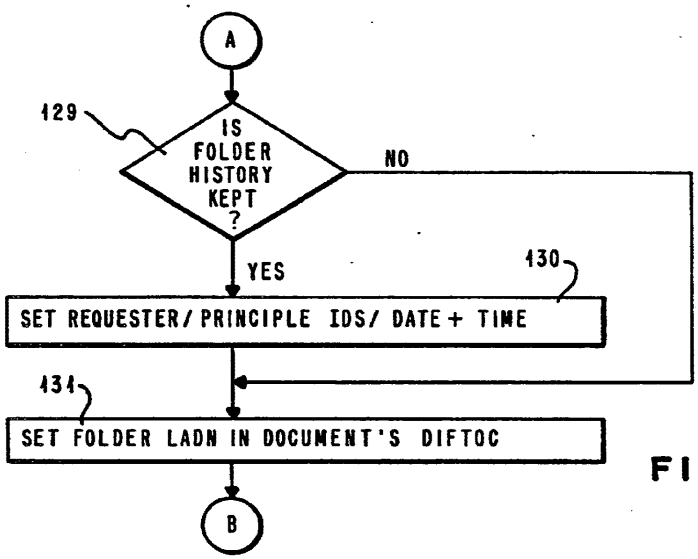

A
129
IS FOLDER HISTORY KEPT ?
NO
YES
130
SET REQUESTER/ PRINCIPLE IDS/ DATE + TIME
131
SET FOLDER LADN IN DOCUMENT'S DIFTOC
B

FIG. 12

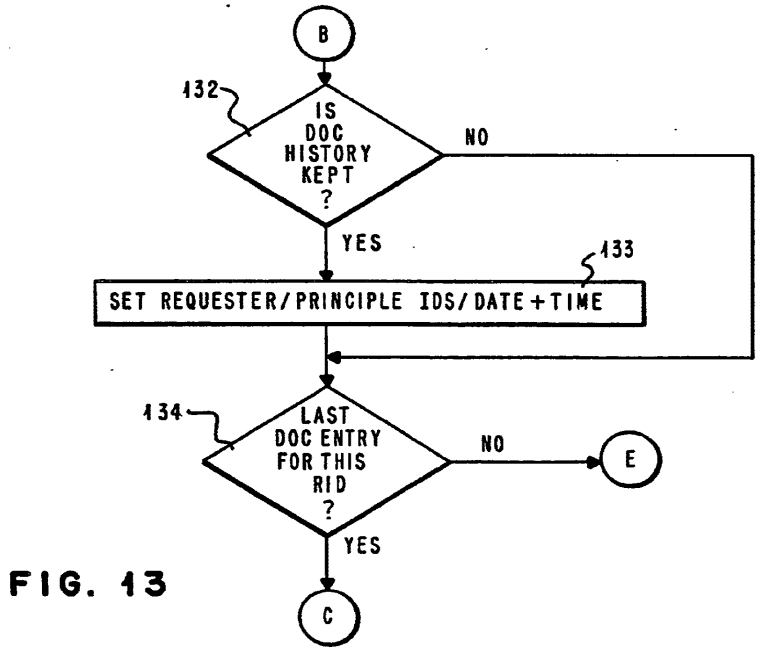

B
132
IS DOC HISTORY KEPT ?
NO
YES
133
SET REQUESTER/PRINCIPLE IDS/DATE+TIME
134
LAST DOC ENTRY FOR THIS RID ?
NO
E
YES
C

FIG. 13

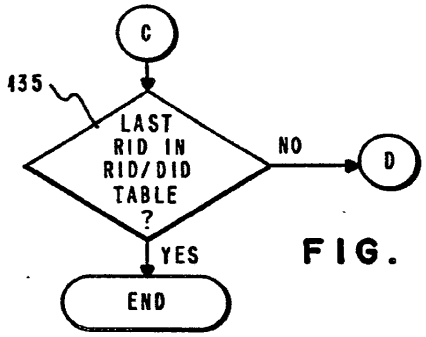

C
135
LAST RID IN RID/DID TABLE ?
NO
D
YES
END

FIG. 14

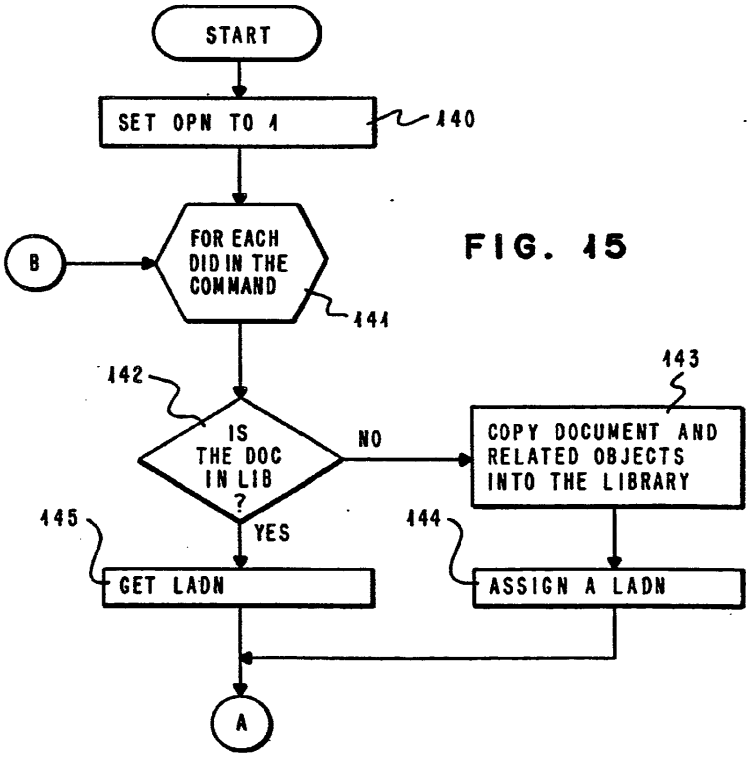

START
SET OPN TO 1
140
B
FOR EACH DID IN THE COMMAND
141
142
IS THE DOC IN LIB ?
NO
143
COPY DOCUMENT AND RELATED OBJECTS INTO THE LIBRARY
YES
145
GET LADN
144
ASSIGN A LADN
A

FIG. 15

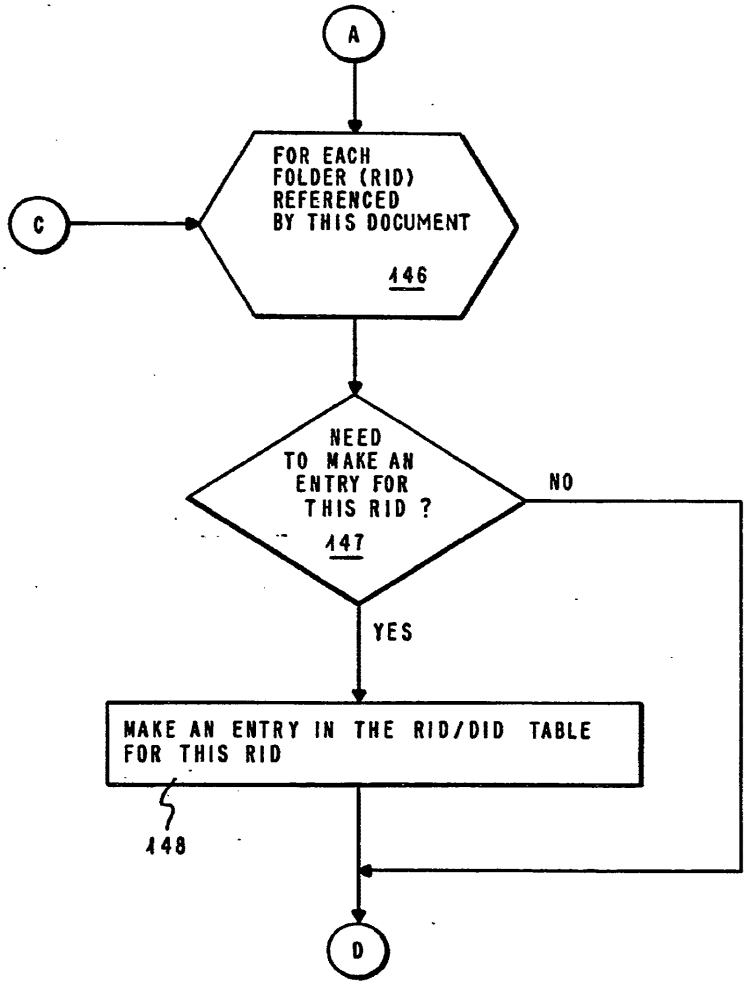

A
C
FOR EACH FOLDER (RID) REFERENCED BY THIS DOCUMENT
146
NEED TO MAKE AN ENTRY FOR THIS RID ?
147
NO
YES
MAKE AN ENTRY IN THE RID/DID TABLE FOR THIS RID
148
D

FIG. 16

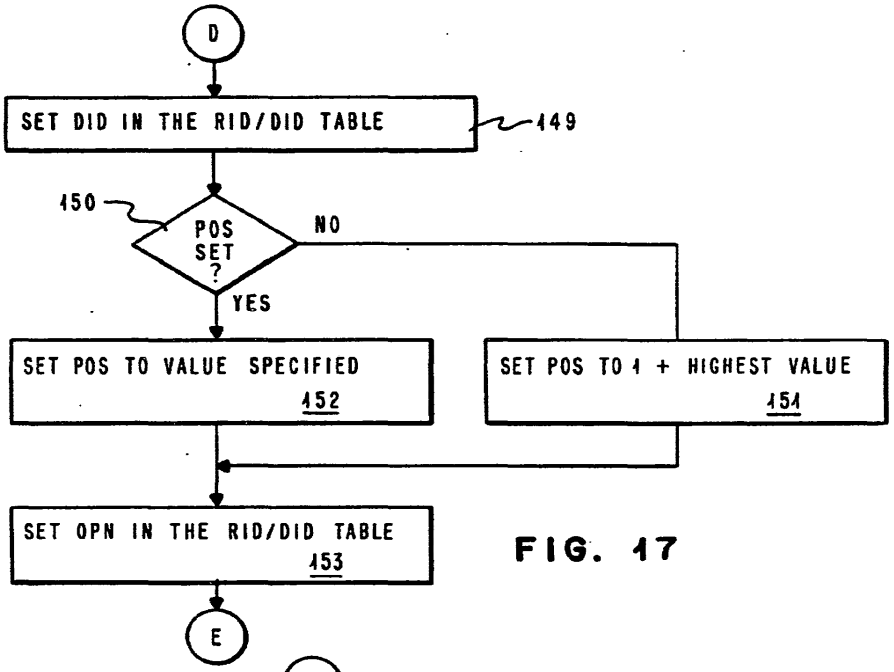

D
SET DID IN THE RID/DID TABLE
149
150
POS SET ?
NO
YES
SET POS TO VALUE SPECIFIED
152
SET POS TO 1 + HIGHEST VALUE
151
SET OPN IN THE RID/DID TABLE
153
E

FIG. 17

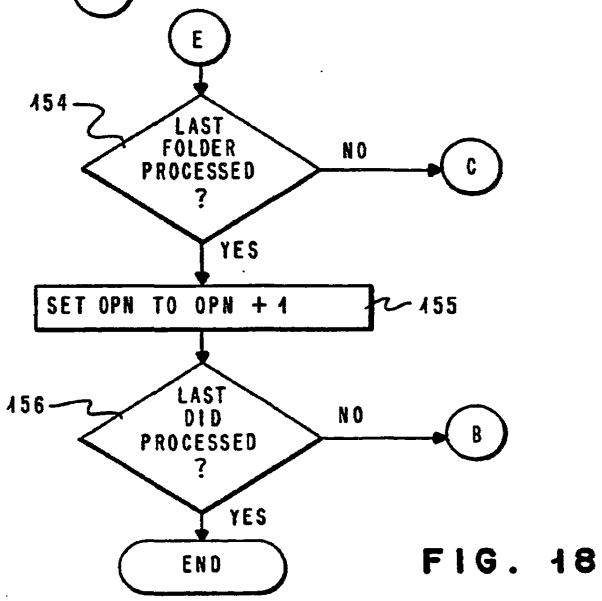

E
154
LAST FOLDER PROCESSED ?
NO
C
YES
SET OPN TO OPN + 1
155
156
LAST DID PROCESSED ?
NO
B
YES
END

FIG. 18

PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference TP102824	FOR FURTHER ACTION	see Form PCT/ISA/220 as well as, where applicable, item 5 below.
International application No. PCT/FI 2004/050051	International filing date (day/month/year) 26 April 2004	(Earliest) Priority Date (day/month/year) 30 April 2003
Applicant NOKIA CORPORATION ET AL		

This international search report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This international search report consists of a total of 3 sheets.

☐ It is also accompanied by a copy of each prior art document cited in this report.

1. **Basis of the report**
   a. With regard to the language, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.
      ☐ The international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).
   b. ☐ With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, see Box No. I.

2. ☐ **Certain claims were found unsearchable** (see Box No. II)

3. ☐ **Unity of invention is lacking** (see Box No. III)

4. With regard to the **title**,
   ☒ the text is approved as submitted by the applicant.
   ☐ the text has been established by this Authority to read as follows:

5. With regard to the **abstract**,
   ☒ the text is approved as submitted by the applicant.
   ☐ the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box No. IV. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. With regard to the **drawings**,
   a. the figure of the drawings to be published with the abstract is Figure No. 1
      ☒ as suggested by the applicant.
      ☐ as selected by this Authority, because the applicant failed to suggest a figure.
      ☐ as selected by this Authority, because this figure better characterizes the invention.
   b. ☐ none of the figures is to be published with the abstract.

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 104 of 431

INTERNATIONAL SEARCH REPORT

International application No.
PCT/FI 2004/050051

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: H04N 7/26
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: H04N, G06T

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-INTERNAL, WPI DATA, PAJ, INSPEC, COMPENDEX

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5838265 A (ADOLPH, D), 17 November 1998 (17.11.1998), column 1, line 32 - line 35; column 2, line 3 - line 8; column 2, line 34 - line 36, column 3, line 60 - line 63; column 4 line 15 - line 27, claim 4, abstract --	1-23
A	EP 0322123 A2 (INTERNATIONAL BUSINESS MACHINES CORP), 28 June 1989 (28.06.1989), page 4, line 50 - line 53 --	1,6,10-12, 14-16,20-23
P,A	US 20040008786 A1 (BOYCE, J MCDONALD), 15 January 2004 (15.01.2004), paragraph [0039] --	1-23

[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
15 Sept 2004	17 -09- 2004
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer Jesper Bergstrand /LR Telephone No. +46 8 782 25 00

Form PCT/ISA/210 (second sheet) (January 2004)

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 105 of 431

INTERNATIONAL SEARCH REPORT

International application No.
PCT/FI 2004/050051

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
P,A	US 6646578 B1 (AU, J), 11 November 2003 (11.11.2003), paragraphs [0068]-[0070] --	1-23
P,A	US 20040008766 A1 (WANG, Y-K ET AL), 15 January 2004 (15.01.2004) --	1-23
P,A	US 20040013202 A1 (LAINEMA, J), 22 January 2004 (22.01.2004) -- --------	1-23

Form PCT/ISA/210 (continuation of second sheet) (January 2004)

INTERNATIONAL SEARCH REPORT
Information on patent family members

31/07/2004

International application No.
PCT/FI 2004/050051

US	5838265	A	17/11/1998	DE	19524808	A	09/01/1997
				EP	0752789	A	08/01/1997
				JP	9187007	A	15/07/1997
EP	0322123	A2	28/06/1989	AU	2402488	A	29/06/1989
				JP	1195531	A	07/08/1989
US	20040008786	A1	15/01/2004	WO	2004008761	A	22/01/2004
				US	20040008782	A	15/01/2004
				US	20040008783	A	15/01/2004
				WO	2004008642	A	22/01/2004
				WO	2004008762	A	22/01/2004
US	6646578	B1	11/11/2003	NONE			
US	20040008766	A1	15/01/2004	FI	20020810	A	30/10/2003
				WO	03094530	A	13/11/2003
US	20040013202	A1	22/01/2004	WO	03092297	A	06/11/2003
				WO	2004025943	A	25/03/2004

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/426,928	04/30/2003	Miska Hannuksela	915-005.053	6259

7590 01/11/2007

Ware, Fressola, Van Der Sluys & Adolphson, LLP
Building Five, Bradford Green
755 Main Street
P.O. Box 224
Monroe, CT 06468

EXAMINER	
PHILIPPE, GIMS S	
ART UNIT	PAPER NUMBER
2621	

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	01/11/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

PTOL-90A (Rev. 10/06)

Office Action Summary	Application No.	Applicant(s)	
	10/426,928	HANNUKSELA ET AL.	
	Examiner	Art Unit	
	Gims S. Philippe	2621	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1-23 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1-23 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date 10/04/04.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 109 of 431

DETAILED ACTION

This is a first office action in response to application no. 10/426,928 filed on April 30 2003 in which claims 1-23 are presented for examination.

Specification

1. Applicant is reminded of the proper language and format for an abstract of the disclosure.

The abstract should be in narrative form and generally limited to a single paragraph on a separate sheet within the range of 50 to 150 words. It is important that the abstract not exceed 150 words in length since the space provided for the abstract on the computer tape used by the printer is limited. The form and legal phraseology often used in patent claims, such as "means" and "said," should be avoided. The abstract should describe the disclosure sufficiently to assist readers in deciding whether there is a need for consulting the full patent text for details.

The language should be clear and concise and should not repeat information given in the title. It should avoid using phrases which can be implied, such as, "The disclosure concerns," "The disclosure defined by this invention," "The disclosure describes," etc.

2. The abstract of the disclosure is objected to because of the phrase "the invention relates". Correction is required. See MPEP § 608.01(b).

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent

granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

4. Claims 1-23 are rejected under 35 U.S.C. 102(e) as being anticipated by Visharam et al. (US Patent Application Publication no. 2004/0010802 A1).

Regarding claims 1, 6, 10-12, 14, 15-16, and 20-23, Visharam discloses the same encoder/decoder, software programs with machine executable steps and method for encoding sequences of pictures into a bitstream wherein parameters are defined in a parameter set and each picture comprises information on one or more slices (See figs. 5, 9, 10A, 10B, and [0033 to 0037]), and comprising defining parameters in a sequence parameter set (See [0042], lines 2-7), defining parameters in a picture parameter set (See [0042], lines 11-14), and defining at least one picture parameter in a slice header, the picture parameter remaining unchanged at least in all slice headers of one picture (See [0042], lines 7-11). The applicant should note that the step of identifying the picture parameter in the slice header will help in decoding as noted in [0022]. Also the step of defining the picture parameter in the slice header is met in [0067-0068].

As per claims 2, 7, and 17, Visharam further discloses a slice header included with a reference to a picture parameter set (See [0040, 0041]).

As per claims 3, 8, and 18, Visharam further discloses the picture parameter set included with reference to a sequence parameter set (See [0042]).

As per claims 4, 9, and 19, Visharam further discloses the picture parameter selected from a group of information of a picture order count, a frame number and an identifier of an independently decodable picture (See fig. 5, items 500 and 502, fig. 11, and [0037]).

As per claim 5, Visharam further discloses the sequence parameter set and picture parameter set are transmitted less often than once per each picture (See [0046-0048]).

As per claim 13, Visharam further discloses storing the parameter set in both the encoder and the decoder (See [0022] and [0070]).

5. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Boice et al. (US Patent Application Publication no. 2003/0012275 A1) teaches multiple parallel encoders and statistical analysis thereof for encoding a video sequence.
Visharam et al. (US Patent Application Publication no. 2004/0199565) teaches method and apparatus for supporting advanced coding formats in media files.
Chiang et al. (US Patent no. 5515107) teaches method of encoding a stream of motion picture data.
Boice et al. (US Patent no. 7072393) teaches multiple parallel encoders and statistical analysis thereof for encoding a video sequence.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Gims S. Philippe whose telephone number is (571) 272-7336. The examiner can normally be reached on M-F (10:30-7:00).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Dastouri S. Mehrdad can be reached on (571) 272-7418. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Gims S Philippe
Primary Examiner
Art Unit 2621

GSP

September 14, 2006

FORM PTO-1449 INFORMATION DISCLOSURE STATEMENT	ATTY DOCKET NO. 915-005.053	SERIAL NO. 10/426,928
	APPLICANT: M. HANNUKSELA, et al.	
	FILING DATE: April 30, 2003	ART UNIT: 2631

OIPE JC24 OCT 04 2004 PATENT & TRADEMARK OFFICE

UNITED STATES PATENT DOCUMENTS

EXAM. INITIAL		DOCUMENT NUMBER	DATE	INVENTOR/ASSIGNEE	CLASS	SUBCLASS	FILING DATE IF APPROPRIATE
GP		5,838,265	Nov. 17, 1998	*Adolph*			
GP		20040008786	Jan. 15, 2004	*Boyce*			
GP		6,646,578	Nov. 11, 2003	*Au*			
GP		20040008766	Jan. 15, 2004	*Wang, et al.*			
GP		20040013202	Jan. 22, 2004	*Lainema*			

FOREIGN PATENT DOCUMENTS

		DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES/NO
GP		EP 0322123	June 28, 1989	Europe			

OTHER DOCUMENTS (INCLUDING AUTHOR, TITLE, DATE, PERTINENT PAGES, ETC.)

Examiner (To be assigned) /Gims Philippe/	Date: September 30, 2004 09/14/2006

Notice of References Cited	Application/Control No. 10/426,928	Applicant(s)/Patent Under Reexamination HANNUKSELA ET AL.	
	Examiner Gims S. Philippe	Art Unit 2621	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-5,515,107	05-1996	Chiang et al.	348/473
*	B	US-2004/0010802	01-2004	Visharam et al.	725/95
*	C	US-7,072,393	07-2006	Boice et al.	375/240.01
*	D	US-2004/0199565	10-2004	Visharam et al.	709/201
*	E	US-2003/0012275	01-2003	Boice et al.	375/240.01
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 115 of 431

Index of Claims

Application/Control No.	Applicant(s)/Patent under Reexamination
10/426,928	HANNUKSELA ET AL.
Examiner	**Art Unit**
Gims S. Philippe	2621

√	Rejected	–	(Through numeral) Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

Claim		Date
Final	Original	9/14/06
	1	√
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Claim		Date
Final	Original	
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Claim		Date
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Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 116 of 431

Search Notes	Application/Control No.	Applicant(s)/Patent under Reexamination	
	10/426,928	HANNUKSELA ET AL.	
	Examiner	Art Unit	
	Gims S. Philippe	2621	

SEARCHED			
Class	Subclass	Date	Examiner
375	240.14 240.01 240.28 240.25	9/14/2006	GP
348	473		
709	201		
725	95		

INTERFERENCE SEARCHED			
Class	Subclass	Date	Examiner

SEARCH NOTES (INCLUDING SEARCH STRATEGY)		
	DATE	EXMR
Text searched; class/subclass	9/14/2006	GP

EAST Search History

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	0	(sequence near3 parameter$1) and "20040010802"	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/14 17:10
L2	1	(sequence$1 with parameter$1) and "20040010802"	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/14 17:10
S1	371	(pixel$1 near5 predict$ near4 mode$1)	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/11 15:00
S2	111	(adjacent near4 block$1) and S1	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/09 17:46
S3	89	horizontal$2 and vertical$2 and S2	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/09 17:46
S4	81	encod$3 and decod$3 and S3	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/09 17:47
S5	31	(DC near4 prediction) and S4	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/09 17:47
S6	31	(default near5 quantization near4 (encoding or coding))	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2006/09/09 19:59
S7	0	(motion compesat$ near4 predict$ near4 pixels)	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/09 20:01
S8	482	(motion compensat$ near4 predict$ near4 pixels)	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/09 20:02
S9	319	(predict$ near4 error$1) and S8	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/09 20:02
S10	37	(quantization near3 level$1) and S9	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/09 21:22

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 118 of 431

EAST Search History

S11	291	((pixel$1 near4 array$1) and ((bitstream$1 or bit stream$1) near4 sequence$1))	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/09 21:23
S12	85	(motion near4 compensat$ near4 predict$) and S11	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/09 21:24
S13	58	(predict$ near4 error$1) and S12	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/09 21:24
S14	19	(quantization near4 level$1) and S13	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/09 21:25
S15	4	(sequence near3 level near quantization near4 parameter$1)	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/11 15:01
S16	25	(sequence with level$1 with quantization near4 parameter$1)	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/11 15:08
S17	12	(sequence with level$1 near5 QP)	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/11 15:15
S18	54	(default near5 quantization) and (motion near4 prediction with error$1)	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/11 15:19
S19	43	(sequence$1 with bitstream$1) and S18	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/11 15:24
S20	71	(bitstream$1 same digital near4 video near4 sequences)	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/11 15:25
S21	0	(default near5 level$1 near5 quantization) and S20	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/11 15:25
S22	14	(default near5 level$1 near5 quantization)	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/11 15:26
S23	27	(default with level$1 with quantization)	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/11 15:26

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 119 of 431

EAST Search History

S24	2	(predict$ near4 error$1 near3 value$1) and S23	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/11 15:27
S25	1365	(predict$ with error$1 with value$1 same coefficients)	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/11 15:28
S26	909	(predict$ with error$1 with value$1 with coefficients)	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/11 15:28
S27	72	(digital near4 sequence$1) and S26	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/11 15:28
S28	18	(quantization near5 level$1) and S27	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/11 15:56
S29	42210	(digital near3 video sequence$1)	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/11 15:57
S30	1385	(motion near3 compensat$ near predict$) and S29	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/11 15:58
S31	614	(prediction near4 error$1) and S30	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/11 15:58
S32	309	(default near5 quantization)	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/11 15:59
S33	8	S31 and S32	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/11 16:02
S34	45514	(digital near4 video sequence$1)	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/11 16:03
S35	681	(motion near4 prediction with error$1) and S34	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/11 16:05
S36	21	(default near4 level with quantization)	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/11 16:11

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 120 of 431

EAST Search History

S37	0	(default with level with quantization) andl S35	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/11 16:11
S38	0	(level with quantization) andl S35	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/11 16:12
S39	179	(level with quantization) and S35	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/11 16:13
S40	126	(transform near3 coefficients) and S39	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/11 16:13
S41	117	(pixel$1 near4 blocks) and S40	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/11 16:14
S42	117	video and S41	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/11 16:15
S43	112	(bitstream$1 or bit stream$1) and S42	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/11 16:15
S44	112	(transform near3 coefficients) and S43	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/11 17:02
S45	112	(digital video sequence$1) and S44	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/11 17:03
S46	28	(default near4 level$1) and S45	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/11 17:06
S47	180	(encod$3 near4 digital near3 video near3 sequence$1)	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/11 17:07
S48	78	(pixel$1 near4 block$1) and S47	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/11 17:07
S49	23	(motion near3 compensat$ near4 prediction) and S48	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/11 18:09

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 121 of 431

EAST Search History

S50	1955	((motion near compensat$ prediction) same transform)	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/11 18:10
S51	530	((motion near3 compensat$ prediction) same transform near3 (coding or encoding))	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/11 18:11
S52	7920	prediction error near3 value	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/11 18:11
S53	173	(prediction error near3 value$1) and S51	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/11 18:11
S54	163	transform coefficients and S53	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/11 18:12
S55	3	(default near3 level$1 near7 quantiz$) and S54	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/11 18:13
S56	38	(level$1 near4 quantiz$) and S54	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/11 18:13
S57	21	(digital near5 video sequence$1) and S56	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/11 18:14
S58	1355	(digital near3 video sequence$2) and (compensat$2 near5 predict$3)	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/12 12:14
S59	667	(predict$3 near4 error$1) and S58	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/12 12:15
S60	925	(transform$ near5 predict$3 near3 error$1)	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/12 12:16
S61	172	S59 and S60	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/12 12:16
S62	325	(default near4 quantiz$5)	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/12 12:17

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 122 of 431

EAST Search History

S63	4	S61 and S62	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/12 12:16
S64	373	(default near7 quantiz$5)	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/12 12:17
S65	4	S61 and S64	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/12 12:18
S66	48	(quantization near3 level$1) and S61	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/12 13:49
S67	13	("5751358" or "5054103" or "5144426" or "5715009" or "6256349").pn.	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/12 14:34
S68	13	(default near4 quantization near4 level$1)	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/12 14:37
S69	252	(difference near4 quantization near4 level$1)	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/12 14:38
S70	30	(motion near3 compensat$ near4 prediction) and S69	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/12 17:37
S71	2	(dct near3 scalab$5 near4 compression)	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/12 17:39
S72	3	(dct near7 scalab$5 near4 compression)	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/12 17:41
S73	4	(dct with scalab$5 near4 compress$)	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/12 17:45
S74	15	(quantiz$3 near4 scalar near6 map$1)	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/12 18:53
S75	107	((multiresolution or multi-resolution) near4 coefficients)	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/12 18:54

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 123 of 431

EAST Search History

S76	32	significance map$1 and S75	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/12 18:55
S77	29	arithmetic and S76	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/12 19:11
S78	265	(frame$1 near3 two-dimensional near4 array$1)	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/12 19:12
S79	19	(motion near4 macroblock$1) and S78	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/12 19:13
S80	13	resolution$1 and S79	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/12 19:13
S81	213	(random near4 access near4 point near7 video)	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/13 11:55
S82	63	refresh$ and S81	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/13 11:55
S83	50	(intra-cod$3 or intracod$3) and S82	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/13 11:57
S84	50	predict$ and S83	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/13 12:15
S85	1410	((intracoded or intra coded) near4 block)	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/13 12:15
S86	416	(random$2 near3 access$3) and S85	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/13 12:17
S87	119	(loop near4 filter$3) and S86	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/13 12:18
S88	76	entry point and S87	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/13 12:36

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 124 of 431

EAST Search History

S89	5057	(region$1 near5 sequence$1) and video	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/13 12:19
S90	45	S88 and S89	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/13 12:22
S91	0	(region$1 near4 (intra coded or intracoded) near4 block$1) and entry point	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/13 12:38
S92	3757	(entry point with random access$)	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/13 12:56
S93	47	(intra-coding or intracod$3) and S92	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/13 12:57
S94	4015	(divid$3 near4 frame$1 near5 block$1)	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/13 12:58
S95	6	S93 and S94	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/13 13:03
S96	1217	((intracoding or intra coding) near4 block$1)	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/13 13:04
S97	170	entry point and S96	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/13 13:04
S98	99	(random$2 near3 access$3) and S97	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/13 13:05
S99	99	information and S98	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/13 13:05
S100	66	loop filter$3 and S99	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/13 13:06
S101	64	(video near4 sequence$1) and S100	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/13 13:06

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 125 of 431

EAST Search History

S102	63	(frame$1 near4 block$1) and S101	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/13 13:07
S103	63	predict$ and S102	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/13 13:57
S104	7	((random$ near4 access$) and (gradual$2 near4 decoder$1 near4 refresh$3))	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/13 13:59
S105	9	(gradual$2 near4 decoder$1 near4 refresh$3)	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/13 14:00
S106	9	(gradual$2 with decoder$1 with refresh$3)	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/13 14:01
S107	3170	(decoder$1 with refresh$3)	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/13 14:01
S108	1418	(decoder$1 near4 refresh$3)	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/13 14:01
S109	542	(random$2 near3 access point$1) and S108	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/13 14:02
S110	13	(intra-coding or intracoding) and S109	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/13 14:19
S111	2	"5778143".pn.	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/13 16:12
S112	0	filter$ and "5568200".pn.	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/13 16:13
S113	1	interpolat$ and "5568200".pn.	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/13 16:22
S114	1	(sub picture$1 or sub frame$1) and "5568200".pn.	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/13 16:30

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 126 of 431

EAST Search History

S115	2	(sub picture$1 or subframe$1) and "5568200".pn.	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/13 16:41
S116	1	(motion near3 compensat$) and "5568200".pn.	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/13 16:47
S117	40	"5568200"	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/13 16:48
S118	14	random$ and S117	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/13 18:04
S119	37	(mask$3 near4 display) and surveillance and security	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/13 18:11
S120	1388	(mask$3 near4 magnification)	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/13 18:11
S121	0	(mask$3 near4 magnification near4 range$1) and surveillance	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/13 18:12
S122	49	(mask$3 near4 range$1) and surveillance	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/13 19:15
S123	38	display and S122	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/13 18:13
S124	15	window$1 and S123	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/13 18:13
S125	1	((mask$3 near4 range$1) and surveillance).clm.	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/13 20:24
S126	1104	surveillance and camera$1 and continuous$ and display and scene	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/13 20:25
S127	259	node$1 and location and S126	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/13 20:25

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 127 of 431

EAST Search History

S128	204	(sound or voice or audio) and S127	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/13 20:26
S129	203	control$4 and S128	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/13 20:26
S130	177	(real time or live or realtime) and S129	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/13 20:31
S131	165	(gui$1 or interface$1) and S130	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/13 20:31
S132	159	record$ and S131	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/13 20:34
S133	85	(recorder$ or dvr) and S132	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/13 20:34
S134	21	ATM and S133	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/13 20:38
S135	1	surveillance and monitoring and cameras and dvt$1 and dvr$1 and atm	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/13 20:40
S136	5402	surveillance and monitoring and cameras	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/13 20:40
S137	923	surveillance node$1 and S136	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/13 20:40
S138	700	continuous$ and S137	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/13 20:41
S139	444	live and record$3 and S138	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/13 20:41
S140	13	(display$3 near4 scene$1) and S139	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/13 20:44

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 128 of 431

EAST Search History

S141	22	(surveillance node$1 same events same continuous$)	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/13 20:47
S142	78	(continuous$ near4 monitoring same cameras same display$3)	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/13 20:54
S143	1	nodes and S142	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/13 20:47
S144	2422	348/143	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/13 20:54
S145	96	(continuous$ near5 display$3) and S144	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/13 20:55
S146	76	cameras$1 and S145	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/13 20:55
S147	229	(parameter$1 near5 set$1 near7 slice$1)	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/14 13:57
S148	77	sequence$1 and video and S147	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/14 12:22
S149	54	(header$1 near4 slice$1) and S148	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/14 12:22
S150	54	((encod$3 or coding) and (decod$3)) and S149	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/14 12:23
S151	36	count$3 and S150	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/14 12:51
S152	115882	(parameter$1 near6 parameter set$1)	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/14 12:52
S153	44	S152 and S150	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/14 12:53

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 129 of 431

EAST Search History

S154	10	(parameter$1 near3 parameter$1 near4 set$1 near4 slice$1)	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/14 14:01
S155	372	(parameter$1 near3 parameter$1 set$1 near4 slice$1)	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/14 14:01
S156	67	(sequence$1 near4 picture$1) and S155	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/14 14:02
S157	43	(header$1 near5 slice$1) and S156	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/14 14:05
S158	43	(parameter$1 set$1) and S157	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/14 14:06
S159	31	(parameter$1 near3 set$1) and S157	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/14 14:48
S160	95388	(parameter set$1 and encoding)	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/14 14:49
S161	77650	sequence parameter$1 and S160	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/14 14:49
S162	59	((sequence near3 parameter$1) and (parameter near2 set$1 near5 encoding))	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/14 17:09

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 130 of 431

EAST Search History

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	229	(parameter$1 near5 set$1 near7 slice$1)	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/14 13:57
L2	77	sequence$1 and video and l1	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/14 12:22
L3	54	(header$1 near4 slice$1) and l2	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/14 12:22
L4	54	((encod$3 or coding) and (decod$3)) and l3	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/14 12:23
L5	36	count$3 and l4	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/14 12:51
L6	115882	(parameter$1 near6 parameter set$1)	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/14 12:52
L7	44	l6 and l4	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/14 12:53
L8	10	(parameter$1 near3 parameter$1 near4 set$1 near4 slice$1)	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/14 14:01
L9	372	(parameter$1 near3 parameter$1 set$1 near4 slice$1)	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/14 14:01
L10	67	(sequence$1 near4 picture$1) and l9	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/14 14:02
L11	43	(header$1 near5 slice$1) and l10	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/14 14:05
L12	43	(parameter$1 set$1) and l11	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/14 14:06

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 131 of 431

EAST Search History

L13	31	(parameter$1 near3 set$1) and l11	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2006/09/14 14:06

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 132 of 431

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PATENT
Attorney Docket No. 915-005.053

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In Re Application Of:

Miska HANNUKSELA et al.	:	Confirmation No.: **6259**
Application Serial No.: **10/426,928**	:	Group/Art Unit: **2621**
Filing Date: **April 30, 2003**	:	Examiner: **Gims S. PHILIPPE**

Title: ***Method for Coding Sequences of Pictures***

Commissioner of Patents
Mail Stop **AMENDMENT**
P.O. Box 1450
Alexandria, VA 22313-1450

AMENDMENT IN RESPONSE TO NON-FINAL OFFICIAL ACTION

Sir:

In response to the non-final Official Action of January 11, 2007, please amend the above-captioned patent application as follows:

I hereby certify that this communication is being deposited with the United States Postal Service today, **April 10, 2007**, in an envelope with sufficient postage as first-class mail addressed to the Commissioner of Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

Lissette Ramos

IN THE CLAIMS:

Please amend the claims as follows:

1. (original) A method for encoding sequences of pictures into a bitstream, wherein parameters are defined in a parameter set and each picture comprises information of one or more slices, the method comprising:

- defining parameters in a sequence parameter set;
- defining parameters in a picture parameter set; and
- defining at least one picture parameter in a slice header, the picture parameter remaining unchanged at least in all slice headers of one picture.

2. (original) The method according to claim 1, wherein the slice header is included with a reference to a picture parameter set.

3. (original) The method according to claim 1, wherein the picture parameter set is included with a reference to a sequence parameter set.

4. (original) The method according to claim 1, wherein the picture parameter is selected from a group of information of a picture order count, a frame number and an identifier of an independently decodable picture.

5. (original) The method according to claim 1, wherein the sequence parameter set and picture parameter set are transmitted less often than once per each picture.

6. (original) A method for decoding sequences of pictures from a bitstream, wherein parameters are defined in a parameter set and each picture comprises information of one or more slices, the method comprising:

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 134 of 431

- recognizing a sequence parameter set and forming at least one sequence parameter pertaining to a sequence using the parameter set;
- recognizing a picture parameter set and forming at least one first picture parameter pertaining to a picture using the parameter set;
- forming at least one second picture parameter using information of a slice header, the at least one second picture parameter remaining unchanged at least in all slice headers of one picture; and
- using the at least one second picture parameter in decoding.

7. (original) The method according to claim 6, wherein the slice header is included with a reference to a picture parameter set.

8. (original) The method according to claim 6, wherein the picture parameter set is included with a reference to a sequence parameter set.

9. (original) The method according to claim 6, wherein the second picture parameter is selected from a group of information of a picture order count, a frame number and an identifier of an independently decodable picture.

10. (original) An encoder for encoding sequences of pictures into a bitstream, wherein parameters are defined in a parameter set and each picture comprises information of one or more slices, the encoder comprising:

- means for defining parameters in a sequence parameter set;
- means for defining parameters in a picture parameter set; and
- means for defining at least one picture parameter in a slice header, the picture parameter remaining unchanged at least in all slice headers of one picture.

11. (original) A decoder for decoding sequences of pictures from a bitstream, wherein parameters are defined in a parameter set and each picture comprises information of one or more slices, the decoder comprising:

- means for recognizing a sequence parameter set and forming at least one sequence parameter pertaining to a sequence using the parameter set;
- means for recognizing a picture parameter set and forming at least one first picture parameter pertaining to a picture using the parameter set;
- means for forming at least one second picture parameter using information of a slice header, the at least one second picture parameter remaining unchanged at least in all slice headers of one picture; and
- means for using the at least one second picture parameter in decoding.

12. (original) A system comprising an encoder for encoding sequences of pictures into a bitstream, a decoder for decoding sequences of pictures from the bitstream, wherein parameters are defined in a parameter set and each picture comprises information of one or more slices, the encoder comprising:

- means for defining parameters in a sequence parameter set;
- means for defining parameters in a picture parameter set; and
- means for defining at least one picture parameter in a slice header, the picture parameter remaining unchanged at least in all slice headers of one picture;

and the decoder comprising

- means for recognizing a sequence parameter set and forming at least one sequence parameter pertaining to a sequence using the parameter set;
- means for recognizing a picture parameter set and forming at least one first picture parameter pertaining to a picture using the parameter set;
- means for forming at least one second picture parameter using information of a slice header, the at least one second picture parameter remaining unchanged at least in all slice headers of one picture; and

- means for using the at least one second picture parameter in decoding.

13. (original) The system according to claim 12, wherein a parameter set is stored in both the encoder and the decoder.

14. (original) A transmitting device comprising an encoder for encoding sequences of pictures into a bitstream, wherein parameters are defined in a parameter set and each picture comprises information of one or more slices, the encoder comprising:

- means for defining parameters in a sequence parameter set;
- means for defining parameters in a picture parameter set; and
- means for defining at least one picture parameter in a slice header, the picture parameter remaining unchanged at least in all slice headers of one picture.

15. (original) A receiving device comprising a decoder for decoding sequences of pictures from a bitstream, wherein parameters are defined in a parameter set and each picture comprises information of one or more slices, the decoder comprising:

- means for recognizing a sequence parameter set and forming at least one sequence parameter pertaining to a sequence using the parameter set;
- means for recognizing a picture parameter set and forming at least one first picture parameter pertaining to a picture using the parameter set;
- means for forming at least one second picture parameter using information of a slice header, the at least one second picture parameter remaining unchanged at least in all slice headers of one picture; and
- means for using the at least one second picture parameter in decoding.

16. (original) A bitstream comprising:

- encoded pictures;
- sequence parameters in a sequence parameter set;

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 137 of 431

- picture parameters in a picture parameter set;
- information of a slice comprising a slice header; and
- at least one picture parameter in the slice header, the picture parameter remaining unchanged at least in all slice headers of one encoded picture.

17. (original) The bitstream according to claim 16, wherein the slice header is included with a reference to a picture parameter set.

18. (original) The bitstream according to claim 16, wherein the picture parameter set is included with a reference to a sequence parameter set.

19. (original) The bitstream according to claim 16, wherein the picture parameter is selected from a group of information of a picture order count, a frame number and an identifier of an independently decodable picture.

20. (currently amended) A software program product comprising machine executable steps stored on a readable medium for execution on a processor, the machine executable steps for encoding sequences of pictures into a bitstream, wherein parameters are defined in a parameter set and each picture comprises information of one or more slices, the software program product comprising:

- defining parameters in a sequence parameter set;
- defining parameters in a picture parameter set; and
- defining at least one picture parameter in a slice header, the picture parameter remaining unchanged at least in all slice headers of one picture.

21. (currently amended) A software program product comprising machine executable steps stored on a readable medium for execution on a processor, the machine executable steps for decoding sequences of pictures from a bitstream, wherein

parameters are defined in a parameter set and each picture comprises information of one or more slices, the software program comprising:

- recognizing a sequence parameter set and forming at least one sequence parameter pertaining to a sequence using the parameter set;
- recognizing a picture parameter set and forming at least one first picture parameter pertaining to a picture using the parameter set;
- forming at least one second picture parameter using information of a slice header, the at least one second picture parameter remaining unchanged at least in all slice headers of one picture; and
- using the at least one second picture parameter in decoding.

22. (original) A storage medium including a software program comprising machine executable steps for encoding sequences of pictures into a bitstream, wherein parameters are defined in a parameter set and each picture comprises information of one or more slices, the software program comprising machine executable steps for:

- defining parameters in a sequence parameter set;
- defining parameters in a picture parameter set; and
- defining at least one picture parameter in a slice header, the picture parameter remaining unchanged at least in all slice headers of one picture.

23. (original) A storage medium including a software program comprising machine executable steps for decoding sequences of pictures from a bitstream, wherein parameters are defined in a parameter set and each picture comprises information of one or more slices, the software program comprising machine executable steps for:

- recognizing a sequence parameter set and forming at least one sequence parameter pertaining to a sequence using the parameter set;
- recognizing a picture parameter set and forming at least one first picture parameter pertaining to a picture using the parameter set;

- forming at least one second picture parameter using information of a slice header, the at least one second picture parameter remaining unchanged at least in all slice headers of one picture; and
- using the at least one second picture parameter in decoding.

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 140 of 431

IN THE ABSTRACT:

Please amend the abstract as follows:

~~--The invention relates to~~ A method for encoding sequences of pictures into a bitstream, wherein parameters are defined in a parameter set and each picture comprises information of one or more slices. The method comprises defining parameters in a sequence parameter set; defining parameters in a picture parameter set; and defining at least one picture parameter in a slice header. The picture parameter remains unchanged at least in all slice headers of one picture.--

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 141 of 431

REMARKS

In response to the Official Action of January 11, 2007, the Abstract has been amended so as to be in compliance with MPEP §608.01(b) and claims 20 and 21 have been amended.

Referring now to paragraph 4 of the Official Action, claims 1-23 are rejected under 35 USC §102(e) as anticipated in view of US patent application publication 2004/0010802, Visharam et al (hereinafter Visharam). It is asserted that Visharam, inter alia, discloses the same method for encoding sequences of pictures into a bit stream as set forth in claim 1, wherein parameters are defined in a parameter set and each picture comprises information of one or more slices. Applicant respectfully disagrees for the reasons set forth below.

More particularly, Visharam is directed to an encoding system that includes a video coding layer (VCL) to generate slices when encoding multimedia data, a generic adaptation layer (GAL) to create, from the slices, a set of GAL units having a format that is generic to various transport systems, and a network adaptation layer (NAL) associated with a specific transport system so as to map the set of GAL units to the format of the specific transport system (see Abstract of Visharam).

The concept of a parameter set as set forth in Visharam discloses no more than what is included in ITU-T document VCEG-N52 (available from http://ftp3.itu.ch/av-arch/video-site/0109 San/VCEG-N52.doc) and which is attached hereto as Appendix A. An accompanying Form PTO-1449 is also enclosed. As described in the Background of the Invention section of the present application, the present application is in fact directed to improvements to the standardization effort of the Joint Video Team (JVT) of ITU-T and ISO/IEC. The present invention is thus an improvement over the disclosure of Visharam.

In particular, the improvements of the present invention are mainly the separation of parameter sets to more than one category, including both a sequence parameter set and a picture parameter set.

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 142 of 431

The Office argues at page 3 of the Action that paragraph [0042], lines 11-14 define "parameters in a picture parameter set". It is respectfully submitted that this statement is incorrect since lines 11-14 of reference paragraph [0042] state:

"In one embodiment, each parameter set is assigned a unique identifier, which is constant throughout a video sequence, and each slice unit references a corresponding parameter set identifier."

This passage thus states that a parameter set identifier is assigned, the parameter set identifier is constant throughout a video sequence, and the parameter set identifier is referenced by each slice unit. A "picture parameter set" as required in claim 1 is not mentioned at all in the recited passage of Visharam. This observation also pertains to the Office's rejection of claims 3, 8 and 18 as set forth in the last sentence of paragraph 4 of the Action.

Therefore, independent claim 1 is not anticipated by Visharam. Since claim 1 is not anticipated by Visharam, it is respectfully submitted that claims 2-5, all of which depend from claim 1, are further not anticipated by Visharam.

Independent method claim 6 is directed to a method for decoding sequences of pictures from a bit stream which also recites actions concerning a sequence parameter set and a picture parameter set. For similar reasons as set forth above with respect to claim 1, Visharam does not anticipate this method for decoding sequences of pictures from a bit stream.

Independent encoder claim 10 corresponds to method claim 1 and, for similar reasons, is believed to be not anticipated by Visharam.

Independent decoder claim 11 is similar to method for decoding claim 6 and, for similar reasons as set forth above, is not anticipated by Visharam.

System claim 12 is directed to both an encoder and a decoder similar to claims 10 and 11 and is therefore also not anticipated by Visharam for the reasons set forth above.

Independent transmitting device claim 14, independent receiving device claim 15, and bit stream device claim 16 are similar to method claims 1 and 6 and, for similar reasons, are believed to be not anticipated by Visharam.

Independent software program product claim 20 and independent software program product claim 21 are respectively similar to method claims 1 and 6 and, for similar reasons, are believed to be distinguished over Visharam. Claims 20 and 21 have been slightly amended so as to insure that the claims define statutory subject matter. No new matter has been added.

Independent storage medium claim 22 and independent storage medium claim 23 are also similar to method claims 1 and 6 respectively and are therefore believed to be not anticipated by Visharam.

The Office also asserts that lines 7-11 of paragraph [0042] of Visharam defines at least one picture parameter in a slice header, the picture parameter remaining unchanged at least in all slice headers of one picture. In fact, lines 7-11 of paragraph [0042] of Visharam states:

> "For example, a GOP parameter value like picture size may change between GOPs but not at any lower levels. Hence, in one embodiment, all of the pictures and slices in a single GOP use the same GOP parameter value while a slice parameter may vary for every slice."

It is seen at paragraphs [0040] and [0041] of Visharam that slices and slice data partitions are described. These descriptions do not in any way relate to including a picture parameter set identifier in a slice header as required in claims 2, 7 and 17 and, consequently, these claims are further not anticipated by Visharam.

Furthermore, regarding dependent method claim 5, the Office asserts that paragraphs [0046-0048] of Visharam further disclose the sequence parameter set and picture parameter set being transmitted less often than once per picture frame. The referenced paragraphs of Visharam only refer to "parameter set" but do not refer to "sequence parameter set" and "picture parameter set" as required by claim 5. Therefore, this claim is further not anticipated by Visharam.

Since each of the independent claims is believed to be not anticipated by Visharam, it is respectfully submitted that all of the dependent claims are further not anticipated by Visharam, including those specifically discussed above.

In view of the foregoing, it is respectfully submitted that the present application as amended is in condition for allowance and such action is earnestly solicited.

The undersigned respectfully submits that no fee is due for filing this Amendment. The Commissioner is hereby authorized to charge to deposit account 23-0442 any fee deficiency required to submit this paper, including submission of such PTO-1449 and the enclosed document.

Respectfully submitted,

Dated: April 10, 2007

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Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 145 of 431

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FORM PTO-1449 INFORMATION DISCLOSURE STATEMENT	ATTY DOCKET NO. 915-005.053	SERIAL NO. 10/426,928
	APPLICANT: **M. HANNUKSELA, et al.**	
	FILING DATE: April 30, 2003	ART UNIT: 2621

UNITED STATES PATENT DOCUMENTS

EXAM. INITIAL		DOCUMENT NUMBER	DATE	INVENTOR/ASSIGNEE	CLASS	SUBCLASS	FILING DATE IF APPROPRIATE

FOREIGN PATENT DOCUMENTS

		DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES/NO

OTHER DOCUMENTS (INCLUDING AUTHOR, TITLE, DATE, PERTINENT PAGES, ETC.)

		"H.26L over IP and H.324 Framework"; ITU-Telecommunications Standardization Sector, Study Group 16 Question 6, Video Coding Experts Group (VCEG); Fourteenth Meeting, Santa Barbara, CA; September, 2001.

Examiner (To be assigned)	Date:

ITU - Telecommunications Standardization Sector
STUDY GROUP 16 Question 6
Video Coding Experts Group (VCEG)

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Title: H.26L over IP and H.324 Framework

Purpose: Proposal

Summary

This document discusses one possible concept for the transport of H.26L over IP and H.324 networks. We will present the approach based on an IP network and discuss the simple extension to H.324 in the end of this proposal. With this proposal a simple interworking of H.324 terminals with IP based terminals can be achieved.

An IP/UDP/RTP best effort network is assumed. The main design consideration is to distinguish clearly between such media information that has to be transported in real-time and non-real-time information, which is transported by means other than the media RTP stream. This concept leads to non self-contained RTP packet streams. It is applicable for all current IP transports, including IP over wireless links.

Parts of this framework have to be standardized within VCEG. Others, however, are under the responsibility of the IETF and IANA (for the MIME registrations), and, in case of wireless, ETSI, and industry consortia. The framework is for now only proposed in VCEG, but the authors are in close contact with key people in the IETF AVT and MMUSIC working groups to sanity check the content from their point-of-view.

The RTP stream consists of RTP packets that carry partitions of slices. It was found, that, in the current TML8 design, a maximum of three partitions per slice is appropriate. Pictures are divided into slices mainly to prevent partition sizes exceeding the path MTU size. A slice is a self-contained entity of a picture that does not rely on any information conveyed by previous RTP packets. Hence, mechanisms such as HEC or RFC2429 picture header repetition are unnecessary.

Any information that is concerned with more than a single slice is conveyed out of band. In particular, all information traditionally conveyed in the picture header and higher header layers, such as the picture size, entropy coding method, optional modes (if we are unlucky enough to use this concept again), and similar are never sent in the RTP stream.

The decoder maintains parameters sets in numbered storage locations. The simplest systems will need at least two storage locations, one for Intra slices and one for Inter slices. More complex systems maintain a multitude of parameter storage spaces for different picture resolutions, coding modes, and similar. Each slice contains in its header partition the information which storage space to use. Synchronization between updates of the parameter storage (when desired) and the media streams is handled externally.

For the parameter information a syntax is proposed that can one-to-one be converted into SDP, the description language used by SIP systems (such as 3GPP phones).

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 147 of 431

Intellectual Property Notice: The authors believe that there is no intellectual property associated with this proposal

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 148 of 431

Overview

Figure 1 depicts the architecture of a terminal using the H.26L over IP framework. A simple coder is assumed which is not capable to suggest coding modes by itself.

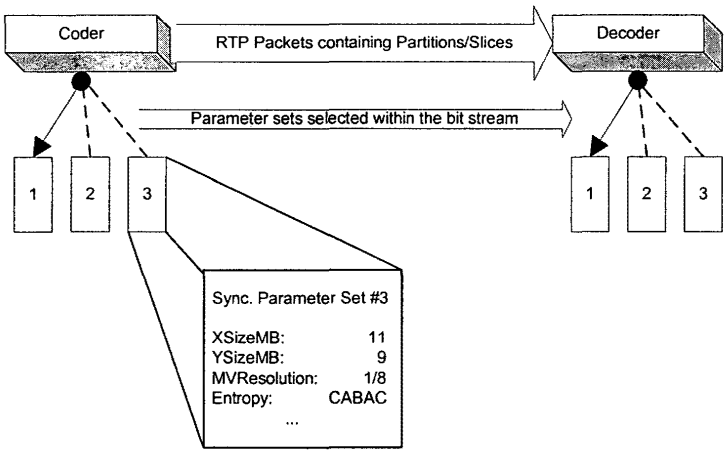


Figure 1: System Architecture

During the setup of the logical channel the capability exchange takes place. This procedure was already subject to many discussions within VCEG, and it was agreed that a simple version/profile/level concept should be used in order to avoid too much baseline operation due to an excessive number of options – as we have seen it with H.263. A profile/level/version combination defines the maximum capabilities of the codec, but all smaller/simpler modes must also be supported. In addition we propose that a profile also defines a *main operation point*, which, in many cases, will be the maximum capabilities at the maximum picture size allowed by the version/profile/level. The coding parameters of this *main operation point* are the initial *parameter set*. *Parameter sets* can be changed at any time, but only within the limits of the given version/profile/level combination. They perform many of the functions and contain most of the information of the traditional picture header.

The video coder converts pixel information into up to three bit fields per slice, containing the coded bits of each of the three partitions. Each partition may correspond to the payload of a single RTP packet, or all three partitions are combined into a single RTP packet in such cases in which data partitioning is not used (for example extremely low bit rates or gateway scenarios between ISDN and IP). The coder also generates side information such as the start MB address and the number of MBs of the slice and the *parameter set* to be used. Optionally, the coder may generate new *parameter sets* and convey them to the system. *Parameter sets* are transmitted out of band, typically through a reliable control channel. The coder can use *parameter sets* as soon as the system informs the coder that they are available at the decoder. This information is normally a side effect of the control protocol operation, as all control protocols currently under consideration for systems use some form of an acknowledgement mechanism. Hence, as an input, the coder has information about the available *parameter sets* at the decoder, as well as environment information such as the current network conditions and the desired sending bit rate.

The RTP/UDP/IP protocol stack conveys the media information to the receiver. Currently we do not foresee the need for an RTP payload header. This is very fortunate, because it eliminates the need for an additional packetization layer for H.324 systems, where no transport service comparable to the RTP payload header is available – hence fewer problems for gateway designers. There is also the advantage of lower overhead, especially since the new RTP draft (forthcoming successor of RFC1889) strongly suggests the use of 32 bit alignment, instead of 8 bit alignment, to allow for easier processing in high speed networking equipment. The bits of a partition are conveyed directly as the RTP payload, similar to simple audio codecs such as G.711.

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 149 of 431

At the receiver, the IP/UDP/RTP protocol stack generates the re-ordered packet stream and feeds it into the decoder. Any lost packets are signaled in an implementation specific way in order to trigger the use of error concealment. Currently, we assume the integrity of RTP packets as established by the use of the UDP checksum[1].

The video decoder receives all correctly transmitted partitions in the correct order. It maintains a number of *parameter set* storages. The header partition of each slice contains information which parameter set to use.

In this framework, the signaling path is typically implemented by the use of the SIP/SDP or H.245 control protocols. In many applications it will be sufficient to generate only a single parameter sets, which will be implicitly transmitted during capability exchange through the *default operation point* mechanism. (To recap, each version/profile/level combination implies the set up of one or more *parameter sets*. The first of these is the *default operation point*). More complex systems may generate and transmit additional parameter sets immediately following the capability exchange (possibly in the same setup message, at least for SIP based systems, see examples below), e.g. to allow for different picture formats for dynamic picture resizing. The most sophisticated systems may enable the change parameters during the existence of a logical channel. The resulting synchronization problems can be handled by RTCP return path signaling – current work in the IETF is underway to enable such features.

Note that there will be a need to carefully design the *main operation point* the version/profile/level definitions with the information typically used in real world systems in order to prevent excessive sending of update information. Work on this can commence as soon as the first profiles are defined. It is also a possibility to leave the version/profile/level definition and the associated *main operation point* definition to industry consortia.

Slices and Partitions

The fundamental data structure of the video coder is a slice. A slice compromises an integer number of macroblocks in scan order corresponding to the same picture – similar to scan-order slices of H.263 Annex K. Slices are not syntactical elements of H.26L, but a logical concept. Slices are independently decodable, but may import texture data from outside the slice boundaries during motion compensation.

The pixel data of slice may be composed of a maximum of three partitions. Partition A contains all header information including what is called in H.263 the slice header, motion vectors, MBTYPEs and similar. Partition B contains all Intra information, namely the Intra CBPs and all Intra coefficients. Partition C, finally, contains all Inter information, namely Inter-CPB and Inter coefficients. It is also possible to put all slice information into a single "partition" and, hence not use data partitioning. The signaling whether data partitioning is used or not is provided by external means through a version/profile/level combination.

Each partition starts with an UVLC codeword called PartitionId that indicates the type of the partition. Using this field, the RTP sequence number (or the AL3 sequence number in case of H.223), and in rare cases syntax violations due to the use of partitions not belonging to the same slice it is possible to detect the loss of partitions and/or whole frames, to trigger error concealment algorithms. See the section on De-Packetization below for an example.

Partition A: Header Data Partition

This partition contains everything traditionally associated with the Slice header, and the header info such as MBTYPEs, REFFRAME, INTRAPREDMODE, and MVD.

The Header Partition starts with a number of UVLC codewords that contain information about the slice:

PartitionId=1	UVLC codeword, indicating Partition type A.
ParameterSet	UVLC codeword, symbol number represents the *parameter set* number used for the slice. Here, information such as the Entropy Coding Method, the PartitionMode, or the picture size is stored.
SliceType	UVLC codeword, indicates the slice type. Here we can allow/permit different slice types in a single picture. We do not see a reason to permit such mixing, but we did not yet do a thorough analysis, especially not regarding SP frames. The following UVLC codes are used:

[1] However, systems may elect to allow the decoding of packets that failed the UDP checksum tests and in such cases the decoder will also receive a packet integrity signal by the protocol stack that indicates the passed/failed UDP checksum test. (Note that this case needs significant further study, because a failed UDP test may imply a corrupted RTP header with all the critical information in it)

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 150 of 431

0: Inter (P-) Slice
1: B-Slice
2: SP-Slice (this needs to be thought through)
3: Intra (I-) Slice

FirstMBInSlice — UVLC codeword, symbol number represents the MB number of the first MB in the Slice, starting from the upper left MB in the picture in scan order (same as H.263 Annex K). Note that the size of the codeword scales with the maximum picture size. For very big spatial picture sizes this mechanism is not very efficient. It was chosen, because it fits into the UVLC-only slice header architecture and scales with the picture size, i.e. more bits are used for bigger picture sizes than for small ones. Better ideas are very welcome.

InitialQP — UVLC codeword, symbol number represents 31 – QP of the first macroblock in the slice. The QP was not coded directly, because numerically higher QPs lead to fewer coefficient bits and higher compression, hence shorter symbols for higher QPs are desirable.

PictureID — UVLC codeword, symbol number represents the PictureID of the picture the slice belongs to. Note that, currently, the Picture ID would probably be a circular counter similar to the classic TR. However, this is the place to build in the "generalized Annex U functionality" which allows encoder dictated buffer management in the decoder. Exact timing information is not conveyed in the bit stream but by the means of the RTP timestamp (see the H.324 section below for info on how timing information is conveyed in non-RTP systems). Note also, that the numbering space for the Picture ID is a function of the number of available reference memories at the decoder, as specified in the sequence header and established during the capability exchange.

NumberMBsInSlice — UVLC codeword, symbol number represents the number of MBs represented by the slice.

At the next byte-aligned location, the bit buffer of the partition starts. This bit buffer may either contain UVLC or CABAC coded information. The following syntax elements are coded in this partition:

```
0     SE_MBTYPE              Macroblock Type
2     SE_INTRAPREDMODE       Intra Prediction Mode
1     SE_REFFRAME            Reference Frame
3     SE_MVD                 Motion Vector Data
0     SE_BFRAME              All Macroblock Data assigned to B-frames
0     SE_SPFRAME             All Macroblock Data assigned to SP-frames
```

Note that there is no need to transmit the number of bits/bytes used by the partition data because the IP header contains the packet size, and all other information can easily be deducted from this size information.

The coding of the numerical parameters of the "slice header" in the form of UVLC symbols seems at the first glance to be inefficient. However, we believe that a) it is not as inefficient as it seems, b) that the architectural advantages of using UVLC coding throughout are worth the few additional bits, and c) that the added flexibility of UVLCs regarding the numbering space clearly make this design favorable.

Partition B: Intra Partition

This partition contains Intra-CBP and all Intra coefficients.

The Intra partition starts with a one UVLC codeword header that is followed by the bit stream:

PartitionId=2 — UVLC codeword, fixed value of 1 indicating a type B partition.

At the next byte-aligned location, the bit buffer of the partition starts. This bit buffer may either contain UVLC or CABAC coded information. The following syntax elements are coded in this partition:

```
4     SE_CBP_INTRA           Coded Block Pattern for Intra Coded MBs
5     SE_LUM_DC_INTRA        Luma DC Coefficients for Intra Coded MBs
6     SE_CHR_DC_INTRA        Chroma DC Coefficients for Intra Coded MBs
7     SE_LUM_AC_INTRA        Luma AC Coefficients for Intra Coded MBs
8     SE_CHR_AC_INTRA        Chroma AC Coefficients for Intra Coded MBs
```


Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 151 of 431

There is no need to transmit the number of bits/bytes used by the partition data because the IP header contains the packet size, and all other information can easily be deducted from this size information.

Partition C: Inter Partition

This partition contains Inter-CBP and all Inter coefficients.

PartitionId=3 UVLC codeword.

At the next byte-aligned location, the bit buffer of the partition starts. This bit buffer may either contain UVLC or CABAC coded information. The following syntax elements are coded in this partition:

```
9     SE_CBP_INTER            Coded Block Pattern for Inter Coded MBs
10    SE_LUM_DC_INTER         Luma DC Coefficients for Inter Coded MBs
11    SE_CHR_DC_INTER         Chroma DC Coefficients for Inter Coded MBs
12    SE_LUM_AC_INTER         Luma AC Coefficients for Inter Coded MBs
13    SE_CHR_AC_INTER         Chroma AC Coefficients for Inter Coded MBs
```

There is no need to transmit the number of bits/bytes used by the partition data because the IP header contains the packet size, and all other information can easily be deducted from this size information.

Packetization for No Data Partitioning

The packetization for complete slices is similar to the packetization of the header partition, except that a "partition Type" 0 is introduced to distinguish between a header partition and a full slice partition. This allows gateway designs to identify the different partition types without parsing the bit stream. Hence, the header looks as follows:

PartitionId=0	UVLC codeword, indicating a full slice with no data partitioning.
ParameterSet	UVLC codeword, symbol number represents the parameter storage location used for the slice.
SliceType	UVLC codeword, indicates the slice type, same semantics as for Partition type A.
FirstMBInSlice	UVLC codeword, symbol number represents the MB number of the first MB in the Slice.
InitialQP	UVLC codeword, symbol number represents 31 – QP of the first macroblock in the slice.
PictureID	UVLC codeword, symbol number represents the PictureID of the picture the slice belongs to.
NumberMBsInSlice	UVLC codeword, symbol number represents the number of MBs represented by the slice.

At the next byte-aligned location, the bit buffer of the partition starts. This bit buffer contains one complete slice either in UVLC or CABAC entropy coding.

RTP Packetization Process

The packetization process for RTP is straightforward and follows the general principles outlined in RFC1889. In principle, the bit buffer containing the coded bits (and the UVLC codewords of the slice header in case of the header Partition or the full slice) are the RTP payload. There is no specific RTP payload header. The RTP header information is set as follows:

Timestamp	The presentation timestamp of the picture the slice belongs to, 27 MHz base clock is assumed. Slices are associated to pictures by using this time stamp.
Marker bit	Set for the very last packet of a picture, in line with the normal use of the M bit and to allow an efficient playout buffer handling.
Sequence No	Increased by one for each sent packet. Set to a random value during startup as per RFC1889
Version (V)	set to 2
Padding (P)	set to 0
Extension (X)	set to 0

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 152 of 431

Payload Type (PT) established dynamically during connection establishment

All other RTP header fields are set as per RFC1889 or, in the near future, its successor.

The slices MUST be sent in scan order, and the partitions MUST be sent in their natural order, Partition A before Partition B before Partition C. In other words, if the sequence number of Partition A of a given slice is n, then the sequence number of Partition B is n+1 and Partition C is n+2. Empty partitions MUST NOT be send. Unless no data partitioning is used, all partitions MUST be send in their own RTP packet. If no data partitioning is used then the slice MUST be sent in a single RTP packet. The slice size SHOULD be selected such as the MTU size is never exceeded by the partition.

Note that the data partitioning was designed to support unequal error protection schemes or priority supporting mechanisms. One naïve way to implement such a scheme is to simply send the header partition twice, with the same RTP sequence number. Such a scheme was shown to be quite efficient even considering the "wasted" bit rate [Q15J53]. Other schemes will typically employ more than one transport stream with different QoS properties. For those, a packetization scheme has to be defined as soon as Industry interest picks up and a suitable infrastructure becomes available (Currently, neither the public Internet, nor private IP networks support application based QoS management on a large scale, and will likely not do so in the foreseeable future).

RTP De-Packetization Process

The RTP de-packetization process is not to be standardized but implementation dependent. The following description will likely end up in the RTP payload specification and maybe also in the test model, but only as one possible example for a de-packetization method that works reasonably well.

An incoming stream of uncorrupted RTP packets, as asserted by the correct UDP checksum, is assumed. The playout buffer is filled with those packets after re-ordering according to the RTP sequence number. Whenever error free conditions exist, i.e. no packet loss occurred, the de-packetization process collects all non-empty partitions of a slice and passes them to the decoder. Doing so requires only to check the RTP header for sequence numbers, and the very first bits of the payload for the PartitionId – a task that can be done without implementing a full UVLC parser.

If, after waiting the playout buffer filling, a packet loss is detected, the de-packetization process can only pass those partitions to the decoder that were received. It may also drop individual partitions if necessary information from other partitions was not received. For the test model, it is proposed that, if the A partition was lost, the B and C partitions are dropped, and some form of concealment (proposed: TCON) is employed to "guess" the lost motion vectors. If Partition A is available, but Partition B is lost, then Partition C may be used in conjunction with Partition A to decode the Inter part of the slice. Error concealment of some form MAY be used to conceal the missing Intra information. If partition C is lost, then the Intra information of partition B is used for reconstruction and the motion vectors of partition A are used for the concealment of the Inter MBs. Table 1 lists the possibilities again. "Optional" here means, that decoders are free to implement the optional concealment mechanisms, whereas the other concealment mechanisms are mandatory at least for the test model (but possibly also for the standard itself):

Table 1: Actions upon detection of a partition loss

Available Partition	Intentional Drop	Concealment Method
-xx	B, C	TCON (using motion vectors of the spatially above MB row for each lost MB)
AB-	none	Conceal using MVs from Partition A, and texture from Partition C. Intra concealment optional
A-C	none	Conceal using MVs and Intra info from Partition B. Inter texture concealment optional
A--	none	Conceal using MVs from Partition A
Whole Slice	none	TCON

Note that a very similar de-packetization/reconstruction process was already shown to produce good results in an H.26L TML1 environment [Q15J53].

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 153 of 431

Parameter Sets

In this framework, all information that was traditionally conveyed in sequences, group-of-picture, or picture headers is conveyed out of band. Encoder and decoder maintain a synchronized set of *parameter sets*, which contain all information associated with a picture and/or higher syntax layers. Synchronization of the encoder's and decoder's *parameter sets* is normally established by the means of control protocols as a side effect of the opening of a logical channel. In more sophisticated systems, dynamic management of the *parameter sets* is also feasible. While the use of *parameter sets* in the described fashion renders the packet stream not self contained, it yields several advantages:

- The results of the capability exchange can be used directly for establishing knowledge of the parameters thus making more transmissions (e.g. of picture headers) unnecessary
- There is some improvement in security – the coded bits are pretty much useless if you don't have the parameters available, which allows for weaker protection of the media stream in a secure system
- Good compression is possible in case of frequently changing picture parameters (such as picture size) once the parameters are available at the decoder.

Note: in the following it is distinguished between parameters of four different syntax levels (not to be confused with the levels of the Version/Profile/Level system!). Making this distinction is helpful from a logic point-of-view and possibly also when defining a file format. Within this framework, however, each *parameter set*, as referenced by the slice header, uses one location which contains information of all four syntax levels. In other words, all storage spaces for parameter sets contain information of all the sequence, GOP, picture and slice layers.

Sequence Parameters

int MaxPicId	Maximum number for the PicId Calculation. Is typically smaller than or equal to the number of reference pictures.
float PixAspectRatio	Pixel geometry, calculated by SizeX / SizeY, 0.0 indicates "unspecified"

Group Of Picture Parameters

A Group Of Picture compromises a random access unit, normally starting with an Intra picture (what about SP pictures? Need to discuss!).

int DisplayWindowOffsetTop	The visible display window (may be smaller than the size in MBs of the coded picture
int DisplayWindowOffsetBottom	
int DisplayWindowOffsetRight	
int DisplayWindowOffsetLeft	
int XsizeMB	Picture size, x dimension, in macroblocks
int YSizeMB	

Picture Parameters

enum EntropyCoding	{UVLC, CABAC}
enum MotionResolution	{full, half, quarter, eigth}

Slice Parameters

enum PartitioningType	{Simple, DataPartitioning}

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 154 of 431

Transmission of Parameters sets

In the following a syntax and semantic information for setting parameter set information is defined. The syntax is closely related to SDP attributes, although this limits the flexibility when compared to ASN.1. The other standardized alternative, ASN.1, was not selected, because it is trivial to map SDP to ASN.1 syntax, but not vice versa. Binary or VLC coding of the parameters similar to traditional video codecs was not chosen because it doesn't fit into the architecture of a real-world system – a SIP system stack is not designed to handle binary codes or VLCs.

Default Operation Points

A section like the following will have to be added to any version/profile/level combination. Each decoder knows (hard coded) the *Default Operation Points* of all these combinations it supports. This mechanism renders in many cases the transmission of full parameter sets unnecessary, and make their transmission in many other case very simple, short, and efficient.

The following example is meant for a very simple (likely mobile) device with a target bit rate of 64 Kbit/s or less.

MaxPicID	1	// PicId can toggle between 0 and 1, hence only one reference frame
PixAspectRatio	0.0	// unspecified
DisplayWindowOffsetTop	0	// use full window top
DisplayWindowOffsetBottom	0	// use full window
DisplayWindowOffsetRight	0	
DisplayWindowOffsetLeft	0	
XSizeMB	11	// 11 MBs, 176 pels, QCIF
YSizeMB	9	// 9 MBs, QCIF
EntropyCoding	UVLC	
MotionResolution	quater	
PartitioningType	DataPartitioning	

SDP: What you must know

Note: This section can be safely skipped by those who have a basic understanding of SDP.

Changes of parameters relative to the default or to previous settings are performed out of band, typically through a control protocol. In this description the Session Description Protocol SDP is used. SDP is widely used in applications such as 3GPP phones (where SIP is based on SDP) or for many streaming applications based on RTSP. An H.245 representation of a similar mechanism could be specified in an almost mechanical fashion, without much thinking.

A SDP session description normally consists of many lines that define a session and the media used in the session. All these lines start with a letter, indicating the type of the SDP parameter to be set, an equal sign, and the parameter's value. A simple example for a complete session description is depicted below and was taken from draft-ietf-mmusic-sdp-new-03.txt[2].

```
v=0
o=mhandley 2890844526 2890842807 IN IP4 126.16.64.4
s=SDP Seminar
i=A Seminar on the session description protocol
u=http://www.cs.ucl.ac.uk/staff/M.Handley/sdp.03.ps
e=mjh@isi.edu (Mark Handley)
c=IN IP4 224.2.17.12/127
t=2873397496 2873404696
```

[2] SDP currently undergoes a revision. The discussed mechanisms are working in both the old and the new SDP version. The reason for citing the new draft instead of the old RFC is simply that the new draft is much more readable for people not familiar with SDP.

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 155 of 431

```
a=recvonly
m=audio 49170 RTP/AVP 0
m=video 51372 RTP/AVP 31
m=application 32416 udp wb
a=orient:portrait
```

Most lines in a typical SDP session description are irrelevant to video coding. Hence, no syntactically complete session description is given later. In particular, only the a= attributes of the Media description are relevant in the given context, because all other parameters deal with specifics of the transport of the media stream, such as the name of the stream, the transport address, bandwidth information or an encryption key.

Attributes generally have one of the two following forms:

a=<AttributeName>

a=<AttributeName>:<AttributeValue>

AttributeName is an US-ASCII string, AttributeValue is an UTF-8 string. AttributeValue can, of course, consist of strings that contain a more complex semantic than just setting a string value to AttributeName.

Several attributes names are predefined, but implementers are free to reserve additional attribute names as MIME types with IANA. This is what we propose to do for H.26L.

Parameter updates using SDP

It is suggested that we use the following syntax for parameter updates (of course we would register with IANA H.264, or whatever the ITU recommendation number is, and not H.26L:

a=H26L:<AttributeValue>, whereby

<AttributeValue> ::= (<ParameterSetNumber>*) <ParameterName> <ParameterValue>

<ParameterSetNumber> ::= int

<ParameterName> ::= (MaxPicID | PixAspectRatio | DisplayWindowOffsetTop | DisplayWindowOffsetBottom | DisplayWindowOffsetRight | DisplayWindowOffsetLeft | XsizeMB | YSizeMB | EntropyCoding | MotionResolution | SliceType)

<ParameterValue> ::= string

Examples:

A QCIF sequence using UVLC, I and P pictures, 1/8th pel MV resolution and up to 5 reference frames
(Note: it is assumed that during capability exchange a version/profile/level was selected that has QCIF as its maximum picture size).

```
m=video 49170 RTP/AVP 105
a=H26L:(0) MaxPicID 5
a=H26L:(0) MotionResolution eigth
```

The first line announces a video data stream, to be send to port #49170 on the target system, using RTP with the audio-visual minimal control profile and the dynamic RTP payload type 105.

A CIF sequence using CABAC, I, P, B pictures, ¼ pel MV resolution, and 5 reference frames.

(Note: it is assumed that during capability exchange a version/profile/level was selected that has CIF as its maximum picture size).

```
m=video 49170 RTP/AVP 105
```

a=H26L: (0) MaxPicID 5

a=H26L: (0) EntropyCoding CABAC

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 156 of 431

Complex scenario: A Videoconferencing terminal that wants to change dynamically between QCIF, CIF, and 4CIF (for document camera), I, P pictures, ¼ pel MV resolution, CABAC, 1/8th pel MV resolution for QCIF only, 10 reference frames for QCIF, 5 reference frames for CIF, and 1 reference frame for 4CIF

Note: it is assumed that a version/profile/level combination was selected that has CIF as its default maximum picture size (in the *Default Operation Point* definition), but allows 4CIF with limited frame rate.

```
m=video 49170 RTP/AVP 105
a=H26L:(0 1 2) EntropyCoding CABAC
a=H26L:(1 2) MotionResolution eigth
a=H26L:(0) XsizeMB 11
a=H26L:(0) YSizeMB 9
a=H26L:(0) MaxPicID 10
a=H26L:(0) MotionResolution quater
a=H26L:(1) MaxPicID 5
a=H26L:(2) XsizeMB 44
a=H26L:(2) YSizeMB 36
a=H26L:(2) MaxPicID 1
```

Reference Picture Selection Feedback (Back channel msg., Annex N/H.263)

In IP/UDP/RTP environments the implementation of Annex N type feedback messages (or MB-based ARQ messages) is performed through RTCP receiver reports, and there is no need to worry about this functionality in the current stage of standardization.

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 157 of 431

Transmission within H.324

It is assumed that the discussed IP/UDP/RTP mechanisms above work equally well for H.223 transports used in H.324 systems, with only small changes to add protocol elements that are supported in RTP but not in H.223. The following sections describe briefly such a design.

The main differences between RTP and H.223 are as follows:

1. H.223 is frequently used in highly bit error prone environments, and is designed to allow bit errors in its payload as a normal condition of operation (Note that UDP/RTP also *allows* such conditions, but that they are extremely unlikely in real world systems and most systems simply do not tolerate bit errors but rely on the optional UDP checksum).
2. H.223 AL3 has a limited re-transmission mechanism for lost/damaged SDUs.
3. H.223 typically runs over channels with much smaller MTU size: 100 bytes or so compared to 1.5 Kbytes. H.223 has considerable lower overhead. Real world systems will likely use a maximum of 256 kbit/s or so for video. On RTP, the maximum bandwidth is much higher.
4. H.223 works normally in a constant (or at least not highly fluctuating) bandwidth environment – it has not to be congestion control friendly like RTP applications have to be.
5. H.223 does not carry many of the RTP header fields. In particular, there is no such thing as a RTP timestamp or a marker bit.

The issues are addressed by the following design choices:

1. This test model does not address bit errors in the H.223 SDUs, and follows in that the tradition of TMN. Instead, it relies on dropping erroneous SDUs, as identified by the AL3 checksum, and concealing them. Note that a real-world system may perform different actions such as to repair the bit stream or to attempt decoding the SDU until the decoder senses a syntax/semantic violation.
2. The re-transmission capability of AL3 is transparent for the video codec and only observed through a slightly longer latency and an improved service quality in terms of bit errors and SDU losses.
3. Luckily, the combination of slices and data partitioning allows to split coded video pictures into very small units so that the small MTU sizes of H.223 do not pose a problem.
4. The constant bit rate environment has implications to the rate control but not to the packetization scheme.
5. The absence of a few fields of the RTP header in H.223 presents a real problem. In particular, the RTP solution was able to avoid a Temporal Reference field and use the RTP timestamp instead (which is there in any case) – this is not possible on H.223 as there is no such protocol field in H.223 and there is no picture header in H.26L.

Setup and Transmission of Parameter Sets for H.324

H.324 terminals offering video communication by supporting H.26L have two setup procedures. The capability exchange based on H.245 messages allows all video decoders to signal the maximum bit rate, which can be decoded in the H.245 **maxBitRate** parameter. Which picture formats, minimum number of skipped pictures and algorithm options can be accepted by the receiver is also determined during the capability exchange using H.245. All this information is established by the version/profile/level mechanism. As soon as a common knowledge of a version/profile/level is established, the *Default Operation Point* is also defined and video transmission can start using those parameters if desired (a fast start procedure).
In addition a procedure has to be introduced to update parameter sets established through the Default Operation point mechanism. We identified two different ways, both of which seem to be suitable for certain applications. Maybe the best way is to follow both paths, which would give us essentially the same flexibility as we have it with SDP messages in SIP systems.

- One way would be through a set of additional command messages, see H.245 Annex B.13.5 for examples. In the current version of H.245, commands are, for example, used to signal requests such as freeze picture request, or Annex N back channel messages. A number of ASN.1 codepoints, similar to those in the SDP definition section above, could be used to signal any form of parameter update.
- A second way would be to simply add the necessary codepoints to the setup message for opening a logical H.26L channel. This would imply that one has to close a logical channel and re-open it when changing parameters such as the picture size.

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 158 of 431

Packetization for H.324

All H.324 terminals offering video communication shall support the required video codecs in segmentable logical channels using H.223 adaptation layer AL3, and using a control field of at least one octet. Support of retransmission is required in encoders, with a minimum AL3 **SendBufferSize** of 1024 octets.

The H.223 AL3 should be used to transport each partition separately. AL3 sequence numbering and error detection shall be used for the transmission of partitions. The AL3 header information is set as follows:

Sequence No Increased by one for each sent packet.

The only significant difference between H.223 and RTP in terms of the packetization is the lack of an RTP timestamp in H.223, which is used to associate slices with pictures, and carries the only timing information in the system. The RTP timestamp is 32 bits long and, in RTP systems, comes "free" (no bit rate overhead), because it is a mandatory part of the RTP header and heavily used in RTP's internal protocol mechanisms. Simply introducing a 4 byte timestamp for each H.223 SDU is difficult since it introduces significant overhead that cannot easily be justified.

As an alternative we propose the use of a circular 8 bit counter (the good old TR), which is to be placed in the first byte of each H.223 SDU. This TR is used for two purposes:

a) establishing a association with the current SDU (containing a partition or a whole slice) with a picture and

b) carrying timing information for the picture.

The TR mechanism lacks the beauty of the RTP timestamp for such applications which do not transmit video in a fixed frame rate (e.g. video games, or other computer generated video). It can also not be abused as a field indication in interlaced video. However, both advantages of a full timestamp cannot justify the 24 additional bits per H.223 SDU (or 3% overhead assuming 100 bytes MTU size).

The 8 bit TR immediately solves the problem of associating slices to pictures, but presents a new set of problems when discussing timing issues:

a) There is a need for a TR interval definition (picture clock frequency in H.263). This has to be signaled through H.245, probably as an extension of the setup message and the command message as discussed above, with NTSC (or PAL?) default, or the default is version/profile/level dependent.

b) The mapping of TRs to RTP timestamps is simple, but the other way round is difficult (likely a best match algorithm has to be used – but what happens if a video game on a very fast machine suddenly renders 100 fps due to little activity, this is sent out by RTP, but the mobile terminal is set up to accept a clock rate of 25 Hz?). This needs to be thought through.

The size of each AL-SDU, and their alignment with the video packet, is determined by video encoders, within the limit of the maximum AL3 SDU size the receiver indicates it is capable of. Video packets may span more than one AL-SDU but this should be avoided. H.26L encoders shall align slice/partition starts with the start of an AL-SDU. If video communication is supported only in one direction (transmit or receive), the H.223 adaptation layer AL3 protocol for the reverse direction shall also be supported, even if no video information will be sent on the reverse channel. Since the AL3 protocol requires a reverse channel for operation, logical channels using AL3 shall be opened using the H.245 procedures for opening associated logical channels in each direction of transmission (bi-directional channels). The use of multiple logical channels for a single video stream (possibly with different QoS parameters) is for further study.

While H.223 AL3 allows for the retransmission of video information with detected errors, the receiving terminal may decide not to request a retransmission, based on factors including but not limited to: the measured network delay, the error rate, whether the terminal is part of a multipoint conference, whether there is interworking with a H.320 terminal, and the effectiveness of its error concealment techniques.

When a H.26L codec receives an AL-DRTX indication from H.223 AL3, indicating that the local AL3 layer was unable to satisfy a retransmission request, appropriate actions like intra refreshes should be carried out.

H.26L reference picture selection mode support (back channel messages)

Need further study.

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 159 of 431

De-Packetization Process for H.324

The de-packetization operation is similar to the one discussed above for RTP. The only difference is that it is possible that a partition is split over more than one H.223 AL3 SDUs, in which case they have to be concatenated first – after deleting the first byte of the payload which contains the TR.

Note: this has to be though through again in detail. For example: how does a de-packetizer/decoder know, whether a partition was split or not? Difficult.

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 160 of 431

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PATENT APPLICATION FEE DETERMINATION RECORD
Substitute for Form PTO-875

Application or Docket Number: 10-426,928

APPLICATION AS FILED – PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	SMALL ENTITY RATE ($)	SMALL ENTITY FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	OTHER THAN SMALL ENTITY FEE ($)
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	
SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A	
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	X =		OR	X =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X =			X =	
APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $250 ($125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).						
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))			N/A			N/A	
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL			TOTAL	

APPLICATION AS AMENDED – PART II

4.13.07

AMENDMENT A

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE ($)	SMALL ENTITY ADDITIONAL FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	* 23	Minus	** 23	= —	X =		OR	X =	
Independent (37 CFR 1.16(h))	* 12	Minus	*** 12	= —	X =		OR	X =	
Application Size Fee (37 CFR 1.16(s))									
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))					N/A		OR	N/A	
					TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

AMENDMENT B

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)	OR	RATE ($)	ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	*	Minus	**	=	X =		OR	X =	
Independent (37 CFR 1.16(h))	*	Minus	***	=	X =		OR	X =	
Application Size Fee (37 CFR 1.16(s))									
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))					N/A		OR	N/A	
					TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/426,928	04/30/2003	Miska Hannuksela	915-005.053	6259

7590 07/13/2007

Ware, Fressola, Van Der Sluys & Adolphson, LLP
Building Five, Bradford Green
755 Main Street
P.O. Box 224
Monroe, CT 06468

EXAMINER	
PHILIPPE, GIMS S	
ART UNIT	PAPER NUMBER
2621	

MAIL DATE	DELIVERY MODE
07/13/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

PTOL-90A (Rev. 04/07)

Office Action Summary	Application No.	Applicant(s)	
	10/426,928	HANNUKSELA ET AL.	
	Examiner	Art Unit	
	Gims S. Philippe	2621	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *13 April 2007*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-23* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-23* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 163 of 431

Response to Amendment

Applicant's amendment received on April 13, 2007 has been fully considered and entered, but the arguments are not deemed to be persuasive.

Response to Arguments

1. Claims 1-23 are rejected under 35 U.S.C. 102(e) as being anticipated by Visharam et al. (US Patent Application Publication no. 2004/0010802 A1).

Regarding the above claims, the applicant argues that Visharam is directed to an encoding system that includes a video coding layer to generate slices when encoding multimedia data, a generic adaptation layer (GAL) to create, from the slices, a set of GAL units having a format that is generic to various transport systems, and a network adaptation layer (NAL) associated with a specific transport system so as to map the set of GAL units to the format of the specific transport system. The applicant further argues that the improvement of the present invention are mainly separation of parameter sets to more than one category, including both a sequence parameter set and a picture parameter set.

While the examiner understands the explanation of the prior art provided by the applicant, the claimed improvement of the applicant is disclosed in [0042]. The separation of parameter sets into more than one category is understood as being

disclosed in [0041] where the set of symbols are partitioned in the video data header. The prior art notes that the data of each partition in a slice consists of all bits whose symbols are in that partition... (See lines 1-11 of [0041]).

The applicant further argues that a "picture parameter set" as required in claim 1 is not mentioned at all in the recited passage of Visharam. The examiner respectfully disagrees since a "picture parameter set" is disclosed in [0042] where the set 502 contains parameter sets. The "picture parameter set" is inherently included in a "parameter set" where such a set is made of picture.

The applicant argues Visharam does anticipate claim 6 which is directed to a method for decoding sequences of pictures from a bitstream which also recites actions concerning a sequence parameter set and a picture parameter set. The examiner respectfully disagrees since the sequence parameter set is disclosed in [0042], lines 11-14 where it is disclosed that " each parameter set is assigned a unique identifier, which is constant throughout the video sequence, and each slice unit references a corresponding parameter set identifier. To the examiner , the video sequence disclosed in [0042] consisting of parameter sets is the "sequence parameter set".

The applicant should note that while some of the arguments may seem to be persuasive, the claims are broad enough that one skilled in the art needs no other prior

art to anticipate the invention. In other words, the claimed limitations of the current application are believed to be met by the prior art.

The rejection is repeated below for the sake of completeness.

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

3. Claims 1-23 are rejected under 35 U.S.C. 102(e) as being anticipated by Visharam et al. (US Patent Application Publication no. 2004/0010802 A1).

Regarding claims 1, 6, 10-12, 14, 15-16, and 20-23, Visharam discloses the same encoder/decoder, software programs with machine executable steps and method for encoding sequences of pictures into a bitstream wherein parameters are defined in a parameter set and each picture comprises information on one or more slices (See figs. 5, 9, 10A, 10B, and [0033 to 0037]), and comprising defining parameters in a sequence parameter set (See [0042], lines 2-7), defining parameters in a picture parameter set (See [0042], lines 11-14), and defining at least one picture parameter in a slice header,

the picture parameter remaining unchanged at least in all slice headers of one picture (See [0042], lines 7-11). The applicant should note that the step of identifying the picture parameter in the slice header will help in decoding as noted in [0022]. Also the step of defining the picture parameter in the slice header is met in [0067-0068].

As per claims 2, 7, and 17, Visharam further discloses a slice header included with a reference to a picture parameter set (See [0040, 0041]).

As per claims 3, 8, and 18, Visharam further discloses the picture parameter set included with reference to a sequence parameter set (See [0042]).

As per claims 4, 9, and 19, Visharam further discloses the picture parameter selected from a group of information of a picture order count, a frame number and an identifier of an independently decodable picture (See fig. 5, items 500 and 502, fig. 11, and [0037]).

As per claim 5, Visharam further discloses the sequence parameter set and picture parameter set are transmitted less often than once per each picture (See [0046-0048]).

As per claim 13, Visharam further discloses storing the parameter set in both the encoder and the decoder (See [0022] and [0070]).

4. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Gims S. Philippe whose telephone number is (571) 272-7336. The examiner can normally be reached on M-F (10:30-7:00).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Dastouri Mehrdad can be reached on (571) 272-7418. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Gims S Philippe
Primary Examiner
Art Unit 2621

GSP

July 3, 2007

Index of Claims

Application/Control No.	Applicant(s)/Patent under Reexamination
10/426,928	HANNUKSELA ET AL.
Examiner	**Art Unit**
Gims S. Philippe	2621

√	Rejected	–	(Through numeral) Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

Claim		Date
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Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 170 of 431

Search Notes	Application/Control No.	Applicant(s)/Patent under Reexamination	
	10/426,928	HANNUKSELA ET AL.	
	Examiner	Art Unit	
	Gims S. Philippe	2621	

SEARCHED			
Class	Subclass	Date	Examiner

INTERFERENCE SEARCHED			
Class	Subclass	Date	Examiner

SEARCH NOTES (INCLUDING SEARCH STRATEGY)		
	DATE	EXMR
Updated previously searched areas	7/3/2007	GP

RCE

OIPE
NOV 09 2007
PATENT & TRADEMARK OFFICE

PTO/SB/30 (11-07)
Approved for use through 11/30/2007. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Request for Continued Examination (RCE) Transmittal

Address to:
Mail Stop RCE
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Application Number	10/426,928
Filing Date	April 30, 2003
First Named Inventor	M. HANNUKSELA
Art Unit	2621
Examiner Name	Gims S. PHILIPPE
Attorney Docket Number	915-005.053

This is a Request for Continued Examination (RCE) under 37 CFR 1.114 of the above-identified application.
Request for Continued Examination (RCE) practice under 37 CFR 1.114 does not apply to any utility or plant application filed prior to June 8, 1995, or to any design application. See Instruction Sheet for RCEs (not to be submitted to the USPTO) on page 2.

1. Submission required under 37 CFR 1.114 Note: If the RCE is proper, any previously filed unentered amendments and amendments enclosed with the RCE will be entered in the order in which they were filed unless applicant instructs otherwise. If applicant does not wish to have any previously filed unentered amendment(s) entered, applicant must request non-entry of such amendment(s).

   a. ☐ Previously submitted. If a final Office action is outstanding, any amendments filed after the final Office action may be considered as a submission even if this box is not checked.

      i. ☐ Consider the arguments in the Appeal Brief or Reply Brief previously filed on _____

      ii. ☐ Other _____

   b. ☑ Enclosed

      i. ☑ Amendment/Reply

      ii. ☐ Affidavit(s)/ Declaration(s)

      iii. ☐ Information Disclosure Statement (IDS)

      iv. ☐ Other _____

2. Miscellaneous

   a. ☐ Suspension of action on the above-identified application is requested under 37 CFR 1.103(c) for a period of _____ months. (Period of suspension shall not exceed 3 months; Fee under 37 CFR 1.17(i) required)

   b. ☐ Other _____

3. Fees The RCE fee under 37 CFR 1.17(e) is required by 37 CFR 1.114 when the RCE is filed.

   a. ☑ The Director is hereby authorized to charge the following fees, any underpayment of fees, or credit any overpayments, to Deposit Account No. 23-0442. I have enclosed a duplicate copy of this sheet.

      i. ☐ RCE fee required under 37 CFR 1.17(e)

      ii. ☐ Extension of time fee (37 CFR 1.136 and 1.17)

      iii. ☑ Other DEFICIENCIES AND OVERPAYMENTS ONLY

   11/13/2007 HNGUYEN1 00000007 10426928
   01 FC:1801 810.00 OP
   02 FC:1201 420.00 OP
   03 FC:1202 100.00 OP

   b. ☑ Check in the amount of $ 1,450 (RCE/ext./add.claims) enclosed

   c. ☐ Payment by credit card (Form PTO-2038 enclosed)

WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT REQUIRED

Signature		Date	November 7, 2007
Name (Print/Type)	Alfred A. Fressola	Registration No.	27,550

CERTIFICATE OF MAILING OR TRANSMISSION

I hereby certify that this correspondence is being deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to: Mail Stop RCE, Commissioner for Patents, P. O. Box 1450, Alexandria, VA 22313-1450 or facsimile transmitted to the U.S. Patent and Trademark Office on the date shown below.

Signature			
Name (Print/Type)	Lissette Ramos	Date	November 7, 2007

This collection of information is required by 37 CFR 1.114. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Mail Stop RCE, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**
If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

Practitioner's Docket No. 915-005.053 *PATENT*

OIPE
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PATENT & TRADEMARK OFFICE

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of: **Miska HANNUKSELA et al.**

Application No.: **10/426,928** Group No.: **2621**

Filed: **April 30, 2003** Examiner: **Gims S. PHILIPPE**

For: ***Method for Coding Sequences of Pictures***

Commissioner of Patents
Mail Stop: **RCE**
P.O. Box 1450
Alexandria, VA 22313-1450

AMENDMENT TRANSMITTAL

1. Transmitted herewith is an amendment for this application.

STATUS

2. Applicant is
   - ☐ a small entity. A statement:
     - ☐ is attached.
     - ☐ was already filed.
   - ☒ other than a small entity.

CERTIFICATE OF MAILING/TRANSMISSION UNDER 37 C.F.R. §1.8(a)

I hereby certify that this correspondence is, on the date shown below, being:

MAILING

☒ deposited with the United States Postal Service with sufficient postage as first-class mail, in an envelope addressed to the Commissioner for Patents, Alexandria, VA 22313-1450.

Date: November 7, 2007

FACSIMILE

☐ transmitted by facsimile to the U.S. Patent and Trademark Office.

11/13/2007 HNGUYEN1 00000007 10426928
04 FC:1251 120.00 OP

Signature

Lissette Ramos
(type or print name of person certifying)

EXTENSION OF TERM

NOTE: "Extension of Time in Patent Cases (Supplement Amendments) - If a timely and complete response has been filed after a Non-Final Office Action, an extension of time is not required to permit filing and/or entry of an additional amendment after expiration of the shortened statutory period.

If a timely response has been filed after a Final Office Action, an extension of time is required to permit filing and/or entry of a Notice of Appeal or filing and/or entry of an additional amendment after expiration of the shortened statutory period unless the timely-filed response placed the application in condition for allowance. Of course, if a Notice of Appeal has been filed within the shortened statutory period, the period has ceased to run." Notice of December 10, 1985 (1061 O.G. 34-35).

NOTE: See 37 C.F.R. §1.645 for extensions of time in interference proceedings, and 37 C.F.R. §1.550(c) for extensions of time in reexamination proceedings.

3. The proceedings herein are for a patent application and the provisions of 37 C.F.R. §1.136 apply.

(complete (a) or (b), as applicable)

(a) ☒ Applicant petitions for an extension of time under 37 C.F.R. §1.136 (fees: 37 C.F.R. §1.17(a)(1)-(4)) for the total number of months checked below:

Extension (months)	Fee for other than small entity	Fee for small entity
☒ one month	$ 120.00	$ 60.00
☐ two months	$ 460.00	$230.00
☐ three months	$1,020.00	$510.00
☐ four months	$1,480.00	$740.00

Fee: $ 120.00

If an additional extension of time is required, please consider this a petition therefor.

(check and complete the next item, if applicable)

☐ An extension for ____ months has already been secured. The fee paid therefor of $_____ is deducted from the total fee due for the total months of extension now requested.

Extension fee due with this request $ 120.00

OR

(b) ☐ Applicant believes that no extension of term is required. However, this conditional petition is being made to provide for the possibility that applicant has inadvertently overlooked the need for a petition for extension of time.

FEE FOR CLAIMS

4. The fee for claims (37 C.F.R. §1.16(b)-(d)) has been calculated as shown below:

(Col. 1)		(Col. 2)		(Col. 3)	SMALL ENTITY			OTHER THAN A SMALL ENTITY	
CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NO. PREVIOUSLY PAID FOR		PRESENT EXTRA	ADDIT. RATE	FEE	*OR*	ADDIT. RATE	FEE
TOTAL:	**25** MINUS	23	=	2	x $ 25=	$		x $50=$	100.00
INDEP:	**14** MINUS	12	=	2	x $ 105=	$		x $210=$	420.00
☐ FIRST PRESENTATION OF MULTIPLE DEP. CLAIM					+$145=$			+$290=$	
					TOTAL ADDL. FEE	$		TOTAL ADDL. FEE	$520.00

WARNING: "After final rejection or action (§1.113) amendments may be made canceling claims or complying with any requirement of form which has been made." 37 C.F.R. §1.116(a) (emphasis added).

(complete (c) or (d), as applicable)

(c) ☐ No additional fee for claims is required.

OR

(d) ☒ Total additional fee for claims required is $ 520.00 .

FEE PAYMENT

5. ☒ Attached is a check in the sum of $ **1,450.00 (RCE + extension + additional claims)** .

☐ Authorization is hereby made to charge the amount of $ _____
to Deposit Account No. _____

☐ to credit card as shown on the attached credit card information authorization Form PTO-2038.

*WARNING: Credit card information should **not** be included on this form as it may become public.*

☐ Charge any additional fees required by this paper or credit any overpayment in the manner authorized above.

A duplicate of this request is attached.

FEE DEFICIENCY

NOTE: If there is a fee deficiency and there is no authorization to charge an account, additional fees are necessary to cover the additional time consumed in making up the original deficiency. If the maximum six-month period has expired before the deficiency is noted and corrected, the application is held abandoned. In those instances where authorization to charge is included, processing delays are encountered in returning the papers to the PTO Finance Branch in order to apply these charges prior to action on the cases. Authorization to charge the deposit account for any fee deficiency should be checked. See the Notice of April 7, 1986 (1065 O.G. 31-33).

6. ☒ If any additional extension and/or fee is required, charge Account No. **23-0442**

AND/OR

☒ If any additional fee for claims is required, charge Account No. **23-0442**.

Date: November 7, 2007

Reg. No.: 27,550

Telephone No.: (203) 261-1234

Customer No.: 004955

Signature of Practitioner
Alfred A. Fressola
Ware, Fressola, Van Der Sluys & Adolphson LLP
Bradford Green, Building Five
755 Main Street, P.O. Box 224
Monroe, CT 06468

OIPE
NOV 09 2007
PATENT & TRADEMARK OFFICE

PATENT
Attorney Docket No. 915-005.053

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In Re Application Of:

Miska HANNUKSELA et al.	:	Confirmation No.: **6259**
Application Serial No.: **10/426,928**	:	Group/Art Unit: **2621**
Filing Date: **April 30, 2003**	:	Examiner: **Gims S. PHILIPPE**

Title: ***Method for Coding Sequences of Pictures***

Commissioner of Patents
Mail Stop: **RCE**
P.O. Box 1450
Alexandria, VA 22313-1450

AMENDMENT AFTER FINAL ACCOMPANYING RCE

Sir:

In response to the final Official Action of July 13, 2007, please amend the above-captioned patent application as follows:

I hereby certify that this communication is being deposited with the United States Postal Service today, **November 7, 2007**, in an envelope with sufficient postage as first-class mail addressed to the Commissioner of Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

Lissette Ramos

IN THE CLAIMS:

Please amend the claims as follows:

1. (currently amended) A method for encoding sequences of pictures into a bitstream, wherein parameters are defined in a parameter set and each picture comprises information of one or more slices, the method comprising:

- defining parameters in a sequence parameter set for a sequence of pictures;
- defining parameters in a picture parameter set for a picture; and
- defining at least one picture parameter in a slice header, the picture parameter remaining unchanged at least in all slice headers of one picture.

2. (original) The method according to claim 1, wherein the slice header is included with a reference to a picture parameter set.

3. (original) The method according to claim 1, wherein the picture parameter set is included with a reference to a sequence parameter set.

4. (original) The method according to claim 1, wherein the picture parameter is selected from a group of information of a picture order count, a frame number and an identifier of an independently decodable picture.

5. (original) The method according to claim 1, wherein the sequence parameter set and picture parameter set are transmitted less often than once per each picture.

6. (original) A method for decoding sequences of pictures from a bitstream, wherein parameters are defined in a parameter set and each picture comprises information of one or more slices, the method comprising:

- recognizing a sequence parameter set and forming at least one sequence parameter pertaining to a sequence using the parameter set;
- recognizing a picture parameter set and forming at least one first picture parameter pertaining to a picture using the parameter set;
- forming at least one second picture parameter using information of a slice header, the at least one second picture parameter remaining unchanged at least in all slice headers of one picture; and
- using the at least one second picture parameter in decoding.

7. (original) The method according to claim 6, wherein the slice header is included with a reference to a picture parameter set.

8. (original) The method according to claim 6, wherein the picture parameter set is included with a reference to a sequence parameter set.

9. (original) The method according to claim 6, wherein the second picture parameter is selected from a group of information of a picture order count, a frame number and an identifier of an independently decodable picture.

10. (currently amended) An encoder for encoding sequences of pictures into a bitstream, wherein parameters are defined in a parameter set and each picture comprises information of one or more slices, the encoder comprising:

- a processor configured for:
- ~~means for~~ defining parameters in a sequence parameter set for a sequence of pictures;
- ~~means for~~ defining parameters in a picture parameter set for a picture; and
- ~~means for~~ defining at least one picture parameter in a slice header, the picture parameter remaining unchanged at least in all slice headers of one picture.

11. (currently amended) A decoder for decoding sequences of pictures from a bitstream, wherein parameters are defined in a parameter set and each picture comprises information of one or more slices, the decoder comprising:

- a processor configured for:
- ~~means for~~ recognizing a sequence parameter set for a sequence of pictures and forming at least one sequence parameter pertaining to a sequence using the parameter set for a picture;
- ~~means for~~ recognizing a picture parameter set and forming at least one first picture parameter pertaining to a picture using the parameter set;
- ~~means for~~ forming at least one second picture parameter using information of a slice header, the at least one second picture parameter remaining unchanged at least in all slice headers of one picture; and
- ~~means for~~ using the at least one second picture parameter in decoding.

12. (currently amended) A system comprising an encoder for encoding sequences of pictures into a bitstream, a decoder for decoding sequences of pictures from the bitstream, wherein parameters are defined in a parameter set and each picture comprises information of one or more slices, the encoder comprising:

- a processor configured for:
- ~~means for~~ defining parameters in a sequence parameter set for a sequence of pictures;
- ~~means for~~ defining parameters in a picture parameter set for a picture; and
- ~~means for~~ defining at least one picture parameter in a slice header, the picture parameter remaining unchanged at least in all slice headers of one picture;

and the decoder comprising:

- a processor configured for:

- ~~means for~~ recognizing a sequence parameter set for a sequence of pictures and forming at least one sequence parameter pertaining to a sequence using the parameter set;
- ~~means for~~ recognizing a picture parameter set for a picture and forming at least one first picture parameter pertaining to a picture using the parameter set;
- ~~means for~~ forming at least one second picture parameter using information of a slice header, the at least one second picture parameter remaining unchanged at least in all slice headers of one picture; and
- ~~means for~~ using the at least one second picture parameter in decoding.

13. (original) The system according to claim 12, wherein a parameter set is stored in both the encoder and the decoder.

14. (currently amended) A transmitting device comprising an encoder for encoding sequences of pictures into a bitstream, wherein parameters are defined in a parameter set and each picture comprises information of one or more slices, the encoder comprising:

- a processor configured for:
  - ~~means for~~ defining parameters in a sequence parameter set for a sequence of pictures;
  - ~~means for~~ defining parameters in a picture parameter set for a picture; and
  - ~~means for~~ defining at least one picture parameter in a slice header, the picture parameter remaining unchanged at least in all slice headers of one picture.

15. (currently amended) A receiving device comprising a decoder for decoding sequences of pictures from a bitstream, wherein parameters are defined in a parameter set and each picture comprises information of one or more slices, the decoder comprising:

- a processor configured for:

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 181 of 431

- ~~means for~~ recognizing a sequence parameter set for a sequence of pictures and forming at least one sequence parameter pertaining to a sequence using the parameter set;
- ~~means for~~ recognizing a picture parameter set for a picture and forming at least one first picture parameter pertaining to a picture using the parameter set;
- ~~means for~~ forming at least one second picture parameter using information of a slice header, the at least one second picture parameter remaining unchanged at least in all slice headers of one picture; and
- ~~means for~~ using the at least one second picture parameter in decoding.

16. (currently amended) A bitstream comprising:

- encoded pictures;
- sequence parameters in a sequence parameter set for a sequence of pictures;
- picture parameters in a picture parameter set for a picture;
- information of a slice comprising a slice header; and
- at least one picture parameter in the slice header, the picture parameter remaining unchanged at least in all slice headers of one encoded picture.

17. (original) The bitstream according to claim 16, wherein the slice header is included with a reference to a picture parameter set.

18. (original) The bitstream according to claim 16, wherein the picture parameter set is included with a reference to a sequence parameter set.

19. (original) The bitstream according to claim 16, wherein the picture parameter is selected from a group of information of a picture order count, a frame number and an identifier of an independently decodable picture.

20. (currently amended) A software program product comprising machine executable steps stored on a readable medium for execution on a processor, the machine executable steps for encoding sequences of pictures into a bitstream, wherein parameters are defined in a parameter set and each picture comprises information of one or more slices, the software program product comprising:

- defining parameters in a sequence parameter set for a sequence of pictures;
- defining parameters in a picture parameter set for a picture; and
- defining at least one picture parameter in a slice header, the picture parameter remaining unchanged at least in all slice headers of one picture.

21. (currently amended) A software program product comprising machine executable steps stored on a readable medium for execution on a processor, the machine executable steps for decoding sequences of pictures from a bitstream, wherein parameters are defined in a parameter set and each picture comprises information of one or more slices, the software program comprising:

- recognizing a sequence parameter set for a sequence of pictures and forming at least one sequence parameter pertaining to a sequence using the parameter set;
- recognizing a picture parameter set for a picture and forming at least one first picture parameter pertaining to a picture using the parameter set;
- forming at least one second picture parameter using information of a slice header, the at least one second picture parameter remaining unchanged at least in all slice headers of one picture; and
- using the at least one second picture parameter in decoding.

22. (currently amended) A storage medium including a software program comprising machine executable steps for encoding sequences of pictures into a bitstream, wherein parameters are defined in a parameter set and each picture comprises information of one or more slices, the software program comprising machine executable ~~steps~~instructions for:

- defining parameters in a sequence parameter set for a sequence of pictures;
- defining parameters in a picture parameter set for a picture; and
- defining at least one picture parameter in a slice header, the picture parameter remaining unchanged at least in all slice headers of one picture.

23. (currently amended) A storage medium including a software program comprising machine executable steps for decoding sequences of pictures from a bitstream, wherein parameters are defined in a parameter set and each picture comprises information of one or more slices, the software program comprising machine executable ~~steps~~instructions for:

- recognizing a sequence parameter set and forming at least one sequence parameter pertaining to a sequence using the parameter set for a sequence of pictures;
- recognizing a picture parameter set and forming at least one first picture parameter pertaining to a picture using the parameter set for a picture;
- forming at least one second picture parameter using information of a slice header, the at least one second picture parameter remaining unchanged at least in all slice headers of one picture; and
- using the at least one second picture parameter in decoding.

24. (new) An encoder for encoding sequences of pictures into a bitstream, wherein parameters are defined in a parameter set and each picture comprises information of one or more slices, the encoder comprising:

- means for defining parameters in a sequence parameter set for a sequence of pictures;
- means for defining parameters in a picture parameter set for a picture; and
- means for defining at least one picture parameter in a slice header, the picture parameter remaining unchanged at least in all slice headers of one picture.

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 184 of 431

25. (new) A decoder for decoding sequences of pictures from a bitstream, wherein parameters are defined in a parameter set and each picture comprises information of one or more slices, the decoder comprising:

- means for recognizing a sequence parameter set for a sequence of pictures and forming at least one sequence parameter pertaining to a sequence using the parameter set for a picture;
- means for recognizing a picture parameter set and forming at least one first picture parameter pertaining to a picture using the parameter set;
- means for forming at least one second picture parameter using information of a slice header, the at least one second picture parameter remaining unchanged at least in all slice headers of one picture; and
- means for using the at least one second picture parameter in decoding.

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 185 of 431

REMARKS

In response to the final Official Action of July 13, 2007, claims 1, 10-12, 14-16 and 20-23 have been amended and claims 24 and 25 are newly submitted. No new matter has been added.

Concept of the Claimed Invention

One of the underlying concepts of the present invention is the idea of splitting the parameter set structure into multiple parameter set structures according to the persistency and target of parameters (specification, page 7, lines 10-12).

In particular, the invention includes the concepts of sequence parameter sets and picture parameter sets, wherein the selection of a correct parameter set for each parameter depends on the probable and allowed changing rate of the parameter. In particular, parameters whose values may change in every slice or whose value is likely to change in every picture are included in the slice header, whereas parameters that probably remain unchanged in multiple pictures, but are allowed to change in every picture are included in a picture parameter set. Such parameters which are not allowed to change in a coded video sequence (CVS) are included in a sequence parameter set (see page 7, lines 10-22). This allows the present invention to achieve one of its stated goals; namely, to provide a more efficient method to transmit parameters relating to picture information (see page 6, lines 16-19).

Thus, according to the present invention, there are provided two kinds of parameter sets, one for the sequence (sequence parameter set) and one for the pictures (picture parameter set) (see page 6, lines 29-31). It is to this underlying concept that the following remarks and discussion are based upon.

Claim Rejections - 35 USC §102

At section 1, claims 1-23 are rejected under 35 USC §102(e) as anticipated in view of US patent application publication 2004/0010802, Visharam, et al. It is asserted

that Visharam discloses each of the actions recited in method claim 1 as set forth at section 3 of the final Official Action.

Thus, the Office contends that Visharam discloses defining parameters in a sequence parameter set, defining parameters in a picture parameter set, and defining at least one picture parameter in a slice header, the picture parameter remaining unchanged at least in all slice headers of one picture. Specific reference is made to paragraph [0042], lines 2-7, 7-11 and 11-14.

From this argument, it appears that the Office is asserting that because the slice information is based on picture data (slices contain macroblocks of a picture), any parameter which is formed by using the picture data is a picture parameter. However, it is respectfully submitted that the term "picture parameter" as used in the claims of the present application and as defined in the specification of the present application, are different from "parameters" which could possibly be made of, for example, data of macroblocks of a picture.

More particularly, the Office contends in section 1 that the separation of parameter sets into more than one category is understood as being disclosed in paragraph [0041] of Visharam where the set of symbols are partitioned in the video data header. However, paragraph [0040] of Visharam at lines 2-8 states:

> "There are two types of media data units; slice units and partitioned slice units. In one embodiment, a slice unit contains a slice consisting of a slice header and video data. The video data contains the VCL[1] data for a set of macroblocks. The VCL data is a sequence of bits representing the syntax element defined by the VCL for the microblocks in the slice." (emphasis added)
>
> Furthermore, Visharam at paragraph [0041] states:
>
> "A partitioned slice unit includes a portion of a slice. That is, the data for a slice, including both header data and payload data, may be partitioned. When partitioned, the set of symbols in the video data and the header

> data encodings are divided. The data for each partition in a slice consists of all bits whose symbols are in that partition in the order defined by the header or video syntax. For example, if a data partition contains both header and video data, then the order is header bits followed by video data bits. In one embodiment, there are three different partitions that contain header information (including the slice header), intra coefficients, and inter coefficients respectively. A partitioned slice unit is defined for partitioned slice data, with each unit containing a partition identifier followed by the data in the partition." (emphasis added)

From the foregoing, it is clear that the partitioning disclosed in Visharam means that, for example, a slice can be divided into smaller parts. The slice header and the payload (slice data) are partitioned correspondingly. Different partitions do not belong to different categories. Thus, at paragraph [0041], lines 7-9 state:

> "For example, if a data partition contains both header and video data, then the order is header bits followed by video data bits."

Furthermore, paragraph [0041], lines 9-12, state:

> "In one embodiment there are three different partitions that contain header information (including the slice header), intra coefficients and inter coefficients respectively."

From the foregoing, it is clear that the disclosure set forth in paragraph [0041] of Visharam makes clear that all partitions comprise similar kinds of multimedia data (a part of a slice header, intra coefficients and inter coefficients of slice data of that particular portion of a slice). Dividing multimedia data into smaller sections is not analogous to categorizing data into different categories as set forth in claim 1. This categorizing of data is implicit in claim 1 due to the fact that claim 1 defines parameters for different types of parameter sets.

---

[1] Video coding layer.

In any event, if it is argued that partitioning could be analogous to categorizing, there is still no teaching in Visharam that the slice header comprises at least one picture parameter which remains unchanged at least in all slice headers of one picture. Intra coefficients and inter coefficients are not picture parameters and they usually vary within one slice, contrary to the last action recited in claim 1.

Furthermore, at paragraph [0042], lines 2-11 state:

> "A parameter set element defines a set of parameter values that control the decoding of VCL data. In one embodiment, parameters are associated with levels in the media data structure according to the lowest level at which they may vary. For example, a GOP[2] parameter value like picture size may change between GOPs but not at any lower levels. Hence, in one embodiment, all of the pictures and slices in a single GOP use the same GOP parameter value while a slice parameter may vary for every slice." (emphasis added)

This portion of Visharam teaches a single parameter set which may contain many parameters associated with different levels of the media data and that a parameter is associated with the lowest level at which it may vary. As an example of a picture parameter, there is mentioned picture size, which is included in the GOP header, because picture size cannot vary between pictures of the same group (GOP). Therefore, the picture size is a GOP parameter, not a slice parameter.

Further, Visharam goes on to disclose that a parameter is assigned a "unique identifier" which is constant throughout the video sequence. This further confirms that Visharam can be interpreted as a single parameter set containing many parameters associated with levels in the media data structure according to the lowest level at which they may vary. However, in the present invention there is a need for many different unique identifiers in a video sequence, due to the fact that the different parameter sets need to reference each other in a hierarchical manner during the decoding of a video sequence. Using this analogy, Visharam teaches that picture parameters are associated

to a GOP level, not to any lower level. In the present invention as claimed, at least one picture parameter is associated with the slice level (defining at least one picture parameter in a slice header, the picture parameter remaining unchanged at least in all slice headers of one picture), which is a lower level than the picture level.

The applicant respectfully asserts that the Visharam reference does not disclose the method of claim 1 wherein there are separate parameters defined for a sequence of pictures and for a picture. Furthermore, the Visharam addresses a different problem from the present application; namely, a generic adaptation layer (GAL) to interface between the coding video layer (VCL) and the network adaptation (NAL) layer associated with specific transport systems.

In summary, it appears that the Office has not considered claim 1 of the present invention as a whole, but rather has proceeded to select features in Visharam that appear, in isolation, to match features in claim 1, but which in total do not.

For all of the forgoing reasons, It is therefore respectfully submitted that in view of the meanings associated with sequence parameter set and picture parameter set as set forth in the specification and claims of the present application, claim 1 is not anticipated by Visharam.[3]

Independent encoder claim 10, independent decoder claim 11, independent system claim 12, independent transmitting device claim 14, independent receiving device claim 15, independent bitstream claim 16, independent software program product claim 20, independent software product claim 21, independent storage medium claim 22 and independent storage medium claim 23 have been amended in a manner similar to claim 1 and for similar reasons, each are believed to be not anticipated by Visharam. Furthermore, claims 10-12 and 14-16 have been amended so as to be written using non-means plus function terminology. Support for the amendment to

---

[2] Group of pictures.

[3] It is well settled that with respect to claim terms, "the person of ordinary skill in the art is deemed to read the claim term not only in the context of the particular claim in which the disputed term appears, but in the context of the entire patent, including the specification". *Phillips v. AWH Corp., 415 F3d 1303, 1306 (CAFC, 2005).*

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 190 of 431

these claims is found in Figures 2-4 and the accompanying description at page 20, line 24 through page 22, line 11.

Newly submitted claims 24 and 25 correspond to amended claims 10 and 11, but using means plus function terminology.

Since each of the independent claims of the present application is believed to be not anticipated by Visharam, it is respectfully submitted that all of the dependent claims are further distinguished over Visharam due to such dependency.

In view of the foregoing, it is respectfully submitted that the present application as amended is in condition for allowance and such action is earnestly solicited.

Respectfully submitted,

Dated: November 7, 2007

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Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 191 of 431

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PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number: 10-426,928

APPLICATION AS FILED – PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	SMALL ENTITY RATE ($)	SMALL ENTITY FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	OTHER THAN SMALL ENTITY FEE ($)
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	
SEARCH FEE (37 CFR 1.16(k), (l), or (m))	N/A	N/A	N/A			N/A	
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	X =		OR	X =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X =			X =	
APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $250 ($125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).						
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))			N/A			N/A	
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL			TOTAL	

APPLICATION AS AMENDED – PART II

4.13.07

AMENDMENT A

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE ($)	SMALL ENTITY ADDITIONAL FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	* 23	Minus	** 23	= —	X =		OR	X =	
Independent (37 CFR 1.16(h))	* 12	Minus	*** 12	= —	X =		OR	X =	
Application Size Fee (37 CFR 1.16(s))							OR		
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))					N/A		OR	N/A	
					TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

AMENDMENT B

11/9/07

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE ($)	SMALL ENTITY ADDITIONAL FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	* 25	Minus	** 23	= 2	X =		OR	X =	
Independent (37 CFR 1.16(h))	* 12	Minus	*** 12	= 0	X =		OR	X =	
Application Size Fee (37 CFR 1.16(s))									
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))					N/A		OR	N/A	
					TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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1fw 2621

PATENT
Attorney Docket No. 915-005.053



IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In Re Application of:

Miska HANNUKSELA, et al.

Serial No.: **10/426,928** : Group/Art Unit: **2621**

Filed: **April 30, 2003** : Examiner: **Gims S. PHILIPPE**

For: ***Method for Coding Sequences of Pictures***

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Mail Stop: **AMENDMENT**
P.O. Box 1450
Alexandria, VA 22313-1450

SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT

Sir:

Applicants submit herewith additional references of which they are aware, which they believe may be material to the examination of this application and in respect of which they may have a duty to disclose in accordance with 37 CFR §1.56.

While this Supplemental Information Disclosure Statement (IDS) may be "material" pursuant to 37 CFR §1.56(b), it is not intended to constitute an admission that any document referred to herein is "prior art" for this invention unless specifically designated as such.

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I hereby certify that this correspondence is being deposited with the United States Postal Service on this date, January 7, 2008, in an envelope with sufficient postage as first-class mail addressed to the Commissioner of Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

Lissette Ramos

In accordance with 37 CFR §1.97(g), the filing of this IDS shall not be construed to mean that a search has been made or that no other material information as defined under 37 CFR §1.56(a) exists.

Enclosed is a Russian Patent Office Notice of Allowance dated November 30, 2007 issued in corresponding Russian patent application 2005137172.

Also enclosed is a Form PTO-1449 listing the cited references. Copies of the cited non-US references are also enclosed herewith. A copy of the cited US reference is not enclosed pursuant to the USPTO waiver of the requirement to submit copies of cited US references. The relevance of each reference is specifically explained in the Russian Notice of Allowance and the abstract of each reference provides a concise explanation thereof.

This IDS is being submitted within three months of the issue date of the Russian Notice of Allowance, but after receipt of a final Official Action in this matter, therefore a check for the filing fee is enclosed herewith. The Commissioner is hereby authorized to charge to deposit account 23-0442 any fee deficiency required to submit this IDS.

Respectfully submitted,

Dated: January 7, 2008

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FORM PTO-1449 INFORMATION DISCLOSURE STATEMENT	ATTY DOCKET NO. 915-005.053	SERIAL NO. 10/426,928
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	FILING DATE: April 30, 2003	ART UNIT: 2621

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EXAM. INITIAL		DOCUMENT NUMBER	DATE	INVENTOR/ASSIGNEE	CLASS	SUBCLASS	FILING DATE IF APPROPRIATE
		6,414,608	Jul. 2, 2002	*Nishida et al.*			

FOREIGN PATENT DOCUMENTS

		DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES/NO
		WO 02/15589	Feb. 21, 2002	PCT			
		RU 2201654	Mar. 27, 2003	Russia			
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OTHER DOCUMENTS (INCLUDING AUTHOR, TITLE, DATE, PERTINENT PAGES, ETC.)

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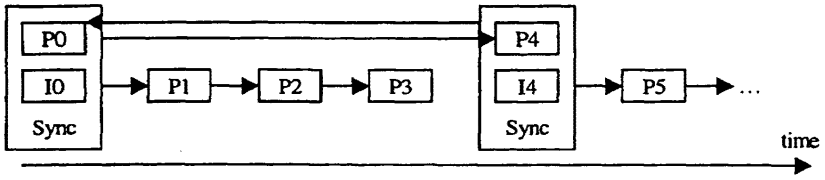
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(54) Title: VIDEO CODING



(57) Abstract: A method of encoding a video signal representing a sequence of pictures, the method comprising encoding a first picture (or segment of a picture) of the sequence without reference to another picture of the sequence to produce a picture (I0) and encoding said first picture (or segment of a picture) with reference to another picture (I4) of the sequence to produce a corresponding temporally predicted picture (P4) or segment of a picture.

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VIDEO CODING

This invention relates to video coding.

A video sequence consists of a series of still pictures or frames. Video compression methods are based on reducing the redundant and perceptually irrelevant parts of video sequences. The redundancy in video sequences can be categorised into spectral, spatial and temporal redundancy. Spectral redundancy refers to the similarity between the different colour components of the same picture. Spatial redundancy results from the similarity between neighbouring pixels in a picture. Temporal redundancy exists because objects appearing in a previous image are also likely to appear in the current image. Compression can be achieved by taking advantage of this temporal redundancy and predicting the current picture from another picture, termed an anchor or reference picture. Further compression is achieved by generating motion compensation data that describes the motion between the current picture and the previous picture.

However, sufficient compression cannot usually be achieved by only reducing the inherent redundancy of the sequence. Thus, video encoders also try to reduce the quality of those parts of the video sequence which are subjectively less important. In addition, the redundancy of the encoded bit-stream is reduced by means of efficient lossless coding of compression parameters and coefficients. The main technique is to use variable length codes.

Video compression methods typically differentiate between pictures that utilise temporal redundancy reduction and those that do not. Compressed pictures that do not utilise temporal redundancy reduction methods are usually called INTRA or I-frames or I-pictures. Temporally predicted images are usually forwardly predicted from a picture occurring before the current picture and are called INTER or P-frames or P-pictures. In the INTER frame case, the

predicted motion-compensated picture is rarely precise enough and therefore a spatially compressed prediction error frame is associated with each INTER frame. INTER pictures may contain INTRA-coded areas.

Many video compression schemes also use temporally bi-directionally predicted frames, which are commonly referred to as B-pictures or B-frames. B-pictures are inserted between anchor picture pairs of I- and/or P-frames and are predicted from either one or both of these anchor pictures. B-pictures normally yield increased compression compared with forward-predicted pictures. B-pictures are not used as anchor pictures, i.e., other pictures are not predicted from them. Therefore they can be discarded (intentionally or unintentionally) without impacting the picture quality of future pictures. Whilst B-pictures may improve compression performance as compared with P-pictures, their generation requires greater computational complexity and memory usage, and they introduce additional delays. This may not be a problem for non-real time applications such as video streaming but may cause problems in real-time applications such as video-conferencing.

A compressed video clip typically consists of a sequence of pictures, which can be roughly categorised into temporally independent INTRA pictures and temporally differentially coded INTER pictures. Since the compression efficiency in INTRA pictures is normally lower than in INTER pictures, INTRA pictures are used sparingly, especially in low bit-rate applications.

A video sequence may consist of a number of scenes or shots. The picture contents may be remarkably different from one scene to another, and therefore the first picture of a scene is typically INTRA-coded. There are frequent scene changes in television and film material, whereas scene cuts are relatively rare in video conferencing. In addition, INTRA pictures are typically inserted to stop temporal propagation of transmission errors in a reconstructed video signal and to provide random access points to a video bit-stream.

Compressed video is easily corrupted by transmission errors, for a variety of reasons. Firstly, due to utilisation of temporal predictive differential coding (INTER frames), an error is propagated both spatially and temporally. In practice this means that, once an error occurs, it is easily visible to the human eye for a relatively long time. Especially susceptible are transmissions at low bit-rates where there are only a few INTRA-coded frames, so temporal error propagation is not stopped for some time. Secondly, the use of variable length codes increases the susceptibility to errors. When a bit error alters a codeword, the decoder loses codeword synchronisation and also decodes subsequent error-free codewords (comprising several bits) incorrectly until the next synchronisation (or start) code. A synchronisation code is a bit pattern which cannot be generated from any legal combination of other codewords and such codes are added to the bit stream at intervals to enable re-synchronisation. In addition, errors occur when data is lost during transmission. For example, in video applications using the unreliable User Datagram Protocol (UDP) transport protocol in IP networks, network elements may discard parts of the encoded video bit-stream. Additionally, the size of an encoded INTRA picture is typically significantly larger than that of an encoded INTER picture. When periodic INTRA frames are encoded, it may therefore be more likely that an INTRA picture would be corrupted.

There are many ways for the receiver to address the corruption introduced in the transmission path. In general, on receipt of a signal, transmission errors are first detected and then corrected or concealed by the receiver. Error correction refers to the process of recovering the erroneous data perfectly as if no errors had been introduced in the first place. Error concealment refers to the process of concealing the effects of transmission errors so that they are hardly visible in the reconstructed video sequence. Typically some amount of redundancy is added by the source or transport coding in order to facilitate error detection, correction and concealment.

In streaming applications, the demultiplexing-decompression-playback chain can be done while still downloading subsequent parts of the clip. In this case, a client may request retransmission of a corrupted INTRA picture. However, sometimes the streaming server may not be able to respond to such requests or the communication protocol between the streaming server and the client may not be able to transmit such requests. For example, the server may send a multicast stream, i.e., a single stream for multiple clients. If one of the clients receives a corrupted INTRA picture and sends a request for retransmission, the multicasting server would either send the retransmitted INTRA picture to all clients using the multicast channel or open an additional unicast channel for retransmission to the specific client. The former case increases network traffic unnecessarily for the majority of clients and the latter case complicates applications and network resource allocations. RTCP (real Time Control Protocol) is an example of a transport protocol incapable of requesting retransmissions of specific pictures. Servers cannot determine which pictures to retransmit based on the receiver reports provided by RTCP.

Current video coding standards define a syntax for a self-sufficient video bit-stream. The most popular standards at the time of writing are ITU-T Recommendation H.263, "Video coding for low bit rate communication", February 1998; ISO/IEC 14496-2, "Generic Coding of Audio-Visual Objects. Part 2: Visual", 1999 (known as MPEG-4); and ITU-T Recommendation H.262 (ISO/IEC 13818-2) (known as MPEG-2). These standards define a syntax for bit-streams and correspondingly for image sequences and images.

Some video coding schemes, such as ITU-T H.263 Annex N Reference Picture Selection (RPS) mode, include an indicator or indicator(s) to the prediction reference frame of an INTER frame.

Video Redundancy Coding (VRC) is also described in Annex N of H.263. In VRC, multiple "threads" of independently coded INTER-pictures are generated. Corruption of a frame in one thread will therefore not affect the

decoding of the other threads. Periodically, all the threads converge to a so-called sync frame which may be an INTRA-picture or a non-INTRA picture that is redundantly represented within all threads. From this sync frame, all the independent threads are started again.

The principle of the VRC method is to divide the sequence of pictures into two or more threads in such a way that all pictures are assigned to one of the threads in a round-robin fashion. Each thread is coded independently. The frame rate within one thread is lower than the overall frame rate: half in the case of two threads, a third in the case of three threads and so on. This leads to a substantial coding penalty because of the generally larger changes and the longer motion vectors typically required to represent accurately the motion related changes between two P-pictures within a thread. At regular intervals all threads converge into a so-called sync frame. From this sync frame, a new series of threads is started.

If one of the threads is corrupted (e.g. because of packet loss), the remaining threads can be used to predict the next sync frame. It is possible to continue the decoding of the damaged thread, which typically leads to slight picture degradation, or to stop its decoding which leads to a decrease in the frame rate. If the length of the threads is kept reasonably small, however, both forms of degradation will persist for a relatively short time, i.e. until the next sync frame is reached.

Sync frames are always predicted from one of the undamaged threads. This means that the number of transmitted I-pictures can be kept small, because there is no need for complete re-synchronization. Only if all threads are damaged between two sync frames, is correct sync frame prediction no longer possible. In this situation, annoying artefacts will be present until the next I-picture is decoded correctly, as would have been the case without employing VRC.

According to a first aspect of the invention there is provided a method of encoding a video signal representing a sequence of pictures, the method comprising encoding at least part of a first picture of the sequence without reference to another picture of the sequence and encoding said at least part of the first picture with reference to another picture of the sequence to produce a corresponding temporally predicted picture.

The invention is applicable whenever a frame or part of a frame is encoded in an INTRA manner. When the encoder encodes a frame (or part of a frame) in an INTRA manner, the encoder also encodes the frame (or part of the frame) again, this time in a temporally predictive manner with reference to another frame within the video sequence.

The invention enables INTRA picture recovery at a decoder even if the original INTRA picture is lost or corrupted. Interaction between the transmitter and the receiver is not needed to recover the INTRA picture. In addition, in certain situations the invention results in lower bit rate overheads than prior art forward error correction methods.

Preferably every picture (or picture segment) encoded without reference to another picture is also encoded with reference to another picture of the sequence.

The first picture (or picture segment) may be encoded with reference to another picture occurring in the sequence temporally prior to said first picture and/or with reference to another picture occurring in the sequence temporally after said first picture. The first picture (or picture segment) may be encoded a plurality of times with reference to other pictures occurring in the sequence.

In a second aspect of the invention there is provided a video encoder comprising an input for receiving a video signal representing a sequence of pictures, the encoder being arranged to encode a first picture of the sequence

or part thereof without reference to another picture of the sequence and to encode said first picture or part thereof with reference to another picture of the sequence to produce a corresponding temporally predicted picture.

The invention also extends to a video codec and a multimedia system including a video encoder according to the invention.

In a further aspect of the invention there is provided a method of encoding a video signal representing a sequence of pictures, the method comprising encoding a segment of a first picture of the sequence without reference to another picture of the sequence and encoding at least said segment of said first picture with reference to another picture of the sequence to produce a corresponding temporally predicted picture segment.

A method of video decoding is also encompassed, comprising receiving a signal representing encoded pictures of a video sequence, determining whether a picture that is not temporally predicted or part of a picture that is not temporally predicted has been corrupted and, if so, monitoring for a temporally-predicted representation of the picture or part thereof and, on receipt of the temporally-predicted representation of the picture or part thereof, decoding the picture or part thereof with reference to another picture.

In a further aspect of the invention there is also provided a video decoder comprising an input for receiving a signal representing encoded pictures of a video sequence, said video decoder being arranged to determine whether a non-temporally predicted frame or part thereof has been corrupted and, if so, to monitor for a temporally-predicted representation of the frame or part thereof and, on receipt of the temporally-predicted representation of the frame or part thereof, to decode the temporally-predicted representation of the frame or part thereof with reference to another frame.

The invention extends to a portable electronic device incorporating a video encoder or video decoder according to the invention.

The invention will now be described, by way of example only, with reference to the accompanying drawings, in which:

Figure 1 shows a multimedia mobile communications system;

Figure 2 shows an example of the multimedia components of a multimedia terminal;

Figure 3 shows an example of a video codec;

Figure 4 is a flow diagram illustrating the operation of a video encoder according to the invention;

Figure 5 shows an example of the output of a first embodiment of a video encoder according to the invention;

Figure 6 is a flow diagram illustrating the operation of a video decoder according to a first embodiment of the invention;

Figure 7 is a flow diagram illustrating the operation of a video encoder according to a second embodiment of the invention;

Figure 8 illustrates a further embodiment of the invention; and

Figure 9 shows a multimedia content creation and retrieval system into which a video encoder and/or decoder according to the invention may be incorporated.

Figure 1 shows a typical multimedia mobile communications system. A first multimedia mobile terminal 1 communicates with a second multimedia mobile terminal 2 via a radio link 3 to a mobile communications network 4. Control data is sent between the two terminals 1,2 as well as multimedia data.

Figure 2 shows the typical multimedia components of a terminal 1. The terminal comprises a video codec 10, an audio codec 20, a data protocol manager 30, a control manager 40, a multiplexer/demultiplexer 50 and a modem (if required). The video codec 10 receives signals for coding from a video input/output device 70 of the terminal (e.g. a camera) and receives

signals for decoding from a remote terminal 2 for display by the terminal 1 on a display of the video input/output device 70. The audio codec 20 receives signals for coding from an audio input/output device 75, (e.g. a microphone) of the terminal 1 and receive signals for decoding from a remote terminal 2 for reproduction by the audio input/output device 75, (e.g. a loudspeaker) of the terminal 1. The terminal may be a portable radio communications device, such as a radio telephone.

The control manager 40 controls the operation of the video codec 10, the audio codec 20 and the data protocols manager 30. However, since the invention is concerned with the operation of the video codec 10, no further discussion of the audio codec 20 and protocol manager 30 will be provided.

Figure 3 shows an example of a video codec 10 according to the invention. The video codec comprises an encoder part 100 and a decoder part 200. The encoder part 100 comprises an input 101 for receiving a video signal from a camera or video source (not shown) of the terminal 1. A switch 102 switches the encoder between an INTRA-mode of coding and an INTER-mode. The encoder part 100 of the video codec 10 comprises a DCT transformer 103, a quantiser 104, an inverse quantiser 108, an inverse DCT transformer 109, an adder 110, one or more picture stores 107, a subtractor 106 for forming a prediction error, a switch 115 and an encoding control manager 105.

The decoder part 200 of the video codec 10 comprises an inverse quantiser 220, an inverse DCT transformer 221, a motion compensator 222, a plurality of picture stores 223 and a controller 224. The controller 224 receives video codec control signals demultiplexed from the encoded multimedia stream by the demultiplexer 50. In practice the controller 105 of the encoder and the controller 224 of the decoder may be the same processor.

The operation of an encoder according to the invention will now be described. The video codec 10 receives a video signal to be encoded. The encoder 100 of the video codec encodes the video signal by performing DCT transformation, quantisation and motion compensation. The encoded video data is then output to the multiplexer 50. The multiplexer 50 multiplexes the video data from the video codec 10 and control data from the control 40 (as well as other signals as appropriate) into a multimedia signal. The terminal 1 outputs this multimedia signal to the receiving terminal 2 via the modem 60 (if required).

In INTRA-mode, the video signal from the input 101 is transformed into DCT co-efficients by a DCT transformer 103. The DCT coefficients are then passed to the quantiser 104 where they are quantised. Both the switch 102 and the quantiser 104 are controlled by the encoding control manager 105 of the video codec, which may also receive feedback control from the receiving terminal 2 by means of the control manager 40. A decoded picture is then formed by passing the data output by the quantiser through the inverse quantiser 108 and applying an inverse DCT transform 109 to the inverse-quantised data. The resulting data is added to the picture store 107 by the adder 110, switch 115 being operated to present no data to the adder 110.

In INTER mode, the switch 102 is operated to accept from the subtractor 106 the difference between the signal from the input 101 and a reference picture stored in the picture store 107. The difference data output from the subtractor 106 represents the prediction error between the current picture and the reference picture stored in the picture store 107. A motion estimator 111 may generate motion compensation data from the data in the picture store 107 in a conventional manner.

The encoding control manager 105 decides whether to apply INTRA or INTER coding or whether to code the frame at all on the basis of either the output of the subtractor 106 or in response to feedback control data from a receiving

decoder and operates the switch 102 accordingly. The encoding control manager may decide not to code a received frame at all when the similarity between the current frame and the reference frame is sufficient or there is not time to code the frame.

When not responding to feedback control data, the encoder typically encodes a frame as an INTRA-frame either only at the start of coding (all other frames being P-frames), or at regular periods e.g. every 5s, or when the output of the subtractor exceeds a threshold i.e. when the current picture and that stored in the picture store 107 are judged to be too dissimilar to enable efficient temporal prediction. The encoder may also be programmed to encode frames in a particular regular sequence e.g. I B B P B B P B B P B B P B B I B B P etc.

The video codec outputs the quantised DCT coefficients of an INTRA coded picture or prediction error data of an INTER coded picture 112a, the quantising index 112b (i.e. the details of the quantiser used), an INTRA/INTER flag 112c to indicate the mode of coding performed (I or P/B), a transmit flag 112d to indicate the number of the frame being coded and the motion vectors 112e in the case of an INTER picture being coded. These are multiplexed together by the multiplexer 50 together with other multimedia signals.

Figure 4 is a flow diagram illustrating the operation of an encoder according to a first embodiment of the invention. The encoder creates one or more temporally predicted frames corresponding to an INTRA coded frame as well as the INTRA coded frame itself. For simplicity the description only refers to the handling of INTER and INTRA frames. The handling of other types of frames (e.g. B-frames) has been omitted from the description. These are handled in a conventional manner.

Firstly the encoder receives a frame (401). The encoder decides (in a conventional manner) whether to code the frame or to skip it (402). If a decision is made to code the frame, the encoder decides (403) whether to code the frame as an INTER frame (404) or an INTRA frame (405). In the former case, the frame is coded (404) in a conventional temporally predictive manner. In the latter case, the frame is coded (405) in a conventional non-temporally predictive manner. The decision to encode the frame as an INTRA frame (405) may be in response to a periodic INTRA request set up in the encoder or in response to a specific request received from a receiving decoder. Alternatively, it may be in response to the encoder determining that there is significant change in picture content which makes the use of an INTRA picture beneficial from the point of view of compression efficiency. This may also be referred to informally as a scene cut.

The invention is applicable whenever a frame or segment of a frame is encoded in an INTRA manner. When the encoder encodes a frame as an INTRA frame, the encoder also encodes the frame (or segment of the frame) again (407, 408), this time in a temporally predictive manner with reference to another frame within the video sequence.

For all but the first frame of the video sequence, a frame that has been INTRA-coded is also encoded (407) in a temporally predictive manner with reference to a frame occurring within the video sequence temporally prior to the frame to be coded i.e. by forward prediction. This exception may also be the case for the first INTRA coded frame after a scene cut.

If the encoder determines (406) that the frame is the first INTRA frame to be coded (or the first INTRA frame to be coded after a scene cut), the encoder encodes the frame again (408), this time in a predictive manner with reference to a frame occurring within the video sequence temporally after the frame to be coded i.e. by backward prediction. The encoder therefore has to wait until

a subsequent frame has been received for encoding before it can encode the predicted frame with reference to the subsequent frame.

In the example shown in Figure 4, the encoder waits (409) until the next INTRA frame has been encoded and then generates (408) the backward predicted representation of the earlier INTRA-coded frame with reference to the second INTRA frame of the scene.

All INTRA pictures after the first INTRA picture of a video sequence may have temporally predicted representation(s) encoded in a forward prediction manner and/or a backward prediction manner.

Figure 5 shows the frame-by-frame output of an encoder according to the invention. I0 is an INTRA coded picture appearing at the very beginning of a video sequence (or after a scene cut). The system shown uses periodic INTRA pictures, and I4 is such a picture. In order to protect I0 and I4 from transmission errors, a second representation of each INTRA coded picture is temporally predictively encoded and transmitted. The second representation of picture 4 is an INTER picture predicted (and motion-compensated) with reference to picture 0. This second representation is indicated by P4 in Figure 5. P4 could be predicted from any of the preceding frames, I0, P1, P2, or P3. Picture 0 is preferably chosen because otherwise P4 would be vulnerable to any transmission errors in the prediction path starting from I0. A receiving decoder can use any representation of picture 4 to reconstruct a picture for display/reference.

To protect picture 0 from transmission errors, a second representation of the same picture is coded and transmitted. Picture 0 is the first INTRA coded frame of a video sequence. This may be of an entire video sequence or may be the first INTRA coded frame of a subset of an entire video sequence (e.g the INTRA frame that occurs immediately after a visual-content discontinuity e.g. a scene cut). The method of selection of a reference picture for such a

INTRA-picture is different from that used for I4. Instead, the second representation of picture 0 is an INTER picture predicted (and motion-compensated) with reference to the picture that corresponds to the next periodic INTRA picture (picture 4 in the example). If I0 is corrupted, a receiver may wait until I4 and P0 have been received, after which it can reconstruct picture 0. Again P0 may be predicted from a picture other than frame I4, but prediction from the temporally nearest frame that has been coded in an INTRA manner is preferred.

The encoded data may be transmitted in the order in which it is encoded i.e. I0, P1, P2, P3, I4, P4, P0, P5... etc. Alternatively the frames of data may be re-ordered.

Considering the terminal 1 as receiving coded video data from terminal 2, the operation of the video codec 10 will now be described with reference to its decoding role. The terminal 1 receives a multimedia signal from the transmitting terminal 2. The demultiplexer 50 demultiplexes the multimedia signal and passes the video data to the video codec 10 and the control data to the control manager 40. The decoder 200 of the video codec decodes the encoded video data by inverse quantising, inverse DCT transforming and motion compensating the data. The controller 124 of the decoder checks the integrity of the received data and, if an error is detected, attempts to conceal the error in a manner to be described below. The decoded, corrected and concealed video data is then stored in one of the picture stores 223 and output for reproduction on a display 70 of the receiving terminal 1.

Errors in video data may occur at the picture level, the picture segment level (e.g. GOB (Group of Blocks) or slice level) or the macroblock level. Error checking may be carried out at any or each of these levels.

Figure 6 is a flow chart illustrating a video decoder according to the invention. Considering first the signal as illustrated in Figure 5, when a decoder

according to the invention receives this signal each frame of the signal is decoded in a conventional manner and then displayed on a display means. The decoded frame may be error corrected and error concealed in a conventional manner. Each time a frame is decoded, the decoder determines when the frame is to be displayed. This may be done by examining a temporal reference (TR) field of the header of the frame or, if the video is transmitted in packets, the time-stamps of the packets may be examined.

Consider the pictures shown in Figure 5, transmitted in the following order: I0, P1, P2, P3, I4, P4, P0, P5... etc. The decoder receives picture I0 (601) and determines (602) from its picture header that the picture is INTRA-coded. The decoder decodes picture I0 (603) without reference to any other picture, displays it and stores it in picture store 223a (604). The decoder then receives picture P1 (601) and determines (602) from its picture header that the picture is INTER-coded as a P-picture. The decoder determines whether picture 1 has already been decoded (605). Since picture 1 has not already been decoded, the decoder checks whether the reference picture for P1 has been received and decoded (606). As picture 0 has been received and decoded, the decoder decodes picture P1 (603) with reference to the reference picture 0, displays it and stores it in the next picture store 223b (604). The decoder then receives picture P2 (601) and determines (602) from its picture header that the picture is INTER-coded as a P-picture. Picture 2 has not been decoded (605) and the reference picture 1 has been decoded (606) so the decoder therefore decodes picture P2 with reference to the preceding reference picture 1, displays it and stores it in the next picture store 223c and so on. The same procedure (steps 602, 603, 605 and 606) is followed for INTER coded picture P3.

The next picture to be received is I4. The decoder then determines (602) from its picture header that the picture is INTRA-coded and decodes the picture. The decoder then receives picture P4 (601) and determines (602) from its picture header that the picture is INTER-coded as a P-picture. However the

decoder notes (605) that picture 4 has already been successfully decoded and discards picture P4 and receives the next picture of data P0. The decoder determines (602) from its picture header that the picture is INTER-coded as a P-picture. However the decoder notes (605) that picture 0 has already been decoded, discards picture P0 and subsequently receives the next picture of data P5. This picture is then decoded with reference to decoded picture 4.

The above description describes what happens when no errors occur during transmission. Consider now the situation in which the decoder is unable to decode successfully the INTRA coded frame I0. This may be because the data for the frame has been lost completely during transmission or some of the data for the frame has been corrupted in such as way that it is not recoverable satisfactorily. When frame P1 is received, the decoder determines that frame 1 has not yet been decoded (605) and that the reference frame for P1 has not been received and decoded (606). The decoder then buffers the data for P1 (607). The same action is taken for P2 and P3.

When I4 is received successfully, the decoder decodes I4 without reference to any other frame. When P4 is received it is ignored because picture 4 has already been decoded (605). When P0 is received the decoder determines that picture 0 has not already been decoded (605) and that the reference picture for P0 (picture 4) has been decoded (606). The decoder therefore decodes (603) frame P0 with reference to picture 4. Since picture 0 has now been decoded, it is possible to decode any buffered frames for which picture 0 was the reference picture. Thus the decoder decodes (608) the buffered frame P1 with reference to picture 0. After decoding frame 1, the decoder is also able to decode the buffered frame P2 and, after decoding frame 2, the decoder is also able to decode the buffered frame P3.

The decoder discards the buffered frames if the decoder does not receive a reference frame for the buffered frames. The decoder may be arranged to

discard the buffered frames if the reference picture for the buffered frames is not received within a given time or when an INTRA-coded frame is received.

Figure 7 is a flow chart also illustrating a second embodiment of a video decoder according to the invention, which is capable of detecting scene changes. The decoder receives (701) a signal for decoding. The decoder detects (702) if there has been a scene cut between the latest decoded frame and if the INTRA picture following the scene cut is missing. This may be done for instance by examining a scene identifier in the header of the encoded frame or by examining the picture number of the frame, as set out in Annex W of H.263. In this latter case, the decoder can deduce from the picture number that a picture is missing and, if the next picture after a missed one does not indicate a spare reference picture number, the decoder assumes that the lost picture is an INTRA picture associated with a scene cut.

If the INTRA picture immediately following a scene cut is not missing, the decoder checks (703) if the frame being decoded is a redundant representation of a frame that has already been decoded (called a sync frame in the figure). In H.263, such a redundant representation may be indicated by giving the encoded frame the same TR as the primary representation of the picture.

If the frame is not a sync frame or if the primary representation of the sync frame has not been decoded (704), the decoder decodes the frame (705) and continues from the beginning of the loop. Otherwise, the decoder skips the decoding and continues from the beginning of the loop (701).

If the first INTRA picture (or that following a scene cut) is missing, the decoder starts to monitor (706) for the receipt of the backward-predicted frame corresponding to the first INTRA picture. The decoder knows that this particular frame should appear after the next periodic INTRA picture. All

frames preceding the expected backward-predicted frame are buffered (707) (in compressed format). When the backward-predicted sync frame is due to appear in the bit-stream, the buffering is stopped. The next received frame is decoded (708) if it and the first periodic INTRA picture (i.e. the second INTRA picture in the scene) are received correctly. After that, all of the buffered frames are decoded (709), and then decoding can continue normally as if the first INTRA picture of the scene were never missing. Otherwise, the decoder cannot decode the buffered frames but rather it must discard them (710) and wait (711) for the next INTRA picture to arrive and continue decoding normally after decoding it.

Frame buffering has two implications. Firstly, the playback (displaying) process should use buffering to absorb the jitter introduced by the decoding process. This kind of a buffer is typical in video streaming and therefore the invention does not necessarily cause any modifications to the displaying process. Secondly, all buffered frames are decoded as soon as the reference frame is decoded. In practice this means that there may be a burst of computational activity when the first INTRA picture (I0) of a scene is lost and a subsequent representation (P0) of the picture of the scene is decoded. The decoder should be fast enough so that it has the resources to make up the time spent on buffering and so that uncompressed frames do not remain in the buffers for a long time.

The typical encoding/decoding order would be:

I0, P1, P2, ..., Pn-1, In, Pn, P0, Pn+1, Pn+2, ...

where I means an INTRA picture, P means an INTER picture, the index corresponds to relative capturing/displaying time, and time instant n corresponds to the first periodic INTRA frame after a scene cut.

The processing power requirement at the decoder can be minimised by re-ordering the transmitted frames compared with the typical encoding/decoding order, i.e., the transmitter can send the frames in the following order:

I0, In, P0, Pn, P1, P2, ..., Pn-1, Pn+1, Pn+2, ...

The invention is applicable to schemes where some segments of a picture are INTRA-coded and others INTER-coded. This is illustrated in Figure 8. Firstly, the bit-stream is coded in a conventional manner. When the encoder decides to update a picture segment in an INTRA manner, it carries out the following three operations:

1. The encoder codes the picture as a normal INTER-picture P(n).

2. The encoder codes P(n)', which is a redundant representation of P(n) where the desired picture segment is INTRA coded and other picture segments remain unchanged from P(n). The time-stamp of this newly coded picture is as close as possible to P(n).

3. The encoder encodes P(n)", which is a secondary representation of P(n)'. In P(n)", the picture segment of P(n)' that was coded in an INTRA manner is INTER-coded. Preferably the reference picture used is the latest picture (other than P(n)') in which the corresponding segment was INTRA-coded. The encoder may limit motion vectors to point only inside the picture segment in order to prevent the propagation of possible decoding errors from the neighbouring segments. Alternatively, the encoder may use a coding mode such as H.263 Independent Segment Decoding (Annex R), which inherently prevents prediction from neighbouring picture segments. Other picture segments of P(n)" remain unchanged from P(n).

After that, the encoder continues coding normally.

The decoder operates similarly to the one described earlier. If the picture segment in P(n) is not corrupted, P(n)' and P(n)" are redundant and may be discarded. Otherwise, the decoder can use either P(n)' or P(n)" to recover the corrupted picture segment.

The error resilience of the invention can be improved if the transmitter sends multiple copies of a temporally predicted frame corresponding to an INTRA frame. The multiple copies may be predicted from different reference pictures in a forward or backward manner. To maximise error protection, these frames should be encapsulated into different packets. Moreover, it is beneficial if each INTRA picture is associated with both forward- and backward-predicted corresponding pictures.

The invention can be used in conversational, low-delay applications. In applications that do not buffer decoded frames before displaying them (but rather display decoded frames more or less immediately), corresponding backward predicted frames cannot be used by a decoder. Thus, a transmitting encoder for such applications (e.g. conversational applications) may be arranged not to code corresponding backward predicted frames for INTRA frames. Consequently, the first INTRA picture will not be protected in accordance with the invention.

The framework of an entire multimedia content creation and retrieval system will now be described with reference to Figure 9. The system has one or more media sources 90, e.g. a camera and a microphone. Multimedia content can be synthetically created e.g. animated computer graphics and digitally generated music. To compose a multimedia clip consisting of different media types, the raw data captured from the sources are edited by an editing system 91. Typically the storage space required for raw multimedia data is huge. To facilitate an attractive multimedia retrieval service over low bit rate channels, multimedia clips are also compressed in the editing system 91. Then the clips are handed to a multimedia server 92. Typically, a number of clients 93 can access the server over a network. The server 92 is able to respond to requests presented by the clients 93. The main task for the server is to transmit a desired multimedia clip to a given client. The client 93 decompresses and plays the clip. In the playback phase, the client utilises

one or more output devices 94, e.g. the screen and the loudspeaker of the client. In the system shown in Figure 9, The server incorporates a video encoder according to the invention and the client incorporates a video decoder according to the invention. In applications involving two-way video transmission, both the server and the clients incorporate a video codec according to the invention.

In a mobile multimedia retrieval system, at least part of the link connecting a client 93 and the server 92 is wireless e.g. by radio.

Typically, multimedia servers 92 have two modes of operation, namely they deliver either pre-stored multimedia clips or live (real-time) multimedia streams. In the former case, clips are stored on a server database, which is then accessed on an on-demand basis by the server for the client(s). In the latter case, multimedia clips are handed to the server as a continuous media stream that is immediately transmitted to clients 93. A server can remove and compress some of the header information produced by a multiplexing format as well as encapsulate the media clip into network packets.

The clients 93 control the operation of the server 92 using a control protocol. The minimum set of controls consists of a function to select a desired media clip. In addition, servers may support more advanced controls. For example, clients may be able to stop the transmission of a clip, to pause and resume the transmission of a clip, and to control the media flow if the throughput of the transmission channel varies, in which case the server dynamically adjusts the bit stream to fit into the available bandwidth.

The client 93 receives a compressed and multiplexed media clip from the multimedia server 92. First, the client demultiplexes the clip in order to retrieve the separate media tracks and then decompresses these media tracks. After that, the decompressed (reconstructed) media tracks are played on output devices 94. In addition to these operations, a controller unit

interfaces with an end-user, controls the playback according to the user input and handles client-server control traffic. The demultiplexing-decompression-playback chain can be carried out while still downloading a subsequent part of the clip. This is commonly referred to as streaming. Alternatively, the whole clip is downloaded to the client 93 and then the client demultiplexes, decompresses and plays it.

The invention is not intended to be limited to the video coding protocols discussed above: these are intended to be merely exemplary. The invention is applicable to any video coding protocol using temporal prediction. The addition of additional INTER frames corresponding to INTRA frames as discussed above introduces error resilience into the encoded signal and allows a receiving decoder to select alternative decoding options if part of the received signal is corrupted.

CLAIMS

1. A method of encoding a video signal representing a sequence of pictures, the method comprising encoding at least part of a first picture of the sequence without reference to another picture of the sequence and encoding said at least part of the first picture with reference to another picture of the sequence to produce a corresponding temporally predicted picture.

2. A method according to claim 1 wherein every picture or part thereof encoded without reference to another picture is also encoded with reference to another picture of the sequence.

3. A method according to claim 1 wherein said first picture or part thereof is encoded with reference to another picture occurring in the sequence temporally prior to said first picture.

4. A method according to claim 1 wherein said first picture or part thereof is encoded with reference to another picture occurring in the sequence temporally after said first picture.

5. A method according to claim 1 wherein said first picture or part thereof is encoded with reference to one or more pictures occurring in the sequence.

6. A video encoder comprising an input for receiving a video signal representing a sequence of pictures, the encoder being arranged to encode a first picture of the sequence or part thereof without reference to another picture of the sequence and to encode said first picture or part thereof with reference to another picture of the sequence to produce a corresponding temporally predicted picture.

7. A video codec including a video encoder according to claim 6.

8. A multimedia system including a video encoder according to claim 6 or a video codec according to claim 7.

9. A method of encoding a video signal representing a sequence of pictures, the method comprising encoding a segment of a first picture of the sequence without reference to another picture of the sequence and encoding at least said segment of said first picture with reference to another picture of the sequence to produce a corresponding temporally predicted picture segment.

10. A method of video decoding comprising receiving a signal representing encoded pictures of a video sequence, determining whether a picture that is not temporally predicted or part of a picture that is not temporally predicted has been corrupted and, if so, monitoring for a temporally-predicted representation of the picture or part thereof and, on receipt of the temporally-predicted representation of the picture or part thereof, decoding the picture or part thereof with reference to another picture.

11. A video decoder comprising an input for receiving a signal representing encoded pictures of a video sequence, said video decoder being arranged to determine whether a non-temporally predicted frame or part thereof has been corrupted and, if so, to monitor for a temporally-predicted representation of the frame or part thereof and, on receipt of the temporally-predicted representation of the frame or part thereof, to decode the temporally-predicted representation of the frame or part thereof with reference to another frame.

12. A portable electronic device incorporating a video encoder or video decoder as claimed in any claim 6 or claim 11.

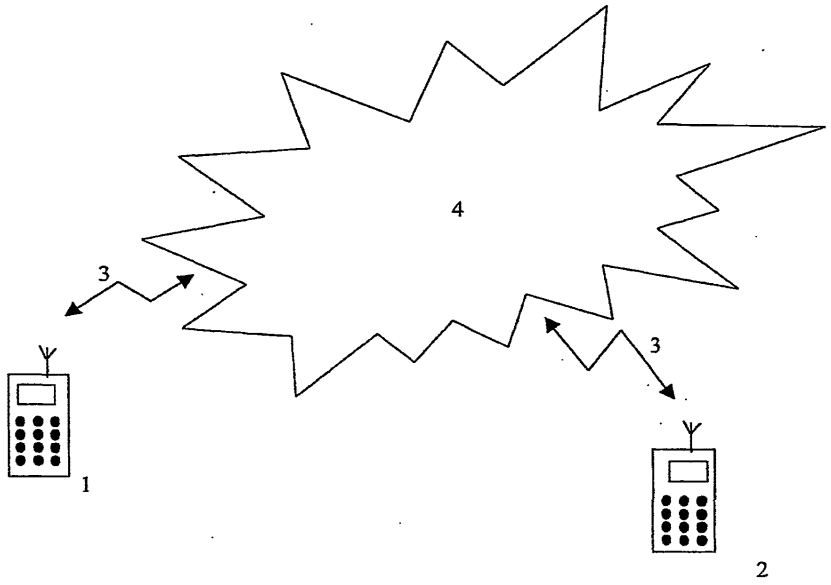


Fig 1

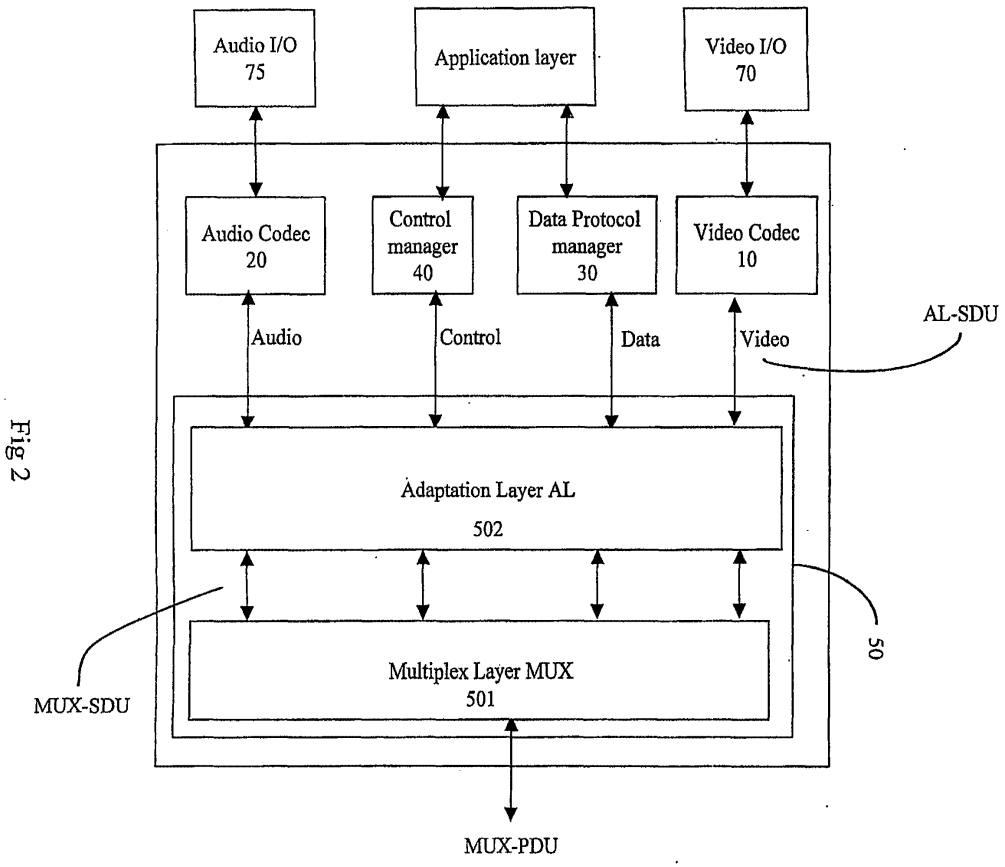


Fig 2

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 222 of 431

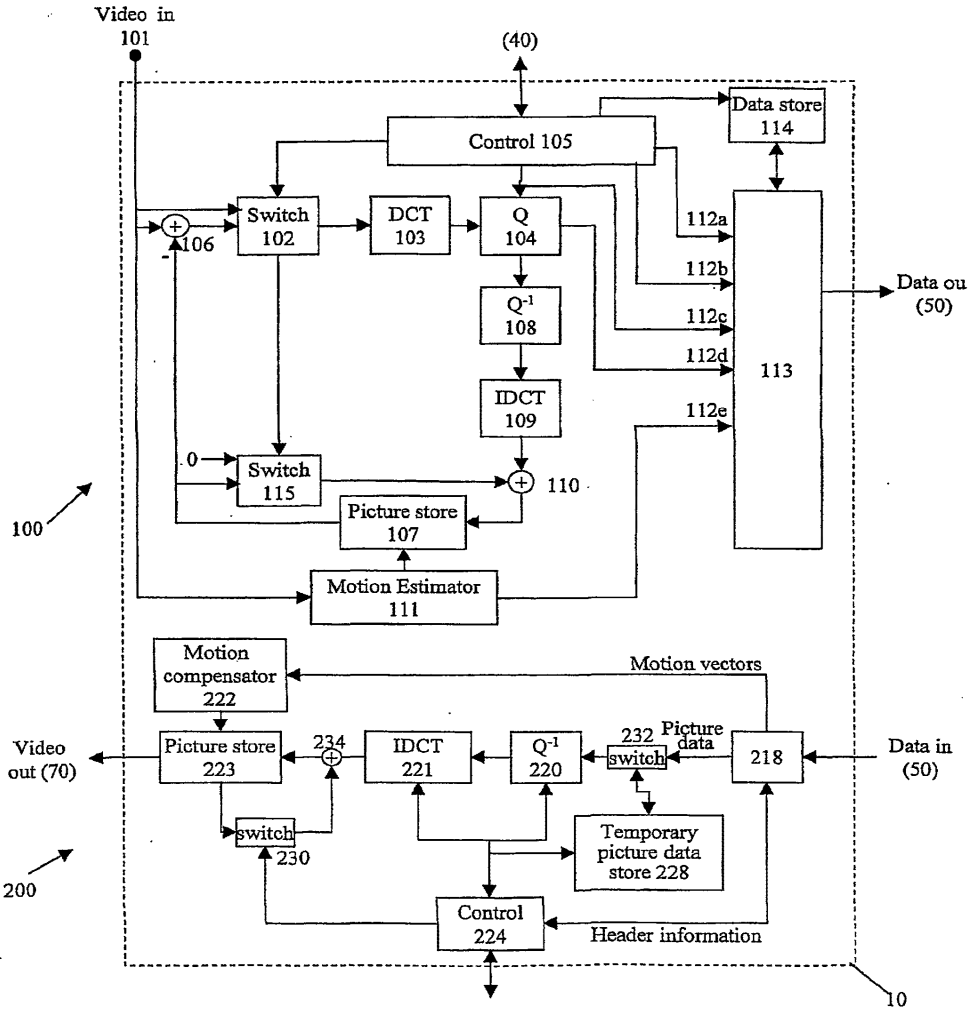

Video in
101
(40)
Data store
114
Control 105
Switch
102
DCT
103
Q
104
106
112a
112b
112c
112d
112e
Data ou
(50)
Q-1
108
IDCT
109
113
0
Switch
115
110
Picture store
107
100
Motion Estimator
111
Motion
compensator
222
Motion vectors
Video
out (70)
Picture store
223
234
IDCT
221
Q-1
220
232
switch
Picture
data
218
Data in
(50)
switch
230
Temporary
picture data
store 228
200
Control
224
Header information
10

Fig 3

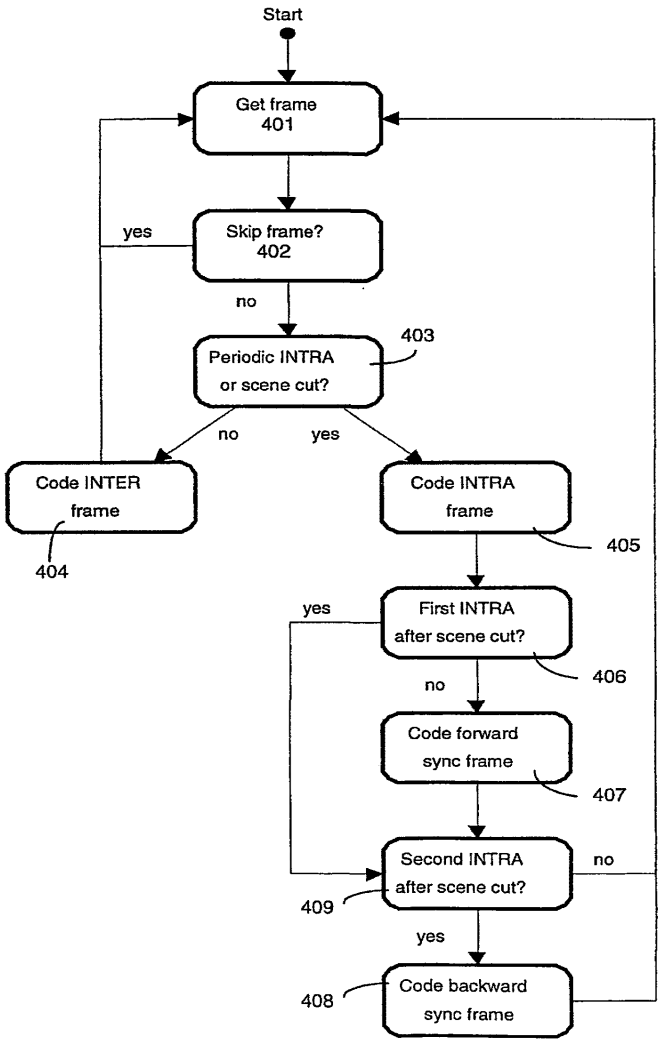

Start
Get frame
401
Skip frame?
402
yes
no
Periodic INTRA
or scene cut?
403
no
yes
Code INTER
frame
404
Code INTRA
frame
405
First INTRA
after scene cut?
406
yes
no
Code forward
sync frame
407
Second INTRA
after scene cut?
409
no
yes
Code backward
sync frame
408

Fig. 4

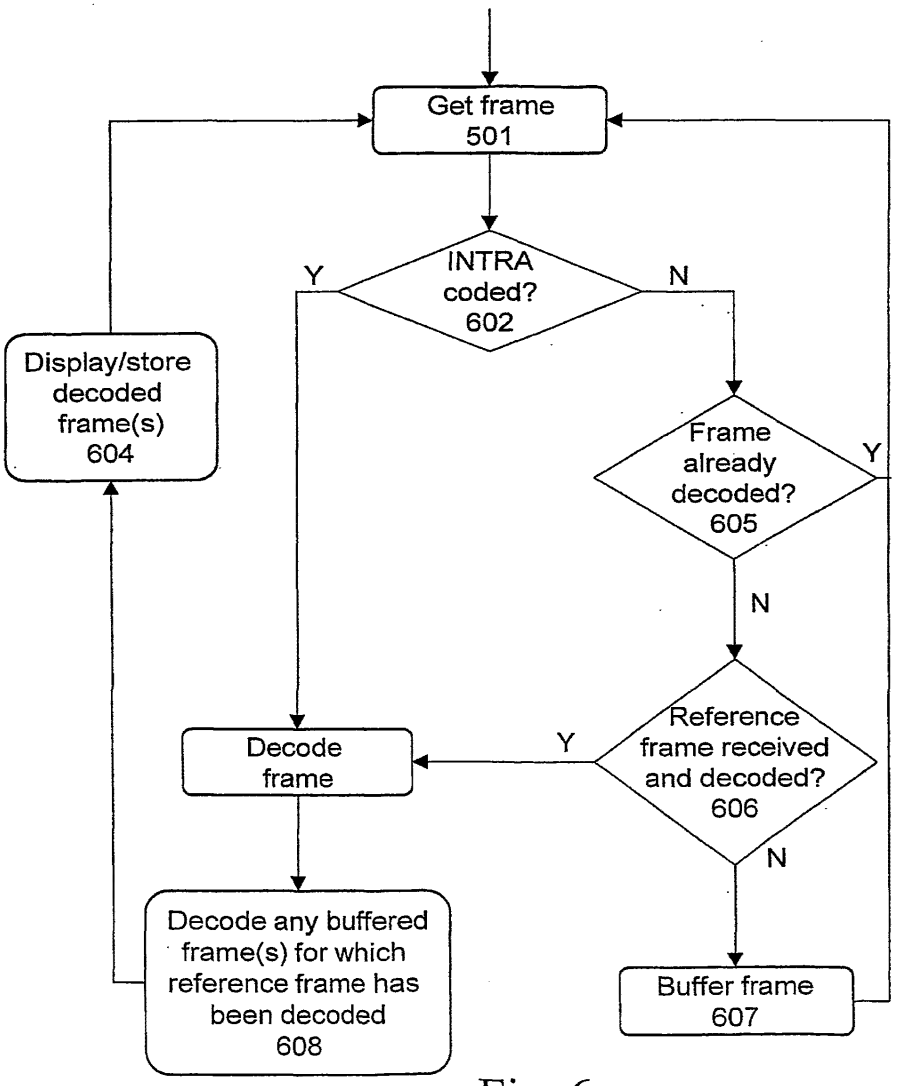

Get frame
501
INTRA
coded?
602
Y
N
Display/store
decoded
frame(s)
604
Frame
already
decoded?
605
Y
N
Reference
frame received
and decoded?
606
Y
N
Decode
frame
Decode any buffered
frame(s) for which
reference frame has
been decoded
608
Buffer frame
607

Fig. 6

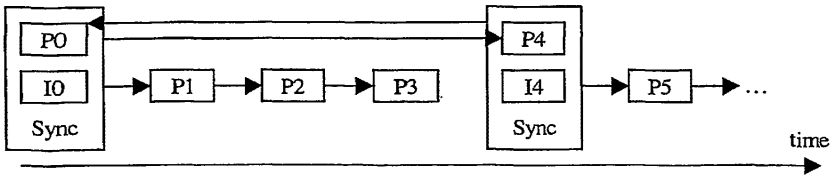

P0
I0
Sync
P1
P2
P3
P4
I4
Sync
P5
...
time

Fig. 5

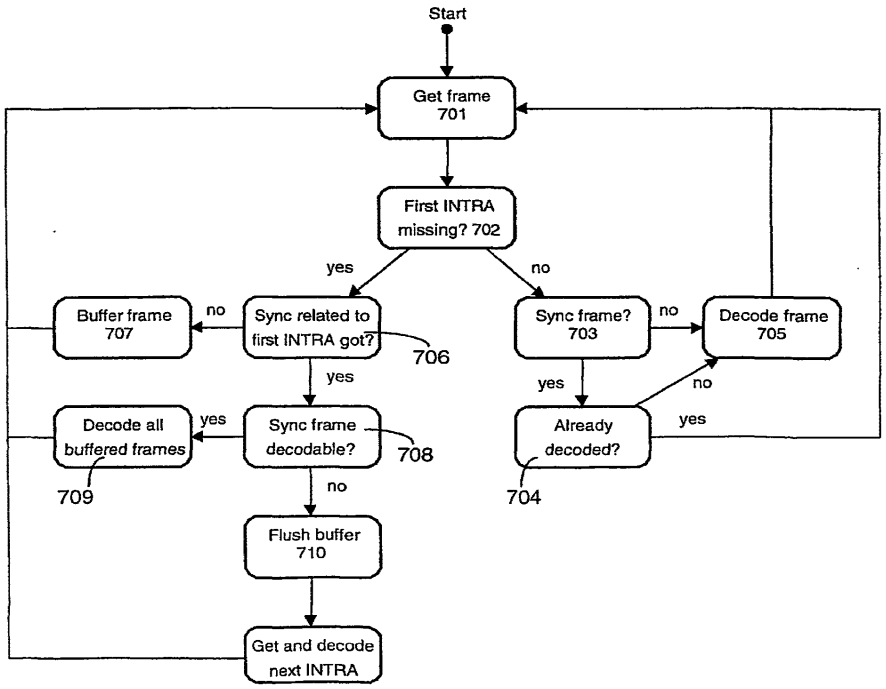

Start
Get frame 701
First INTRA missing? 702
yes
no
Buffer frame 707
no
Sync related to first INTRA got?
706
Sync frame? 703
no
Decode frame 705
yes
yes
no
Decode all buffered frames
yes
Sync frame decodable?
708
Already decoded?
yes
709
704
no
Flush buffer 710
Get and decode next INTRA

Fig. 7

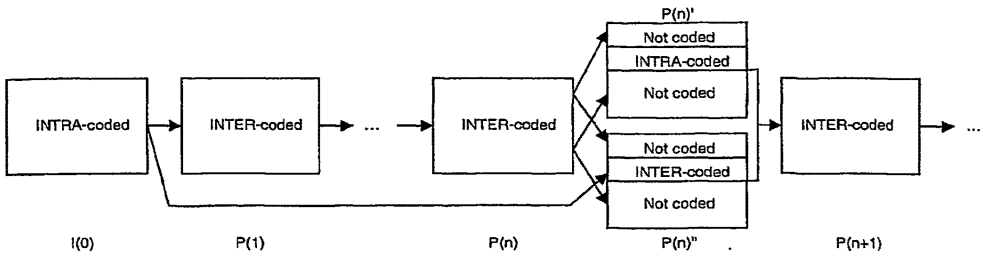

P(n)'
Not coded
INTRA-coded
Not coded
INTRA-coded
INTER-coded
INTER-coded
...
INTER-coded
Not coded
INTER-coded
Not coded
...
I(0)
P(1)
P(n)
P(n)"
P(n+1)

Fig. 8

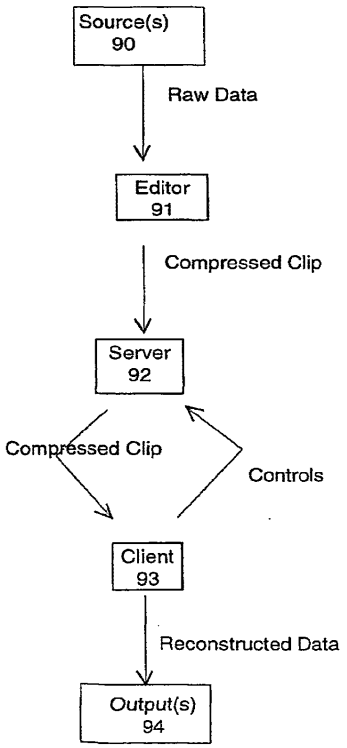

Source(s)
90
Raw Data
Editor
91
Compressed Clip
Server
92
Compressed Clip
Controls
Client
93
Reconstructed Data
Output(s)
94

Fig. 9

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Inte ıal Application No
PC, , LP 01/09220

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H04N7/50 H04N7/68

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 H04N

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Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
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C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5 442 400 A (SUN HUIFANG ET AL) 15 August 1995 (1995-08-15) abstract column 2, line 55 - line 64 column 4, line 13 - line 29	1-12
A	US 5 436 664 A (HENRY MICHEL) 25 July 1995 (1995-07-25) abstract column 3, line 65 -column 4, line 12	1-12

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[X] Further documents are listed in the continuation of box C.

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Date of the actual completion of the international search	Date of mailing of the international search report
24 January 2002	31/01/2002

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Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 228 of 431

Inte nal Application No
PC., ,P 01/09220

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
A	KIM C-S ET AL: "AN ERROR DETECTION AND RECOVERY ALGORITHM FOR COMPRESSED VIDEO SIGNAL USING SOURCE LEVEL REDUNDANCY" IEEE TRANSACTIONS ON IMAGE PROCESSING, IEEE INC. NEW YORK, US, vol. 9, no. 2, February 2000 (2000-02), pages 209-219, XP000912583 ISSN: 1057-7149 abstract paragraph 'III.A!	1-12

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Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 229 of 431

rmation on patent family members

Inter ıal Application No
PC., _P 01/09220

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5442400 A	15-08-1995	NONE	
US 5436664 A	25-07-1995	FR 2696026 A1	25-03-1994
		DE 69301297 D1	22-02-1996
		DE 69301297 T2	19-09-1996
		EP 0588736 A1	23-03-1994
		JP 6253288 A	09-09-1994

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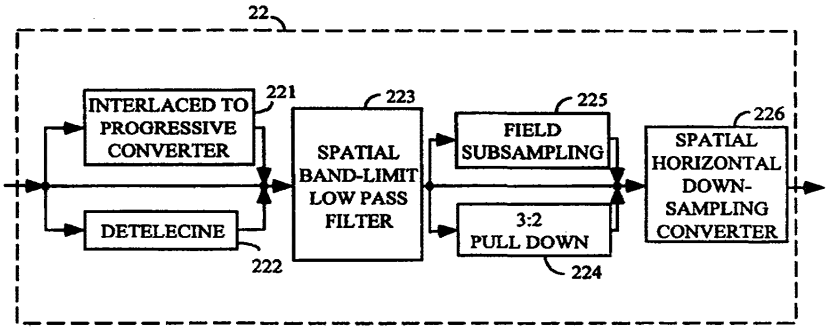
(72) Inventors; and
(75) Inventors/Applicants *(for US only)*: YU, Haoping [CN/US]; Apartment 3012, 3029 West 39th Street, Indianapolis, IN 46228 (US). McNEELY, David, Lowell [US/US]; 7832 Warbler Court, Indianapolis, IN 46256 (US). BEYERS, Billy, Wesley, Jr. [US/US]; 6920 Woodcrest Drive, Greenfield, IN 46140 (US).

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Published
With international search report.

(54) Title: LOW NOISE ENCODING AND DECODING METHOD



(57) Abstract

An adaptive digital image processor (22) precedes an MPEG2 encoder (24). The processor receives a high definition (1920 by 1080 pixels per image) video signal intended for broadcast or storage, and adaptively low–pass filters the signal. The signal is subjected to low–pass two–dimensional filtering (223) to eliminate encoding artifacts and related noise. The video signal is then horizontally down–sampled (226) to create a lower resolution hybrid signal (1280 by 1080 pixels per image). A receiver decodes and decompresses the hybrid signal. The hybrid signal is upsampled to its original resolution using existing hardware and software with a software modification.

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LOW NOISE ENCODING AND DECODING METHOD

Field of the Invention

This invention concerns image compression for reducing the bandwidth requirements of a digital video encoder.

Background of the Invention

The United States Federal Communications Commission (FCC) has approved a digital high definition television (HDTV) standard proposed by the Grand Alliance (GA), clearing the way for terrestrial digital television broadcasting in the United States. The GA HDTV system adopted the Motion Pictures Expert Group (MPEG2) video compression standard. For details, see "Information Technology - Generic Coding of Moving Picture and Associated Audio Information: Video," ISO/IEC 13818-2: 1996(E). Utilizing modern and sophisticated video compression methods, such as source processing, motion estimation and compensation, transform representation and statistical coding, an MPEG compression system can reduce the transmission bit rate by a factor of 50 or more. A full HD signal for one second requires approximately one billion bits before compression. As proposed in the GA specification, 1920 by 1080 pixel (picture element) images at a rate of 60 field per second are compressed to 18 megabits per second for digital broadcast.

The GA video compression system normally comprises two major subsystems, a pre-processor and an MPEG2 video encoder, followed by an output buffer. The input to the pre-processor is analog video in RGB format. The pre-processor digitizes the input signals and performs gamma correction on each color component to compensate for the non-linear response of the imaging camera. Gamma correction reduces the visibility of quantization noise contained in the compressed image, especially in the dark regions of the image. Then the pre-processor linearly transforms the digitized and gamma corrected RGB samples to the SMPTE 240M YC1C2 color space. Finally, the resulting chrominance components are sub-sampled to form the 4:2:0 digital video input signal. In addition to the tasks just described, the pre-processor may perform image conversion. For example, in a broadcast digital satellite system, the video signal is horizontally decimated from 720 pixels per line to 544 pixels per line to further reduce bandwidth requirements. This signal is sent to the MPEG2 video encoder.

The MPEG2 video encoder compresses the input digital video signal by removing some of the temporal redundancy between frames and some of the spatial redundancy within frames. Generally, compression is achieved by utilizing a number of different techniques in succession as described above. Adjusting the quantization precision allows the encoder to generate the compressed bit stream at any rate specified by the application. The quantization in MPEG2 systems is performed on the DCT coefficients of a data block, which may be the original image information or residual information from motion estimation. Using quantization matrices in combination with scalable quantization step sizes, the quantizer selects and quantizes only a small fraction of the DCT coefficients from every DCT block for transmission, resulting in significant data reduction. The quantization matrices can be varied on a frame basis according to the statistical distribution of the DCT coefficients and the content of the video signal. For different areas within a frame, the quantization can be fine tuned on a macroblock by macroblock basis by scaling the quantization step size based on the complexity of the macroblock. For a given output bit rate, an output buffer will provide control signals used by the encoder to adjust the quantization step size for a particular frame to maximize quantization resolution within the available bandwidth.

Ideally, the video compression system removes high frequency components which will not be perceived as missing by viewers when the image is reconstructed and displayed. The remaining low frequency components are quantized to fit within the available bandwidth. Quantization noise introduced to the signal should also be invisible to viewers upon image reconstruction. However, in a real system a trade-off is made between the information to transmit and the quantization step size for an available bandwidth. If the system does not drop sufficient coefficients for quantization, the system increases the quantization step size resulting in blocky artifacts in the reconstructed image. If the picture loses too much high frequency information during the compression process, the reconstructed image will contain other noticeable edge artifacts.

Moreover, differences in quantization between each frame causes frames within a group of pictures (GOP) to contain varying high frequency components. An I frame, for example, may have a substantial amount of high frequency coefficients dropped during encoding, whereas P and B frames retain high frequency components corresponding to those dropped in the I frame. The reconstructed GOP will now contain artifacts because the high frequency information varies between frames used to reconstruct each other.

These problems occur within the GA system as currently defined. Compressing the HD image signal further only decreases displayed picture quality. Satellite broadcast providers are unwilling to transmit HD signals because only one program can be transmitted at a time in a transponder. To date, compressing an HD program sufficiently to fit two programs in one satellite channel (for example, 24 MHz 4-PSK Modulation) at the same time results in unacceptable viewer picture quality. Therefore, satellite broadcast providers are hesitant to broadcast HDTV due to inefficient use of the channel. Likewise, terrestrial broadcast providers

are reluctant to commit to providing full HD programs when one program fully occupies a channel in which several SD programs can reside.

Summary of the Invention

In accordance with the principles of the present invention, a digital image processor identifies a video signal type, and selectively converts the original signal format to a different format as necessary. The converted signal is filtered and reconverted to the original format as necessary. The filtered signal is converted to a lower resolution and compressed to a target bit rate. Finally, the compressed signal is conveyed to an output data channel.

Brief Description of the Drawings

Figure 1 shows one configuration for a video compressor in accordance with the present invention.

Figure 2 shows detail of unit 22 from Figure 1.

Figure 3 shows one possible response of an adaptive filter included in unit 22.

Figure 4 is a flow chart of an exemplary transmitting system using the present invention.

Figure 5 is a flow chart of an exemplary receiving system using the present invention.

Description of the Preferred Embodiment

An MPEG2 encoder including apparatus according to the principles of the present invention includes a two dimensional (vertical and horizontal, for example) filter prior to the encoder. The encoder, the output buffer and the filter each produce information which may be utilized by the other units to improve overall efficiency. Such information concerns image motion, image contrast, quantization matrix selection, scale factor selection, bit rate out of each unit, image texture, for example. The information is communicated between the units by a controller which oversees the encoding process, or by individual controllers resident in each unit.

The controller evaluates the incoming information and identifies commonalties over a group of pictures, a frame, or a partial frame which can be advantageously used to modify the operation of the filter and/or the encoder to efficiently encode the group, frame or partial frame

to the target bit rate. Generally, the filter is adjusted because adjusting the filter induces less noise than adjusting the encoder. Also, the filter is actually a set of filters which allows the greatest flexibility by adjusting individual filter coefficients as needed. These filters are a horizontal anti-aliasing low-pass filter, a vertical low-pass filter, and a two-dimensional low-pass filter, generally in the sequential order just given. The controller evaluates the received information against current filter and encoder setup, and makes adjustments to one or more filers and/or to the encoder according to one or more predominant commonalties. The end result is that the input signal is low-pass filtered by the filter in a manner which generally allows the encoder to encode the image uniformly across a group of pictures, a frame, or a partial frame relative to a dominant commonality of the data being uniformly encoded.

The encoded signal may be transmitted in the available bandwidth, and then reconstructed and displayed without artifacts which would have been present otherwise. For high definition signals having 1920 by 1020 pixels per image frame, the horizontal resolution is reduced to 1280 pixels per line after filtering and before encoding to further reduce the bandwidth of the transmitted signal. The result is a hybrid image resolution which HD receivers can receive, decode and display with a minor software change.

An exemplary configuration of the video compression system according to the present invention is shown in Figure 1. An input video signal is received by movie detector 20, which identifies if the signal is a movie (film) signal which has been reformatted by telecine methods from 24 frames per second to 30 frames per second. The reformatted movie signal is directed to the appropriate section of adaptive image processor 22 as will be described. If the input signal is not a reformatted movie signal, the signal passes to another section of adaptive image processor 22. Identification of telecine movie signals occurs by known methods.

Processor 22 receives control information from output buffer 26 and from MPEG2 encoder 24 via controller 28, and filters image frames so that the encoder 24 can efficiently encode the frame to be within the available bit rate, and to be generally free of noticeable artifacts. Processor 22 filters the signal in two dimensions (2-D) (for example, horizontal and vertical) as needed to improve the reconstructed image quality of a MPEG2 encoded bit stream constrained to an average bit rate. The goal is to modify local 2-D frequency content of the source to improve MPEG2 coding efficiency in a manner least injurious to the MPEG2 reconstructed image with regard to image sharpness and encoding artifacts. Filtering of the signal can be done on predetermined data, for example, a group of pictures (GOP) or frames, a single frame, or pixel by pixel.

The 2-D filter low-pass filters the image. Optimally, the high frequency information which is removed is either redundant or not noticeable to the viewer. In practice, to attain the desired bit rate, some high frequency information may be removed which is noticeable to a viewer. However, a system which includes a processor 22 before MPEG2 encoding generates an image which is superior to a system without a processor 22, as will be discussed.

The filtered signal is encoded by MPEG2 encoder 24, which receives image parameters from processor 22 and output buffer 26 via controller 28, and adjusts MPEG2 compression to comply with available bit rate. Compression occurs in the same manner as described in the GA specification. Encoder 24 sends the compressed data to output buffer 26. Buffer 26 provides the compressed data at a predetermined rate to be transport encoded, modulated, and transmitted via a transmission channel using known signal processing techniques. Prior to modulation, the compressed signal may be sent to a statistical multiplexer to be multiplexed with multiple programs for transmission on a single channel. Signal processing units after buffer 26 are well known and therefore are not shown in Figure 1 to simplify the drawing.

The video compression system can be configured to accept any type of video signal. The system of Figure 1 is configured to accept both television (camera) and movie (film) programs formatted to known industrial standards. One common configuration would be for the system of Figure 1 to receive the output from a pre-processor as previously described in the background, for example. The system may be configured to accept other types of video signals by adding appropriate hardware and/or software. These configurations are not shown to simplify Figure 1.

Movie detector 20 recognizes the presence of certain relationships in the input signal that can be used to improve coding efficiency: (Type 1) 60 Field/Second Interlaced Scanned Source, (Type 2) 60 Field/Second Interlaced Scanned 30 Frame/Second Movie, (Type 3) 60 Field/Second Interlaced Scanned 24 Frame/Second Movie, (Type 4) Progressive Scanned Source, (Type 5) 60 Frame/Second Progressive Scanned 30 Frame/Second Movie, and (Type 6) 60 Frame/Second Progressive Scanned 24 Frame/Second Movie. Detection occurs in response to an external control signal (not shown) or by known techniques such as those used in current standard definition (SD) MPEG2 encoders. Signal format information is passed with the signal to adaptive image processor 22, as is described below. Movie detector 20 also detects whether the signal is interlaced scan or progressive scan type and passes that information to processor 22. These scan types are exemplary and define parameters by which signals are directed through processor 22. Implementations for other field and frame rates may also be used.

Adaptive image processor 22 performs several programmable functions which reduce the amount of data to be compressed by encoder 24. Processor 22 operates on each frame, in general, so that the processed frame can be optimally encoded to eliminate or greatly reduce noise which is noticeable to the viewer. Processor 22 may generally be viewed as a spatial varying 2-D low-pass filter, because it down-samples each image frame spatially and adaptively filters selected 2-D high frequency components from the signal. The adaptive filtering can be adjusted over a series of frames, for a single frame, or pixel-by-pixel to produce a processed frame.

Processor 22 can facilitate encoding for any type of signal. However, for this embodiment, processor 22 is programmed to operated on HD data as defined by the GA specification. This can be either 1920 by 1080 pixels per image or 1280 by 720 pixels per

image. According to the GA specification, each HD format requires approximately 18 megabits per second for broadcast. To simplify the discussion, only the 1920 by 1080 format will be discussed in detail. The discussion is equally applicable for the 1280 by 720 format or any other format.

Figure 2 shows details of adaptive image processor 22. Depending on signal format information received from detector 20, the image signal is routed by controller 28 (Figure 1) to an interlaced to progressive converter 221 (Type 1), a de-telecine unit 222 (Type 2,3), or passed through unmodified (Type 4-6) to a spatial band-limit, low-pass filter 223. Filter 223 receives the output of units 221 and 222 after these units have processed the signal.

Converter 221 receives the signal if its format contains 60 Hz interlaced fields and converts the signal to progressive frames at the rate of 60 frames per second. A progressive frame includes all the image information in each frame. Filtering a progressive scan signal typically does not introduce artifacts such as may occur when filtering field information of an interlaced signal. Converter 221 utilizes known methods to convert interlaced fields to a progressive frame.

De-telecine unit 222 eliminates the redundant fields of a 60 Hz interlaced scanned movie and reconstructs the original progressive scanned movie. The progressive format allows subsequent vertical low-pass filtering to be free of motion artifacts. If a movie source (type 2 or type 3) input were processed as a type 1 source, vertical low-pass filtering would degrade the ability of the MPEG2 encoder to detect and properly process movie source material. Coding efficiency would suffer. Unit 222 converts the signal to a progressive format and removes the redundant fields/frames before filtering because filtering may filter the redundant information differently. If the redundant information is not removed before filtering the information may not be identical after filtering, and the encoder may not recognize the signal as a Type 2/3 signal. Then the encoder would encode information which otherwise would have been removed due to the redundancy.

Also, the design of processor 22 is simplified by providing a single output clock from unit 222. If unit 222 provides output progressive film images at a rate of 24 frames per second and 30 frames per second, two output clocks and supporting circuitry would be required.

Signals which were originally generated in a 30 frames per second progressive format pass directly to filter 223. Filter 223 expects video information represented as complete image frames. Spatial, low-pass filter 223 is actually a set of filters. For example, the first filter is an anti-aliasing, horizontal low-pass filter. The second filter is a vertical low-pass filter. The final filter is a 2-D low-pass filter as previously described. The coefficients of each filter tap may be adaptively set according to control information from encoder 24 and buffer 26 as seen in Figure 1. The progressive signal is low-pass filtered horizontally to eliminate aliasing from subsequent down sampling in sample rate converter 226. The final horizontal output of the 1920 pixels per line will be 1280 pixels per line, as will be discussed. To eliminate alias noise within the final signal, low-pass filter 223 has a cut off frequency of 640 cycles per line. The

horizontal anti-alias filter included in unit 223 may be a 17 tap finite impulse response (FIR) filter with the following tap coefficients:

[f0, f1,...,f15, f16] = [-4, 10, 0, -30, 48, 0, -128, 276, 680, 276, -128, 0, 48, -30, 0, 10, -4]/1024.

Encoding HD video signals at a reduced bit rate normally requires additional vertical low-pass filtering to further reduce the bandwidth of the video signals. Removing vertical high frequency energy before MPEG encoding is necessary to achieve acceptable overall picture quality. Vertical frequency regions of highest phase sensitivity are attenuated. The vertical cut off frequency is set to some fraction of the Nyquist frequency. For example, a cut off frequency equal to approximately half the line rate of the HD input signal may be appropriate for some video material. For an HD signal with 1080 lines/picture height (l/ph), this would correspond to a cut off of 540 l/ph. This frequency may be programmable, and a programmable cut off frequency would be determined by controller 28 from parameters available from encoder 24 and buffer 26 of Figure 1 (i.e. desired bit rate, quantization matrices, etc.). The vertical low-pass filter included in unit 223 may be a 17 tap FIR filter with the following tap coefficients.

[f0, f1,...,f15, f16] = [-4, -7, 14, 28, -27, -81, 37, 316, 472, 316, 37, -81, -27, 28, 14, -7, -4]/1024.

As an alternative, the cut off frequency may be equal to twice the line rate of an SD signal. Generally, the vertical low-pass filter follows the horizontal anti-alias filter.

Processor 22 performs vertical filtering rather than vertical decimation, thereby maintaining constant vertical line resolution. Currently, filtering is preferred over decimation for interlaced video signals. Converting vertical line resolution for an interlaced image sequence requires complex hardware and software, resulting in high receiver costs. Vertical sample rate conversion compromises vertical high frequency performance because of the increasing tap complexity combined with Nyquist sampling (i.e., no oversampling). Cost considerations at the receiver currently discourage reducing vertical resolution to reduce artifacts and the encoded bit rate. The displayed picture would be significantly degraded by employing the current technology in vertical sample rate converters in place of the vertical low-pass filter described above. However, efficient and cost effective vertical sample rate converters may replace the vertical filter described herein without departing from the principles of the present invention.

The coefficients for both the horizontal and vertical low-pass filters can be modified by software, and applied to the pixel level, if necessary, to attain the target bit rate without generating artifacts in the reconstructed image. Generally, coefficient modification on a frame basis is sufficient. An alternative for slower processors is to preprogram a number of different coefficient sets for the filters and select the most appropriate set for the image information

being processed. The greater flexibility of the adaptive filters enables the overall system to produce a data stream with fewer artifacts relative to a system without adaptive filters.

After the signal has been low-pass filtered in the horizontal and vertical directions by unit 223, controller 28 determines whether the signal can be uniformly encoded by encoder 24 on a frame basis without introducing significant quantization noise. If so the signal passes to either unit 224, 225 or 226 depending upon its format, as will be discussed. If, however, the encoding process is likely to introduce noise and/or artifacts into the signal, it is sent to a two dimensional low-pass filter in unit 223 for further adaptive filtering. Control parameters from processor 22, encoder 24, and output buffer 26 (Figure 1) allow controller 28 (or an individual unit controller in unit 223) to determine if further filtering is needed. Control parameters used to make this determination are, for example, measurements of motion and contrast, available quantization tables, encoding efficiency and the current target bit rate.

The 2-D filter in unit 223 reduces high frequency information from an image frame primarily along the diagonal, instead of the horizontal or vertical directions alone. The human eye is very sensitive to high frequency noise in the vertical and horizontal directions relative to the diagonal directions. Removing sufficient high frequency information diagonally to allow uniform quantization by encoder 24 generally results in a better quality signal with less observable noise. The diagonal filter, like all previous filtering, operates on an entire image frame and is programmable.

The diagonal filter may be compatible with the quantization matrices in the encoder. Quantization matrices often use diamond shaped matrices for I frame quantization. However, these matrices often induce noise because B and P frames use other types of quantization matrices which retain the high frequency components during the compression and motion compensation process which occurs in encoder 24. The filters of processor 22 remove high frequency information from each image frame before MPEG2 encoder 24 processes the data into I, P and B frames in a motion estimation network. Therefore, high frequency components are generally eliminated from the P and B frames as well as from I frames. On reconstruction, the image is generally free from artifacts created by MPEG2 encoding as known.

Referring to Figure 1, in practice, the controller 28 evaluates signal parameters, (e.g., motion, contrast, etc.) before filtering a given frame by processor 22, and determines the coefficient settings for all filters in unit 223, including diagonal filtering needed. During the filtering process of a given frame, controller 28 monitors signal parameters from processor 22, encoder 24 and buffer 26 and changes coefficients as necessary to maintain the target bit rate with minimal artifacts/noise. Each frame is filtered based upon the most recent signal parameters and is passed to encoder 24 for compression, and then to buffer 26 as subsequent information is input into filter 223.

If the signal originated as a 24 frame per second movie signal, the filtered signal is applied to 3:2 pull down unit 224. Unit 224 duplicates selected frames to provide a 30 frames

per second output signal. This occurs by known methods. Then the signal passes from unit 224 to horizontal down-sampling converter 226.

Field sub-sampling unit 225 converts progressive signals from filter 223 from progressive to interlaced scan format. This conversion is accomplished by known methods. Without conversion back to interlaced format, the signal would contain twice the amount of data, because the progressive frame rate from unit 221 is 60 Hz. The interlaced signal is applied to converter 226.

Sample rate converter 226 receives progressive signals at 30 frames per second directly from filter 223. Also, units 224 and 225 provide signals to converter 226 as described above. Converter 226 down samples HD signals to the transmission format selected. This format does not need to be a standard format. It may be any image ratio and frame size that is desired. A non-standard format will require receiver modification, however.

When converter 226 receives 1920 by 1080 GA HDTV signals, converter 226 down samples the horizontal information and outputs a hybrid pixel frame format of 1280 by 1080. GA HDTV compatible receivers are capable of receiving image frames containing 1920 by 1080 pixels and 1280 by 720 pixels. Therefore, GA compatible receivers may be modified to support 1280 pixels horizontal resolution and 1080 pixels vertical resolution. Compatible receiver hardware upsamples 1280 horizontal pixels to 1920 horizontal pixels in conjunction with an increase in vertical resolution. However, GA compliant receivers are not required nor programmed to receive an image frame resolution of 1280 by 1080 pixels (horizontal by vertical) as a defined format. The hardware is in place to receive and decode this resolution, but the supporting software to decode and to increase only horizontal resolution must be added. Adding the software is simple and inexpensive relative to redesigning and adding new hardware needed for other non-standard formats.

Processor 22 provides the hybrid 1280 by 1080 format because current display technology is incapable of displaying 1920 pixels/line resolution. Currently, the best television monitors can only display resolution to approximately 1200 to 1300 pixels/line. Therefore, limiting the output resolution to 1280 pixels/line in the horizontal direction has little if any adverse effect on picture quality. By providing a display resolution (1280 by 1080) which is supported by existing decoding and decompressing receiver hardware, receiver manufacturers will be minimally impacted because only a software change is necessary. For certain receivers, such as for broadcast satellites, the software modification can be downloaded and installed remotely via a satellite link. For these receivers there is no need for a service technician to become involved.

The hybrid format is advantageous because terrestrial and satellite program providers have been unwilling to transmit HD programs. A satellite transponder transmits a data stream of approximately 24 Mbits per second (Mbps). A terrestrial HDTV broadcasts can transmit up to 19 Mbps including the HD program at 18 Mbps and other information (such as audio, program guide, conditional access, etc.). Present satellite transponders can each carry at most

one HDTV program, which satellite program providers contend is not sufficiently profitable. Simply reducing the horizontal frame resolution from 1920 to 1280 is not sufficient to allow the simultaneous transmission of two HD programs on a single satellite transponder. The filtering provided by processor 22 advantageously permits such dual HD transmission on a single channel.

The filtering characteristic provided by processor 22 may have various shapes, including diamond, cross, and hyperbolic from axis to axis, where for each filter the filtering is diagonal. One possible shape, 2-D Hyperbolic, is particularly advantageous in this application and has an amplitude-versus-frequency response as illustrated in Figure 3. The adjustable filter cutoff frequency generally is set to allow the GOP, the frame or the partial frame chosen to be compressed uniformly by encoder 24. If necessary, additional horizontal and vertical high frequency information may be filtered, but this is generally not needed. As the picture complexity changes, or as the available bit rate increases, the amount of data filtered by the diagonal filter and other previous filters decreases. The 2-D filter could be described, for example, as a two dimensional FIR with 13 taps in each direction (13 by 13), or as a 2-D infinite impulse response (IIR) filter.

The 2-D FIR filter included in unit 223 may be a 13 by 13 tap filter with the following tap coefficients:

20	0	0	0	1	-3	5	-5	5	-3	1	0	0	0
	0	0	1	-1	-3	9	-11	9	-3	-1	1	0	0
	0	1	-1	-4	4	6	-13	6	4	-4	-1	1	0
	1	-1	-4	1	14	-13	4	-13	14	1	-4	-1	1
	-3	-3	4	14	5	-47	61	-47	5	14	4	-3	-3
25	5	9	6	-13	-47	-55	193	-55	-47	-13	6	9	5
	-5	-11	-13	4	61	193	556	193	61	4	-13	-11	-5
	5	9	6	-13	-47	-55	193	-55	-47	-13	6	9	5
	-3	-3	4	14	5	-47	61	-47	5	14	4	-3	-3
	1	-1	-4	1	14	-13	4	-13	14	1	-4	-1	1
30	0	1	-1	-4	4	6	-13	6	4	-4	-1	1	0
	0	0	1	-1	-3	9	-11	9	-3	-1	1	0	0
	0	0	0	1	-3	5	-5	5	-3	1	0	0	0

For these coefficients, the DC gain is 1024. The coefficients exhibit octant symmetry which gives 28 independent coefficients. Symmetrical coefficient regions allows faster setup of the adjustable filter. It is possible, however, that each octant be different if, for example, an image or region being filtered exhibited different characteristic in one part of the image.

The filter response of processor 22 can vary continuously from one set of coefficients to another on a pixel to pixel basis. Thus, processor 22 may exhibit different operating parameters for maintaining good image quality under bit rate constraint, as will be discussed.

As mentioned previously, processor 22 can be adaptively modified to filter adaptively depending upon the parameter(s) used to define the filter adaptation. For example, variance in an image frame can be used to segment the image into regions for different processing. Edges are an important image feature in that dominant edges mask coding errors in their vicinity, and they can also define image regions. Colorimetry may be used to identify areas of low complexity, such as flesh and sky. Textures may be identified and processed as a region as well. Textures are generally less important than edges. Textures, therefore, identify regions which may be filtered more that other regions. Also, cinematic composition can be used to locate important figures or action which require higher coding efficiency and, thus, less filtering. Background is generally softened by the depth of field of the camera optics and may be more heavily filtered. Pan and scan information may be used to define the center of interest of an image for different processing by processor 22.

The operation of encoder 24 is compatible with the MPEG2 standard. Encoder 24 may provide information via controller 28 which processor 22 may use to enhance performance. Such information may include the bit rate information, for example. This bit rate information may comprise the average bit rate for a GOP, the frame bit rate, and the macro-block or block bit rate. Other information which may enhance the performance of processor 22 includes the discrete cosine transform complexity, the type quantization matrix being used, and the quantization matrix step size being used. Also, processor 22 may provide information to encoder 24 via controller 28 to adjust its operation to improve encoding performance.

After being formed into a transport packet data stream using known techniques, the HD signal is transmitted to a receiver in a known manner, e.g.., as described in the Grand Alliance specification. Except for the required up-sampling to a full HD pixel resolution at the receiver, the signal processing provided by processor 22 is transparent to a decoder in a Grand Alliance compatible receiver.

At the receiver, the data stream is demodulated and the transport stream is processed to recover the data packets and program information using known techniques. For HD programs in the hybrid format described above, the signal is upsampled in the horizontal direction in the display processor if the display requires a full HD signal. The number of vertical lines in the image signal is unchanged. This reconstructs the full HD signal of 1920 by 1080 resolution for display by a high definition image reproducing device. If the image display device requires less than a full HD signal, the signal is appropriately down sampled during image reconstruction before display by known methods. Existing receivers which are Grand Alliance compatible require a software modification to be able to reconstruct the hybrid signal. The software modification allows horizontal and vertical hardware and software processing routines assigned

to Grand Alliance standardized modes to be independently selected as needed for the incoming signal.

Figure 4 is a flow chart of the video image signal flow through the encoding system. In step 30, the signal format is identified and the identifying information is conveyed with the video signal. The format information may indicate, for example, whether the signal is originally from a movie with a 24 frame per second format, and whether the signal is interlaced or progressive. If the video signal is interlaced, the signal is converted to a progressive signal at 60 frames per second in step 31. If the signal has been converted by 3:2 pull down, the redundant frames are removed in step 32. If the video signal is already in a camera progressive format it passes directly to the filter of step 34. In step 34, the video signal is spatially low-passed filtered. This includes vertical, horizontal and diagonal filtering as described above. Step 35 reconverts the progressive signal, which was converted from and interlaced signal in step 31, back to an interlaced signal. In step 36 the signal is subjected to 3:2 pull down to replace redundant frames previously deleted in step 32. Video signals passing directly from step 30 to step 34 above now pass directly from step 34 to step 38. In step 38, the video signal from one of steps 34, 35 and 36 is subsampled to the hybrid 1280 by 1080 HD signal resolution defined above, or to another output format as desired. In step 40, the hybrid signal is MPEG2 encoded as previously described. Step 42 transport processes the encoded signal, and step 44 modulates the transport signal as required for transmission via an output channel, such as an RF terrestrial broadcast channel. Finally, step 46 transmits the modulated signal. Steps 42 to 46 occur by known methods.

Figure 5 is a flow chart of the transmitted image signal flow through a receiver. This flow chart assumes that the image resolution of the received signal is the hybrid 1280 by 1080 HD signal defined above. In step 50, the transmitted signal is received by a tuner and demodulated. The demodulated signal is MPEG2 decoded and decompressed in step 52. Step 54 identifies the video signal resolution as 1280 by 1080 pixels per image via control information sent with the signal. The Grand Alliance MPEG2 protocol supplies image resolution information with the transmitted signal. The hybrid signal is generally identified by a unique code as is any other defined resolution. The hybrid signal could also be defined otherwise, for example, by information in the user data of the transmitted data. The hybrid video signal is horizontally upsampled to a full 1920 by 1080 HD signal during display processing in step 56. The hybrid signal is upsampled with new software in association with existing hardware and software resident in the receiver as previously described. Finally, the full HD video signal is displayed on a 1920 by 1080 display in step 58. Steps 50, 52 and 58 employ known methods.

The apparatus and methods described above can be applied in a number of configurations to achieve an improved image reconstruction for high definition display. Adaptive and non-adaptive options may be used depending on the requirements of a particular system. Some of these options are discussed below.

A non-adaptive strategy would be to set frame filtering of processor 22 to a target bit rate and allow all images to be processed uniformly. Another non-adaptive strategy would make the assumption that the center of a displayed image is the most interesting region. This also assumes that peripheries of the image are less interesting and therefore less important to the viewer. The coefficients of the filters of processor 22 are set by controller 28 via parameters which are functions of pixel spatial position and all image information is uniformly processed.

An adaptive option is to segment the image into regions using texture model parameters, local video variance, colormetrics, or other picture complexity measures based on the source image. Filtering characteristics of processor 22 are adaptively modified for different regions.

Another approach is to adaptively modify the filtering characteristics of processor 22 as a function of the difference between the actual bit rate and the target bit rate. In this case, a single parameter controls transition in filter coefficients for the 2-D frequency response.

Another strategy is to design the 2-D frequency response of the filtering provided by processor 22 to be compatible with the quantization matrix employed by encoder 24. A quantization matrix may be viewed as a low-pass filter which has 2-D shape. For this strategy the values of the filter coefficients would be a function of the quantization matrix step size. As the step size is changed according to known encoder operation, a corresponding change would occur for corresponding filter coefficients.

The options noted above illustrate the flexibility of a system employing the principles of the invention. Such a system preferably operates within the context of MPEG2 rate control to extend the MPEG2 compression capability by reducing encoding artifacts and other noise. The versatility and economics of HDTV deployment is improved through the use of the invention. The number of HD programs transmitted per transponder in a direct broadcast satellite system (i.e., 24 MHz 4-PSK) is increased from one to two programs, or one HD program with multiple SD programs. The ability to transmit one HD program with multiple SD programs in a 6 MHz terrestrial broadcast channel is attainable in accordance with the principles of the present invention. Previously, broadcasters were limited to transmitting one HD program in one channel, or multiple SD programs in one channel.

Although the invention has been described in the context of HD signal transmitting and receiving systems, the principles of the invention are applicable to other arrangements such as data storage systems. In systems such as digital video disk (DVD), video data is encoded and stored for replay at a later time. The storage medium has a limited amount of storage space available. If an encoded program, a movie, or other video sequence exceeds the amount of space available on the medium, further encoding/compression to make the program fit may create unacceptable artifacts. The invention described above may be used to efficiently encode the program to a lower bit rate allowing the program to fit on the disk. Or, multiple programs may now fit on one disk. Digital storage onto tape may also benefit as describe above.

CLAIMS

1. A method for processing first and second video signals respectively exhibiting first and second dissimilar image formats, comprising the step of detecting the presence of said first or second video signal, and further comprising the steps of:

A. when said first video signal is detected,

(a) converting said first video signal to a different format, to produce a converted signal;

(b) filtering said converted signal to produce a filtered signal;

(c) reconverting said filtered signal to the original format of said first signal, to produce a reconverted signal;

(d) converting said reconverted signal to a lower resolution to produce a lower resolution signal;

(e) encoding said lower resolution signal to produce an encoded signal; and

(f) conveying said encode signal to an output channel; and

B. when said second video signal is detected,

(g) filtering said second video signal to produce a filtered signal;

(h) converting said filtered signal to a lower resolution to produce a lower resolution signal;

(i) encoding said lower resolution signal to produce an encoded signal; and

(j) conveying said encode signal to an output channel.

2. The method of claim 1, wherein:

said first video signal is an interlaced scan signal, and said interlaced scan signal is converted to a progressive scan signal in step (a).

3. The method of claim 1, wherein:

said first video signal is a telecined film signal, and said telecined film signal is converted to de-telecined signal in step (a).

4. The method of claim 1, wherein:

said second video signal is a progressive scan signal.

5. The method of claim 1, wherein:

said filtering steps provide low-pass filtering.

6. The method of claim 5, wherein:

said filtering steps provide two-dimensional filtering.

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 246 of 431

7. The method of claim 1, wherein:

said filtering steps provide adaptive filtering adjusted to one of a group of picture frames, a single frame, and a part of a frame.

8. The method of claim 1, wherein:

said filtering steps provide temporally low-pass filtering and adaptively change filtering characteristics in response to characteristics of said signal.

9. The method of claim 1, wherein:

said filtering steps provide spatially low-pass filtering and adaptively change filtering characteristics in response to characteristics of said signal.

10. The method of claim 1, wherein:

said encoding steps are MPEG2 compatible.

11. The method of claim 1, wherein:

said lower resolution signal has a resolution of 1280 by 1020 data samples per frame.

12. The method of claim 1, wherein:

said first and second video signals are high definition signals having a resolution of 1920 by 1080 data samples per frame.

13. A method for processing one of an interlaced scan video signal and a telecined film format signal, comprising the steps of:

detecting the presence of one of said interlaced scan video signal and said telecined film signal,

converting said detected signal to one of a progressive scan signal and a de-telecined signal, respectively, to produce a converted signal;

filtering said converted signal to produce a filtered signal;

reconverting said filtered signal to one of an interlaced scan signal and a telecined signal, respectively, to produce a reconverted signal;

converting said reconverted signal to a lower resolution to produce a lower resolution signal;

encoding said lower resolution signal to produce an encoded signal; and

conveying said encoded signal to an output channel.

14. The method of claim 13, wherein:

said filtering step is low-pass filtering, and said encoding step is MPEG2 encoding.

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 247 of 431

15. The method of claim 13, wherein:
said lower resolution signal has a resolution of 1280 by 1020 data samples per frame.

16. A method for processing a non-telecined progressive scan video signal, comprising the steps of:
filtering said detected signal to produce a filtered signal;
converting said filtered signal to a lower resolution to produce a lower resolution signal;
encoding said lower resolution signal to produce an encoded signal; and
conveying said encode signal to an output channel.

17. The method of claim 16, wherein:
said filtering step is low-pass filtering, and said encoding step is MPEG2 encoding.

18. The method of claim 16, wherein:
said lower resolution signal has a resolution of 1280 by 1020 data samples per frame.

19. In a high definition video signal processing system, a method for processing a received digital video signal subject to exhibiting more than one image resolution, including a resolution of 1280 by 1020 data samples per frame, comprising the steps:
decoding said signal to produce a decoded signal;
determining the image resolution of said decoded signal;
converting horizontal information from said decoded signal to a different resolution if said decoded signal has a horizontal image resolution of 1280 samples per line, to produce a converted signal; and
conveying said converted signal to an output device.

20. The method of claim 19, wherein:
said conversion is up-conversion, and said different resolution is 1980 horizontal samples per line.

21. The method of claim 19 wherein:
said conversion is down-conversion, and said different resolution is a lower resolution.

22. The method of claim 19, wherein:
said received digital video signal is MPEG2 compatible.

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 248 of 431

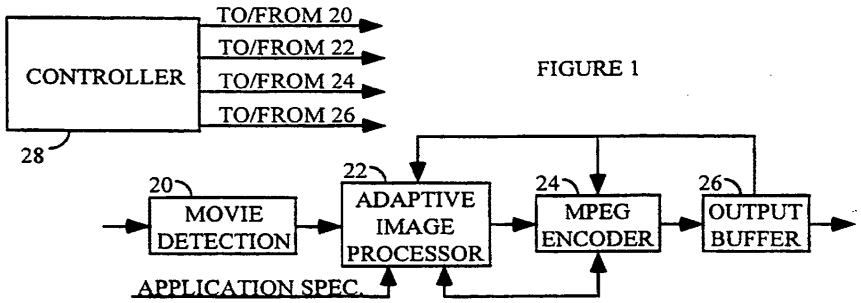


FIGURE 1

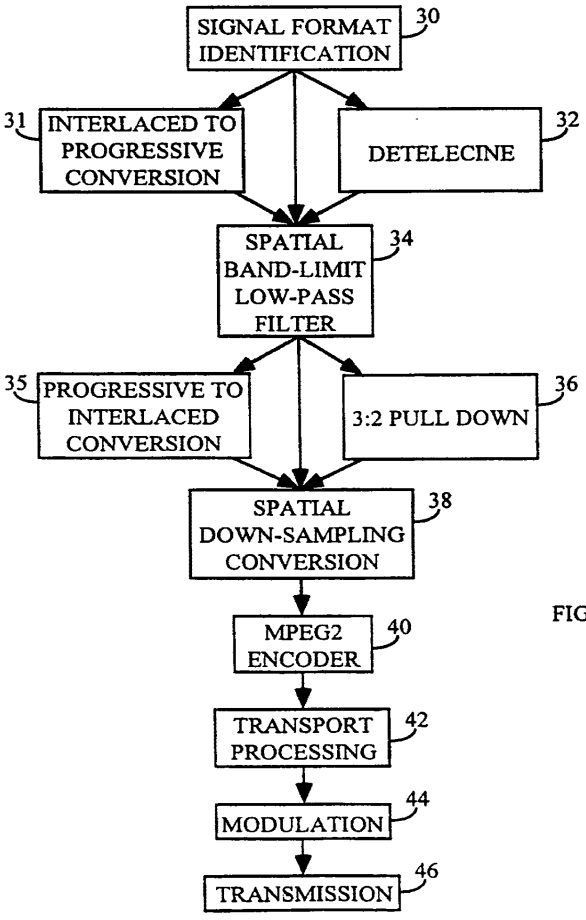


FIGURE 4

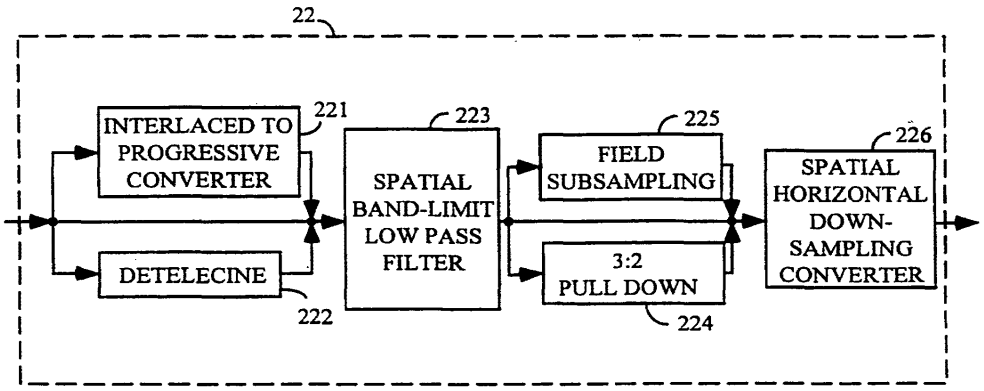
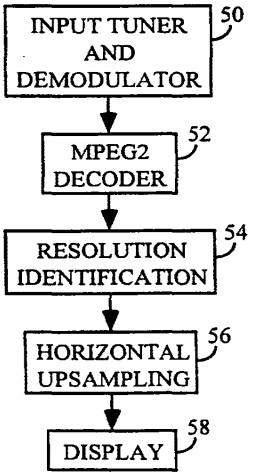


FIGURE 2

FIGURE 5



1.5
1
0.5
0
1
0.5
0
-0.5
-1
-1
-0.5
0
0.5
1
Normalized Vertical Frequency
Normalized Horizontal Frequency

FIGURE 3

INTERNATIONAL SEARCH REPORT

Inte. ...nal Application No
PCT/US 97/23992

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 H04N7/26

According to International Patent Classification(IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 H04N

Documentation searched other than minimumdocumentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 253 059 A (ANSARI RASHID ET AL) 12 October 1993	16-18
A	see column 3, line 25 - column 4, line 33; figure 1	1,13
X	US 5 049 993 A (LEGALL DIDIER J ET AL) 17 September 1991	16
A	see column 6, line 58 - column 7, line 8; figures 1,6	1,13
A	US 5 530 484 A (BHATT BHAVESH B ET AL) 25 June 1996 see column 2, line 55 - column 5, line 65	19
A	EP 0 595 323 A (SONY CORP) 4 May 1994 see column 6, line 37 - column 12, line 22	1,13
	-/--	

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

* Special categories of cited documents :

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"L" document which may throw doubts on priority claim(s) or which is cited to establish the publicationdate of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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"&" document member of the same patent family

1

Date of the actual completion of theinternational search	Date of mailing of the international search report
26 March 1998	06/04/1998

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Beaudoin, O

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Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 252 of 431

INTERNATIONAL SEARCH REPORT

Inte. nal Application No
PCT/US 97/23992

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
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A	EP 0 708 564 A (AT & T CORP) 24 April 1996 see page 3, line 48 - page 4, line 27; figure 2 see page 8, line 44 - page 9, line 30; figure 5	1,13
A	EP 0 685 968 A (VICTOR COMPANY OF JAPAN) 6 December 1995 see column 17, line 49 - column 19, line 8	1,13
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A	WO 97 39577 A (SNELL & WILCOX LTD ;KNEE MICHAEL JAMES (GB); SOMERVILLE STUART (GB)) 23 October 1997 see page 7, line 14 - line 27	1,13
A	EP 0 498 625 A (GRASS VALLEY GROUP) 12 August 1992 see column 2, line 56 - column 4, line 56	1,13

Form PCT/ISA/210 (continuation of second sheet) (July 1992)

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 253 of 431

INTERNATIONAL SEARCH REPORT

Information on patent family members

Inter. al Application No
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		US 5289305 A	22-02-94

Form PCT/ISA/210 (patent family annex) (July 1992)

(19) **RU** (11) **2 201 654** (13) **C2**

(51) МПК[7] **H 04 N 7/26, 7/12, 7/14**

РОССИЙСКОЕ АГЕНТСТВО
ПО ПАТЕНТАМ И ТОВАРНЫМ ЗНАКАМ

(12) ОПИСАНИЕ ИЗОБРЕТЕНИЯ К ПАТЕНТУ РОССИЙСКОЙ ФЕДЕРАЦИИ

(21), (22) Заявка: 2000119786/09 , 23.12.1997

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(56) Ссылки: US 5253058 A, 12.10.1993. US 5049993 A, 17.09.1991. RU 2017348 C1, 30.07.1994. SU 1567097 A1, 20.02.1996.

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US 97/23992 (23.12.1997)

(87) Публикация PCT:
WO 99/33273 (01.07.1999)

(98) Адрес для переписки:
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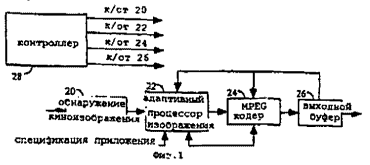
(74) Патентный поверенный:
Кузнецов Юрий Дмитриевич

RU 2201654 C2

(54) СПОСОБ НИЗКОШУМОВОГО КОДИРОВАНИЯ И ДЕКОДИРОВАНИЯ

(57)

Изобретение относится к сжатию изображения для снижения требований к ширине полосы цифрового видеодекодера. Техническим результатом является получение улучшенного восстановления изображения для высокочеткого воспроизведения, что позволяет передавать одну программу высокой четкости с несколькими программами стандартной четкости по каналу наземной трансляции 6 МГц. Технический результат достигается тем, что адаптивный процессор цифрового изображения предшествует MPEG2-кодеру и принимает сигнал высокой четкости (1920•1080 пикселей на изображение), предназначенный для трансляции или хранения, и адаптивно фильтрует сигнал по низким частотам. Сигнал подвергается двумерной фильтрации низких частот для устранения искажений кодирования и связанного с ним шума, затем горизонтально прореживается для создания гибридного сигнала более низкого разрешения (1280 •1080 пикселей на изображение), который распаковывает и декодирует приемник, после чего производится увеличение частоты дискредитации гибридного сигнала до его исходного разрешения. 6 с. и 24 з.п. ф-лы, 5 ил., 1 табл.



Фиг. 1

RU 2201654 C2

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 255 of 431

(19) **RU** (11) **2 201 654** (13) **C2**

(51) Int. Cl.[7] **H 04 N 7/26, 7/12, 7/14**

RUSSIAN AGENCY
FOR PATENTS AND TRADEMARKS

(12) ABSTRACT OF INVENTION

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(85) Commencement of national phase: 24.07.2000

(86) PCT application:
US 97/23992 (23.12.1997)

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WO 99/33273 (01.07.1999)

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(72) Inventor: JJu Khaoping (US), MakNILI Devid Lovell (US), BEJERS Billi Vesli ml. (US)

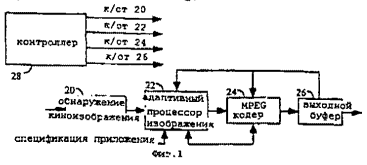
(73) Proprietor:
TOMSON LAJSENSING S.A. (FR)

(74) Representative:
Kuznetsov Jurij Dmitrievich

(54) LOW-NOISE CODING AND DECODING METHOD

(57) Abstract:

FIELD: image compression to reduce requirements to digital video decoder bandwidth. SUBSTANCE: digital-image adaptive processor precedes MPEG2 coder and receives high-definition signal (1920x1080) pixels per image) designed for relaying or storage and adaptively filters off signal with respect to low frequencies. Signal is subjected to two-dimensional filtering of low frequencies to eliminate coding distortions and associated noise; then it is horizontally decimated to produce hybrid signal of lower definition (1280x1080 pixels per image) which is unpacked and decoded by receiver, whereupon hybrid-signal sampling frequency is raised to its source definition. Proposed method enables transmission of one highdefinition program with several standard-definition programs over 6- MHz ground relaying channel. EFFECT: improved image recovery for high-definition reproduction. 30 cl, 5 dwg, 1 tbl



Фиг. 1

RU 2201654 C2

RU 2201654 C2

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 256 of 431

Область техники, к которой относится изобретение

Это изобретение относится к сжатию изображения для снижения требований к ширине полосы цифрового видеокодера.

Уровень техники

Федеральная комиссия связи (FCC) США утвердила цифровой стандарт телевидения высокой четкости (ТВЧ), предложенный компанией Grand Alliance (GA), подготавливая почву для наземной трансляции цифрового телевидения в США. ТВЧ система компании GA использует международный стандарт сжатия и передачи видеосигнала Экспертной группы в области подвижного изображения MPEG2. Для ознакомления с подробностями смотрите "Информационные технологии - общее кодирование киноизображения и взаимосвязанной аудиоинформации: Видео" ISO/IEC 13818-2: 1996 (E). При использовании современных и сложных способов сжатия видеосигнала, таких как обработка источника, оценка и компенсация движения, задание преобразования и статистическое кодирование, система сжатия MPEG может уменьшить битовую частоту передачи на коэффициент 50 и более. До сжатия полный сигнал высокой четкости в течение одной секунды требует приблизительно одного миллиарда бит. Как предложено в спецификации GA, изображения размером 1920•1080 пикселей (элементов изображения) с частотой 60 полей в секунду сжимаются до 18 мегабит в секунду для цифровой трансляции.

Система сжатия видеосигнала компании GA обычно содержит две главные подсистемы, препроцессор и видеокодер MPEG2, за которыми следует выходной буфер. Входным сигналом в препроцессор является аналоговый видеосигнал в формате RGB (red-green-blue, красный - зеленый - голубой). Препроцессор переводит входные сигналы в цифровую форму и выполняет гамма-коррекцию каждого цветового компонента для компенсации нелинейной характеристики, формирующей изображение камеры. Гамма-коррекция уменьшает видимость шума квантования, содержащегося в сжатом изображении, особенно в темных областях изображения. Затем препроцессор линейно преобразует переведенные в цифровую форму и прошедшие гамма-коррекцию дискретизированные сигналы RGB в цветовое пространство SMPTE (Society of motion picture and television engineers - Общество инженеров кино и телевидения) 240M YC1C2. В заключение, результирующие компоненты сигнала цветности подвергаются субдискретизации для создания цифрового входного видеосигнала 4:2:0. Кроме только что описанных задач препроцессор может выполнять преобразование изображения. Например, в цифровой спутниковой системе трансляции видеосигнал горизонтально прореживается с 720 пикселей на строку до 544 пикселей на строку для дальнейшего снижения требований к ширине полосы. Этот сигнал посылается в видеокодер MPEG2.

Видеокодер MPEG2 сжимает входной цифровой видеосигнал путем удаления некоторой временной избыточности между кадрами и некоторой пространственной избыточности внутри кадров. Обычно сжатие достигается путем использования ряда различных технологий в последовательном порядке, как описано выше. Регулирование точности квантования позволяет кодеру генерировать сжатый битовый поток любой частоты, заданной конкретным приложением. Квантование в системах MPEG2 выполняется над коэффициентами дискретного косинусного преобразования (DCT - discrete cosine transform) блока данных, который может представлять собой информацию исходного изображения или разностную информацию от оценки движения. Используя матрицы квантования совместно с масштабируемыми размерами шага квантования, квантователь выбирает и квантует лишь небольшую долю коэффициентов дискретного косинусного преобразования от каждого блока дискретного косинусного преобразования, предназначенного для передачи, что приводит к значительному уменьшению объема данных. Матрицы квантования могут меняться на покадровой основе согласно статистическому распределению коэффициентов дискретного косинусного преобразования и содержимому видеосигнала. Для различных зон внутри кадра квантование может точно настраиваться от макроблока к макроблоку путем масштабирования размера шага квантования исходя из сложности макроблока. Для заданной выходной битовой частоты выходной буфер будет предоставлять управляющие сигналы, используемые кодером для регулирования размера шага квантования для конкретного кадра, чтобы увеличить до максимума разрешающую способность квантования в пределах доступной ширины полосы.

В идеальном случае система сжатия видеосигнала удаляет высокочастотные компоненты, которые не будут восприниматься зрителями как пропавшие, когда изображение восстанавливается и воспроизводится. Остающиеся низкочастотные компоненты квантуются, чтобы уместиться в пределах доступной ширины полосы. Шум квантования, внесенный в сигнал, также должен быть невидим зрителям при восстановлении изображения. Однако в реальной системе выбирается оптимальное соотношение между передаваемой информацией и размером шага квантования для доступной ширины полосы. Если система не обеспечивает достаточного количества коэффициентов для квантования, система увеличивает размер шага квантования, что приводит к блочным искажениям в восстановленном изображении. Если картинка во время процесса сжатия теряет слишком много высокочастотной информации, восстановленное изображение будет содержать другие заметные искажения контуров.

Более того, различия в квантовании между кадрами приводят к тому, что кадры в группе картинок содержат различающиеся высокочастотные компоненты. I кадр, например, может потерять существенное количество высокочастотных коэффициентов во время кодирования, в то время как P и B кадры сохраняют высокочастотные компоненты, соответствующие потерянным в I кадре. Восстановленная группа картинок будет теперь содержать искажения, так как

RU 2201654 C2

RU 2201654 C2

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 257 of 431

высокочастотная информация различается между кадрами, используемыми для восстановления друг друга.

Эти проблемы возникают в системе GA, которая существует в настоящее время. Сжатие сигнала изображения высокой четкости лишь далее снижает качество воспроизводимой картинки. Провайдеры услуг спутниковой трансляции не желают передавать сигналы высокой четкости, так как единовременно через транспондер может передаваться только одна программа. Осуществляемое для соответствия требованиям сжатие программы высокой четкости, достаточное для размещения двух программ на одном спутниковом канале (например, канале 24 МГц с четырехпозиционной фазовой манипуляцией (PSK phase-shift keying)) в одно и то же время, приводит к неприемлемому для зрителя качеству картинки. Следовательно, провайдеры услуг спутниковой трансляции не решаются транслировать ТВЧ из-за неэффективного использования канала. Подобным же образом, провайдеры услуг наземной трансляции неохотно берутся за предоставление полных программ высокой четкости, когда одна программа полностью занимает канал, в котором могут разместиться несколько программ стандартной четкости (SD - standard definition).

Сущность изобретения

Согласно принципам настоящего изобретения процессор цифрового изображения идентифицирует тип видеосигнала и селективно преобразует формат исходного сигнала в другой формат так, как это необходимо. Преобразованный сигнал фильтруется и преобразуется обратно в исходный формат так, как это необходимо. Фильтрованный сигнал преобразуется до более низкого разрешения и сжимается до планируемой битовой частоты. В заключение сжатый сигнал подается на выходной канал данных.

Краткое описание чертежей

На фиг. 1 показана одна из конфигураций устройства сжатия видеосигнала согласно настоящему изобретению.

На фиг.2 подробно показан блок 22, изображенный на фиг.1.

На фиг. 3 показана одна из возможных характеристик адаптивного фильтра, включенного в блок 22.

Фиг. 4 представляет собой блок-схему примерной передающей системы, использующей настоящее изобретение.

Фиг.5 представляет собой блок-схему примерной принимающей системы, использующей настоящее изобретение.

Описание предпочтительного варианта реализации изобретения

MPEG2-кодер, включающий устройство, соответствующее принципам настоящего изобретения, содержит перед кодером двумерный (например, вертикальный и горизонтальный) фильтр. Кодер, выходной буфер и фильтр каждый генерируют информацию, которая может быть использована другими блоками для повышения общей эффективности. Такая информация касается, например, движения изображения, контраста изображения, выбора матрицы квантования, выбора коэффициента масштабирования, битовой частоты на выходе каждого блока, текстуры изображения. Обмен данной информацией между блоками осуществляется при помощи контроллера, который отслеживает процесс кодирования, или при помощи индивидуальных контроллеров, размещенных в каждом блоке.

Контроллер оценивает входящую информацию и определяет унифицированности по группе картинок, кадру или части кадра, использование которых может быть полезно для модификации работы фильтра и/или кодера с целью эффективного кодирования группы, кадра или части кадра до планируемой битовой частоты. Обычно фильтр регулируется, так как регулирование фильтра порождает меньше шума, чем регулирование кодера. Также, фильтр в действительности представляет собой группу фильтров, что делает возможной наибольшую гибкость при регулировании коэффициентов индивидуальных фильтров так, как это требуется. Эти фильтры представляют собой горизонтальный фильтр низких частот для устранения эффектов наложения спектров/ вертикальный фильтр низких частот и двумерный фильтр низких частот, расположенные обычно в только что указанном последовательном порядке. Контроллер оценивает принятую информацию с точки зрения настройки текущего фильтра и кодера и производит регулировку одного или более фильтров и/или кодера в соответствии с одной или более доминирующими унифицированностями. Конечным результатом является то, что входной сигнал фильтруется фильтром по низким частотам методом, который в основном позволяет кодеру закодировать изображение однородно по группе картинок, кадру или части кадра относительно доминирующей унифицированности однородно кодируемых данных.

Кодированный сигнал может передаваться в доступной ширине полосы и затем восстанавливаться и воспроизводиться без искажений, которые присутствовали бы в ином случае. Для сигналов высокой четкости, имеющих размер кадра изображения 1920•1080 пикселей, после фильтрации и перед кодированием горизонтальное разрешение уменьшается до 1280 пикселей на строку для дальнейшего уменьшения ширины полосы передаваемого сигнала. Результатом является гибридное разрешение для изображения, которое приемники высокой четкости могут принять, декодировать и воспроизвести при незначительных изменениях в программных средствах.

Примерная конфигурация системы сжатия видеосигнала согласно настоящему изобретению показана на фиг.1. Входной видеосигнал принимается детектором киноизображения 20, который определяет, является ли сигнал сигналом киноизображения (пленки), который переформатирован способами телекинопреобразования с 24 кадров в секунду на 30 кадров в секунду. Переформатированный сигнал киноизображения направляется в соответствующую секцию адаптивного процессора изображения 22, как будет описано далее. Если входной сигнал не является переформатированным сигналом киноизображения, сигнал проходит в другую

RU 2201654 C2

RU 2201654 C2

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 258 of 431

секцию адаптивного процессора изображения 22. Идентификация сигналов киноизображения, прошедших телекинопреобразование, происходит с использованием известных способов.

Процессор 22 принимает управляющую информацию от выходного буфера 26 и от MPEG2-кодера 24 через контроллер 28 и фильтрует кадры изображения так, чтобы кодер 24 мог эффективно кодировать кадр таким образом, чтобы кадр находился в пределах доступной битовой частоты и был в основном свободен от заметных искажений. Процессор 22 фильтрует сигнал в двух направлениях (2-D) (например, горизонтальном и вертикальном), что требуется для улучшения качества восстановленного изображения, полученного из кодированного в формате MPEG2 битового потока, сжатого до средней битовой частоты. Задачей является модификация локального двумерного частотного содержания источника для повышения эффективности MPEG2-кодирования методом, в наименьшей степени повреждающим восстановленное из формата MPEG2 изображение с точки зрения четкости изображения и искажений при кодировании. Фильтрация сигнала может применяться к заранее определенным данным, например группе картинок или кадров, отдельному кадру или попиксельно.

Двумерный фильтр фильтрует низкие частоты изображения. В оптимальном варианте высокочастотная информация, которая удаляется, либо избыточна, либо незаметна для зрителя. На практике, чтобы достичь требуемой битовой частоты, может быть удалена некоторая часть высокочастотной информации, которая заметна для зрителя. Однако система, которая включает перед MPEG2-кодированием процессор 22, генерирует изображение, лучшее по сравнению с системой без процессора 22, что будет рассмотрено далее.

Фильтрованный сигнал кодируется MPEG2-кодером 24, который получает параметры изображения от процессора 22 и выходного буфера 26 через контроллер 28 и регулирует сжатие в формате MPEG2 так, чтобы оно соответствовало доступной битовой частоте. Сжатие происходит таким же образом, как описано в спецификации GA. Кодер 24 посылает сжатые данные в выходной буфер 26. Буфер 26 предоставляет сжатые данные на заранее определенной частоте для кодирования в целях транспортировки, модуляции и передачи по каналу передачи с использованием известных технологий обработки сигнала. Перед модуляцией сжатый сигнал может быть послан в статистический мультиплексор для мультиплексирования с несколькими программами для передачи по одному каналу. Блоки обработки сигнала после буфера 26 хорошо известны и, следовательно, не показаны на фиг.1 для упрощения чертежа.

Система сжатия видеосигнала может быть сконфигурирована таким образом, чтобы воспринимать любой тип видеосигнала. Система на фиг.1 сконфигурирована для принятия как телепрограмм (камера), так и кинопрограмм (пленка), форматированных в известных промышленных стандартах. Например, одна общая конфигурация использовалась бы для системы по фиг.1, чтобы принять выходной сигнал от препроцессора, как ранее рассмотрено в разделе "Уровень техники". Система может быть сконфигурирована для принятия других типов видеосигналов добавлением соответствующих аппаратных и/или программных средств.

Эти конфигурации не показаны для упрощения фиг.1.

Детектор киноизображения 20 распознает наличие определенных соотношений во входном сигнале, которые могут быть использованы для повышения эффективности кодирования: (Тип 1) Источник с чересстрочной разверткой 60 полей в секунду, (Тип 2) Киноизображение 30 кадров в секунду с чересстрочной разверткой 60 полей в секунду, (Тип 3) Киноизображение 24 кадра в секунду с чересстрочной разверткой 60 полей в секунду, (Тип 4) Источник с построчной разверткой, (Тип 5) Киноизображение 30 кадров в секунду с построчной разверткой 60 кадров в секунду, и (Тип 6) Киноизображение 24 кадра в секунду с построчной разверткой 60 кадров в секунду. Детектирование происходит в ответ на внешний управляющий сигнал (не показан) или с использованием известных технологий, например тех, которые используются в современных MPEG2-кодерах стандартной четкости. Информация о формате сигнала поступает вместе с самим сигналом в адаптивный процессор изображения 22, как описано ниже. Детектор киноизображения 20 также распознает, относится ли сигнал к типу с чересстрочной или к типу с построчной разверткой и направляет эту информацию процессору 22. Эти типы разверток являются примерными и задают параметры, по которым сигналы направляются через процессор 22. Могут также быть использованы варианты реализации других частот полей и кадров.

Адаптивный процессор изображения 22 выполняет несколько программируемых функций, уменьшающих объем данных, которые нужно сжать при помощи кодера 24. Процессор 22 в основном обрабатывает каждый кадр, так чтобы обработанный кадр мог быть закодирован оптимальным образом для устранения или значительного уменьшения шума, который заметен зрителю. Процессор 22 может в основном рассматриваться как пространственный изменяющийся двумерный фильтр низких частот, так как он прореживает каждый кадр изображения, пространственно и адаптивно отфильтровывает выбранные двумерные высокочастотные компоненты из сигнала. Для создания обработанного кадра адаптивная фильтрация может регулироваться по серии кадров, для отдельного кадра или попиксельно.

Процессор 22 может облегчить кодирование для любого типа сигнала. Однако для данного варианта настоящего изобретения процессор 22 программируется для работы с данными высокой четкости, как задано спецификацией GA. Это может быть либо 1920•1080 пикселей на изображение, либо 1280•720 пикселей на изображение. Согласно спецификации GA каждый формат высокой четкости требует для трансляции приблизительно 18 мегабит в секунду. Для упрощения обсуждения далее будет подробно

RU 2201654 C2

RU 2201654 C2

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 259 of 431

рассмотрен только формат 1920•1080. Данное рассмотрение в равной степени применимо для формата 1280•720 или любого другого формата.

На фиг.2 подробно показан адаптивный процессор изображения 22. В зависимости от информации о формате сигнала, полученной от детектора 20, сигнал изображения направляется контроллером 28 (фиг. 1) в преобразователь чересстрочной развертки в построчную 221 (Тип 1), блок обратного телекинопреобразования 222 (Тип 2, 3) или проходит немодифицированным (Тип 4-6) в пространственный фильтр нижних частот с ограниченной полосой частот 223. Фильтр 223 принимает выходной сигнал из блоков 221 и 222 после того, как эти блоки обработали сигнал.

Преобразователь 221 принимает сигнал, если его формат содержит чересстрочные поля с частотой 60 Гц, и преобразует сигнал в построчные кадры с частотой 60 кадров в секунду. Построчный кадр включает всю информацию изображения в каждом кадре. Фильтрация сигнала с построчной разверткой в типичном случае не вносит искажений, как это может произойти при фильтрации информации полей чересстрочного сигнала. Преобразователь 221 применяет известные способы для преобразования чересстрочных полей в построчный кадр.

Блок обратного телекинопреобразования 222 удаляет избыточные поля из киноизображения с чересстрочной разверткой частотой 60 Гц и восстанавливает исходное киноизображение с построчной разверткой. Построчный формат делает возможной последующую вертикальную фильтрацию низких частот без искажений движения. Если входной сигнал источника киноизображения (Тип 2 или Тип 3) обрабатывался как источник Типа 1, вертикальная фильтрация низких частот понизит способность MPEG2-кодера обнаруживать и должным образом обрабатывать материал источника киноизображения. Пострадает эффективность кодирования. Блок 222 преобразует сигнал в построчный формат и перед фильтрацией удаляет избыточные поля/кадры, так как фильтрация может отфильтровать данную избыточную информацию по-разному. Если избыточная информация перед фильтрацией не удаляется, информация после фильтрации может не быть идентичной, и кодер может не распознать сигнал как сигнал Типа 2/3. Тогда кодер закодирует информацию, которая в ином случае была бы удалена из-за избыточности.

Также структура процессора 22 упрощена путем обеспечения единого выходного тактового сигнала из блока 222. Если блок 222 предоставляет выходные построчные киноизображения с частотой 24 кадра в секунду и 30 кадров в секунду, потребуется два выходных тактовых сигнала и поддерживающая их схема.

Сигналы, которые первоначально были созданы в построчном формате 30 кадров в секунду, проходят непосредственно в фильтр 223. Фильтр 223 ожидает видеоинформации, представленной как законченные кадры изображения. Пространственный фильтр низких частот 223 в действительности является группой фильтров. Например, первый фильтр представляет собой горизонтальный фильтр низких частот для устранения эффектов наложения спектров. Второй фильтр представляет собой вертикальный фильтр низких частот. Последний фильтр представляет собой двумерный фильтр низких частот, как описано ранее. Коэффициенты каждого вывода фильтра могут адаптивно устанавливаться в соответствии с управляющей информацией от кодера 24 и буфера 26, как видно на фиг.1. Построчный сигнал горизонтально фильтруется по низким частотам для исключения наложения спектров при последующем прореживании в преобразователе частоты дискретизации 226. Окончательный горизонтальный результат от 1920 пикселей на строку будет 1280 пикселей на строку, как будет рассмотрено далее. Для устранения шума от наложения спектров в результирующем сигнале фильтр низких частот 223 имеет частоту отсечки 640 циклов на строку. Горизонтальный фильтр для устранения эффектов наложения спектров, включенный в блок 223, может представлять собой фильтр с конечной импульсной характеристикой (КИХ) с 17 выводами со следующими коэффициентами для выводов:

[f0, f1, ..., f15, f16]=[-4, 10, 0, -30, 48, 0, -128, 276, 680, 276, -128, 0, 48, -30, 0, 10, -4]/1024.

Кодирование видеосигналов высокой четкости на уменьшенной битовой частоте обычно требует дополнительной вертикальной фильтрации низких частот для дальнейшего уменьшения ширины полосы видеосигналов. Удаление вертикальной высокочастотной энергии перед MPEG - кодированием необходимо, для достижения приемлемого общего качества картинки. Вертикальные частотные области наиболее высокой фазовой чувствительности ослабляются. Вертикальная частота отсечки устанавливается равной некоторой доле частоты Найквиста. Например, для некоторого видеоматериала может подойти частота отсечки, равная приблизительно половине частоты строк входного сигнала высокой четкости. Для сигнала высокой четкости с 1080 строками на высоту картинки это соответствовало бы отсечке 540 строк на высоту картинки. Эта частота может быть программируемой, и программируемая частота отсечка тогда будет определяться контроллером 28 из параметров, доступных от кодера 24 и буфера 26 на фиг.1 (т.е. требуемой битовой частоты, матриц квантования и т.д.). Вертикальный фильтр низких частот, включенный в блок 223, может представлять собой КИХ-фильтр с 17 выводами со следующими коэффициентами для выводов:

[f0, f1,..., f15, f16]=[-4, -7, 14, 28, -27, -81, 37, 316, 472, 316, 37, -81, -27, 28, 14, -7, -4]/1024.

В качестве альтернативы частота отсечки может быть равна двойной частоте строк сигнала стандартной четкости. Обычно вертикальный фильтр низких частот следует за горизонтальным фильтром, предназначенным для устранения эффектов наложения спектров.

Процессор 22 выполняет вертикальную фильтрацию, а не вертикальную децимацию, в результате чего поддерживается постоянное вертикальное строковое разрешение. В

RU 2201654 C2

RU 2201654 C2

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 260 of 431

настоящее время фильтрация более предпочтительна для чересстрочных видеосигналов, чем децимация. Преобразование вертикального строкового разрешения для чересстрочной последовательности изображения требует сложных аппаратных и программных средств, что приводит к высокой стоимости приемника. Вертикальное преобразование частоты дискретизации отрицательно сказывается на вертикальной высокочастотной характеристике из-за возрастающей сложности выводов в комбинации с дискретизацией Найквиста (т.е. отсутствием супердискретизации). Стоимостные соображения для приемника в настоящее время делают неперспективным уменьшение вертикального разрешения для уменьшения искажений и битовой частоты, получаемой в результате кодирования. Воспроизводимая картинка значительно ухудшалась бы при использовании существующей технологии в преобразователях вертикальной частоты дискретизации вместо вертикального фильтра низких частот, описанного выше. Однако эффективные и экономически выгодные преобразователи вертикальной частоты дискретизации могут заменить описанный здесь вертикальный фильтр, не нарушая принципов настоящего изобретения.

Коэффициенты как для горизонтального, так и для вертикального фильтров низких частот могут быть модифицированы программным путем и, если необходимо, могут быть применены на пиксельном уровне для достижения планируемой битовой частоты без создания искажений в восстановленном изображении. Обычно достаточно модификации коэффициентов на покадровой основе. Альтернативой для более медленных процессоров является предварительное программирование ряда различных наборов коэффициентов для фильтров и выбор набора, наиболее подходящего для обрабатываемой информации изображения. Большая гибкость адаптивных фильтров дает возможность всей системе в целом создавать поток данных с меньшим количеством искажений по сравнению с системой без адаптивных фильтров.

После того как сигнал отфильтрован по низким частотам в горизонтальном и вертикальном направлениях блоком 223, контроллер 28 определяет, может ли сигнал быть однородно закодирован кодером 24 на покадровой основе без внесения значительного шума квантования. Если это так, то сигнал поступает в любой из блоков 224, 225 или 226 в зависимости от его формата, как будет рассмотрено далее. Если, однако, процесс кодирования, по всей вероятности, внесет шум и/или искажения в сигнал, сигнал посылается в двумерный фильтр низких частот в блоке 223 для дальнейшей адаптивной фильтрации. Управляющие параметры от процессора 22, кодера 24 и выходного буфера 26 (фиг.1) позволяют контроллеру 28 (или индивидуальному контроллеру блока в блоке 223) определить, требуется ли дальнейшая фильтрация. Используемые для осуществления этого определения управляющие параметры представляют собой, например, измерения движения и контраста, доступные таблицы квантования, эффективность кодирования и текущую планируемую битовую частоту.

Двумерный фильтр в блоке 223 уменьшает объем высокочастотной информации, поступающей от кадра изображения, главным образом в направлении по диагонали вместо горизонтального или вертикального направлений по отдельности. Человеческий глаз очень чувствителен к высокочастотному шуму по вертикали и горизонтали в диагональных направлениях. Удаление достаточного объема высокочастотной информации по диагонали, чтобы сделать возможным однородное квантование кодером 24, обычно дает результатом сигнал более высокого качества с меньшим наблюдаемым шумом. Диагональный фильтр, как и вся предыдущая фильтрация, работает с кадром изображения целиком и является программируемым.

Диагональный фильтр может быть совместим с матрицами квантования в кодере. Матрицы квантования часто применяют ромбовидные матрицы для квантования I кадров. Однако эти матрицы часто порождают шум, так как B и P кадры используют другие типы матриц квантования, которые сохраняют высокочастотные компоненты во время процесса сжатия и компенсации движения, который происходит в кодере 24. Фильтры процессора 22 удаляют высокочастотную информацию из каждого кадра изображения перед тем, как MPEG2-кодер 24 создает в процессе обработки данных I, P и B кадры в контуре оценки движения. Таким образом, высокочастотные компоненты в основном удаляются из P и B кадров, так же как и из I кадров. При восстановлении, как известно, изображение в основном свободно от искажений, созданных MPEG2-кодированием.

На практике контроллер 28 по фиг.1 оценивает параметры сигнала (например, движение, контраст и т.д.) перед фильтрацией конкретного кадра процессором 22 и определяет настройки коэффициентов для всех фильтров в блоке 223, включая необходимую диагональную фильтрацию. Во время процесса фильтрации конкретного кадра контроллер 28 отслеживает параметры сигнала, поступающие от процессора 22, кодера 24 и буфера 26 и изменяет коэффициенты так, как это необходимо для поддержания планируемой битовой частоты с минимальными искажениями/шумом. Каждый кадр фильтруется на основе самых последних параметров сигнала и поступает в кодер 24 для сжатия и затем в буфер 26, в то время как последующая информация вводится в фильтр 223.

Если сигнал был создан как сигнал киноизображения с частотой 24 кадра в секунду, фильтрованный сигнал подается в блок 224, предназначенный для растягивания 3:2. Блок 224 дублирует выбранные кадры, чтобы обеспечить выходной сигнал с частотой 30 кадров в секунду. Это происходит с использованием известных способов. Затем из блока 224 сигнал поступает в преобразователь с горизонтальным прореживанием 226.

Блок субдискретизации полей 225 преобразует построчные сигналы от фильтра 223 из формата построчной развертки в

RU 2201654 C2

RU 2201654 C2

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 261 of 431

формат чересстрочной развертки. Это преобразование осуществляется известными способами. Без обратного преобразования в чересстрочный формат сигнал содержал бы двойной объем данных, так как частота построчных кадров, поступающих от блока 221, составляет 60 Гц. Чересстрочный сигнал подается в преобразователь 226.

Преобразователь частоты дискретизации 226 получает построчные сигналы частотой 30 кадров в секунду непосредственно от фильтра 223. Кроме того, как описано выше, в преобразователь 226 предоставляют сигналы блоки 224 и 225. Преобразователь 226 прореживает сигналы высокой четкости до выбранного формата передачи. Этот формат может не быть стандартным. Это может быть любой размер изображения и кадра, который требуется. Однако нестандартный формат потребует модификации приемника.

Когда преобразователь 226 получает сигналы ТВЧ стандарта GA 1920•1080, преобразователь 226 прореживает горизонтальную информацию и выводит гибридный пиксельный формат кадра 1280•1080. Приемники, совместимые со стандартом ТВЧ компании GA, способны принимать кадры изображения, содержащие 1920•1080 пикселей и 1280•720 пикселей. Следовательно, GA-совместимые приемники могут быть модифицированы для поддержки 1280 пикселей горизонтального разрешения и 1080 пикселей вертикального разрешения. Аппаратные средства совместимого приемника увеличивают частоту дискретизации с 1280 горизонтальных пикселей до 1920 горизонтальных пикселей одновременно с увеличением вертикального разрешения. Однако соответствующие стандарту GA приемники не требуются и не программируются для приема кадров изображения с разрешением 1280 •1080 пикселей (горизонтальное разрешение на вертикальное разрешение) в качестве заданного формата. Аппаратные средства для приема и декодирования этого разрешения уже имеются, но должны быть добавлены программные средства для декодирования и увеличения лишь горизонтального разрешения. Добавление программных средств является более простым и дешевым, чем изменение конструкции и добавление новых аппаратных средств, необходимых для других нестандартных форматов.

Процессор 22 предоставляет гибридный формат 1280•1080, так как современная технология воспроизведения не способна воспроизвести разрешение 1920 пикселей на строку. В настоящее время лучшие телевизионные мониторы могут воспроизвести только разрешение приблизительно 1200-1300 пикселей на строку. Следовательно, ограничение выходного разрешения до 1280 пикселей на строку в горизонтальном направлении оказывает небольшой неблагоприятный эффект на качество картинки, если таковой вообще имеется. Предоставление разрешения при воспроизведении 1280•1080, которое поддерживается существующими аппаратными средствами приемников для декодирования и распаковки, доставит производителям приемников минимум проблем, так как необходимо лишь изменение программных средств. Для определенных приемников, таких как трансляционные спутники, модификация программных средств может быть загружена и установлена дистанционно по спутниковой линии. Для этих приемников отсутствует необходимость задействования обслуживающего персонала.

Гибридный формат имеет преимущества, так как провайдеры наземных и спутниковых программ не желают передавать программы высокой четкости. Спутниковый транспондер передает битовый поток с частотой приблизительно 24 Мбит в секунду (Мбит/с). Наземные ТВЧ трансляции могут передаваться со скоростью до 19 Мбит/с, включая программу высокой четкости с 18 Мбит/с и другую информацию (например, аудиоканал, программу передач, механизмы доступа и т.д.). Каждый из современных спутниковых транспондеров может нести самое большее одну программу ТВЧ, что провайдеры спутниковых программ считают недостаточно выгодным. Простого уменьшения горизонтального разрешения кадра с 1920 до 1280 недостаточно, чтобы сделать возможной одновременную передачу двух программ высокой четкости через один спутниковый транспондер. Фильтрация, обеспечиваемая процессором 22, успешно позволяет осуществлять подобную двойную передачу высокой четкости по одному каналу.

Характеристика фильтрации, предоставляемая процессором 22, может иметь различные формы, включая ромб, крест и гиперболу по осям координат, где для каждого фильтра фильтрация является диагональной. Одна возможная форма, двумерная гипербола, обладает особыми преимуществами для данного приложения и имеет амплитудно-частотную характеристику, которая изображена на фиг.3. Частота отсечки регулируемого фильтра в основном задается, чтобы позволить однородное сжатие выбранной группы картинок, кадра или части кадра кодером 24. Если необходимо, может фильтроваться дополнительная горизонтальная и вертикальная высокочастотная информация, но обычно этого не требуется. По мере того, как меняется сложность картинки или увеличивается доступная битовая частота, объем данных, отфильтрованных диагональным фильтром и другими предшествующими фильтрами, уменьшается. Двумерный фильтр может быть описан, например, как двумерный КИХ-фильтр с 13 выводами в каждом направлении (13•13) или как двумерный фильтр с бесконечной импульсной характеристикой (БИХ-фильтр).

Двумерный КИХ-фильтр, включенный в блок 223, может представлять собой фильтр, имеющий 13•13 выводов, с коэффициентами для выводов, приведенными в таблице (см. в конце описания).

Для этих коэффициентов коэффициент передачи преобразования с понижением частоты ДС (DC - down conversion) составляет 1024. Коэффициенты демонстрируют октантную симметрию, которая дает 28 независимых коэффициентов. Симметричные области коэффициентов делают возможной более быструю настройку регулируемого фильтра. Возможно, однако, чтобы каждый октант отличался, если, например, фильтруемое изображение или область

RU 2201654 C2

RU 2201654 C2

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 262 of 431

демонстрируют отличающуюся характеристику в одной части изображения.

Характеристика фильтра процессора 22 может изменяться непрерывно от одного набора коэффициентов к другому на попиксельной основе. Таким образом, процессор 22 может устанавливать различные рабочие параметры для поддержания хорошего качества изображения при ограничении битовой частоты, как будет рассмотрено далее.

Как упомянуто ранее, процессор 22 может быть адаптивно модифицирован для адаптивной фильтрации в зависимости от параметра (параметров), используемых для задания адаптации фильтра. Например, вариация в кадре изображения может быть использована для сегментирования изображения на области для различной обработки. Контуры являются важной особенностью изображения, так как доминирующие контуры маскируют ошибки кодирования в непосредственной к ним близости, и они также могут определять области изображения. Для идентификации зон низкой сложности, таких как тело или небо, может быть использована колориметрия. Текстуры могут быть также идентифицированы и обработаны как область. Текстуры обычно менее важны, чем контуры. Следовательно, текстуры идентифицируют области, которые могут быть сильнее отфильтрованы, чем другие области. Также, для фиксирования важных образов или действия, которые требуют кодирования с более высокой эффективностью и, следовательно, меньшей фильтрации, может быть использована кинематическая композиция. Фон в основном смягчается глубиной поля оптики камеры и может быть отфильтрован более сильно. Информация панорамирования и обзора может быть использована/ чтобы определить центр интереса в изображении для дифференцированной обработки процессором 22.

Функционирование кодера 24 совместимо со стандартом MPEG2. Кодер 24 может предоставлять через контроллер 28 информацию, которую процессор 22 может использовать для повышения производительности. Такая информация может включать информацию по битовой частоте, например. Эта информация по битовой частоте может содержать среднюю битовую частоту для группы картинок, битовую частоту кадра и битовую частоту макроблока или блока. Другая информация, которая может повысить производительность процессора 22, включает сложность дискретного косинусного преобразования, тип используемой матрицы квантования и используемый размер шага матрицы квантования. Также процессор 22 может предоставлять через контроллер 28 информацию кодеру 24 для регулирования его работы с целью повышения производительности кодирования.

После формирования в транспортный пакетный поток данных с использованием известных технологий, сигнал высокой четкости известным образом передается на приемник, например, как описано в спецификации компании Grand Alliance. За исключением требуемого увеличения частоты дискретизации до полного пиксельного разрешения высокой четкости в приемнике, обработка сигнала, обеспечиваемая процессором 22, прозрачна для декодера в приемнике, совместимом со стандартом Grand Alliance.

В приемнике поток данных демодулируется и транспортный поток обрабатывается для извлечения пакетов данных и информации о программе с использованием известных технологий. Для программ высокой четкости в гибридном формате, описанном выше, частота дискретизации сигнала в процессоре воспроизведения увеличивается в горизонтальном направлении, если воспроизведение требует полного сигнала высокой четкости. Количество вертикальных строк в сигнале изображения остается неизменным. Это восстанавливает полный сигнал высокой четкости с разрешением 1920 •1080 для воспроизведения устройством воссоздания изображения высокой четкости. Если устройство воспроизведения изображения не требует полного сигнала высокой четкости, сигнал подходящим образом прореживается с использованием известных способов во время восстановления изображения перед его воспроизведением. Существующие приемники, совместимые со стандартом Grand Alliance, требуют модификации программных средств, чтобы они могли восстанавливать гибридный сигнал. Модификация программных средств позволяет независимо выбирать алгоритмы горизонтальной и вертикальной аппаратной и программной обработки, выделенные стандартизированным режимом стандарта Grand Alliance, как это требуется для входящего сигнала.

Фиг.4 представляет собой блок-схему прохождения видеосигнала изображения через кодирующую систему. На этапе 30 формат сигнала идентифицируется, и информация идентификации подается вместе с видеосигналом. Информация о формате может указывать, например, происходит ли сигнал первоначально из киноизображения с форматом 24 кадра в секунду и является ли он чересстрочным или построчным. Если видеосигнал является чересстрочным, на этапе 31 он преобразуется в построчный сигнал с частотой 60 кадров в секунду. Если сигнал преобразован растягиванием 3:2, на этапе 32 избыточные кадры удаляются. Если видеосигнал уже имеет построчный формат видеокамеры, он поступает непосредственно в фильтр этапа 34. На этапе 34 видеосигнал пространственно фильтруется по низким частотам. Это включает вертикальную, горизонтальную и диагональную фильтрацию, как описано выше. На этапе 35 происходит повторное преобразование построчного сигнала, который был образован из чересстрочного сигнала на этапе 31, обратно в чересстрочный сигнал. На этапе 36 сигнал подвергается растягиванию 3:2, чтобы вернуть избыточные кадры, ранее удаленные на этапе 32. Видеосигналы, поступившие с этапа 30 непосредственно на этап 34, как описано выше, теперь поступают с этапа 34 непосредственно на этап 38. На этапе 38 видеосигнал с одного из этапов 34, 35 и 36 субдискретизируется до гибридного разрешения сигнала высокой четкости

RU 2201654 C2

RU 2201654 C2

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 263 of 431

1280•1080, определенного выше, или в другой выходной формат, как это необходимо. На этапе 40 гибридный сигнал, кодируется в формате MPEG2, как описано ранее. Этап 42 обрабатывает кодированный сигнал для транспортировки, этап 44 модулирует транспортный сигнал, как требуется для передачи по выходному каналу, такому как высокочастотный канал наземной трансляции. В заключение этап 46 передает модулированный сигнал. Этапы с 42 по 46 осуществляются известными способами.

Фиг. 5 представляет собой блок-схему прохождения переданного сигнала изображения через приемник. Эта блок-схема предполагает, что разрешение изображения принятого сигнала является гибридным сигналом высокой четкости 1280•1080, определенным выше. На этапе 50 переданный сигнал принимается тюнером и демодулируется. Демодулированный сигнал декодируется и распаковывается из формата MPEG2 на этапе 52. Этап 54 идентифицирует разрешение видеосигнала как 1280•1080 пикселей на изображение при помощи управляющей информации, посланной вместе с сигналом. Протокол MPEG2 компании Grand Alliance поставляет информацию о разрешении изображения вместе с передаваемым сигналом. Гибридный сигнал обычно идентифицируется уникальным кодом, как и любое другое заданное разрешение. Гибридный сигнал может также быть описан иным образом, например при помощи информации в данных пользователя, содержащихся в передаваемых данных. На этапе 56 во время обработки воспроизведения происходит увеличение частоты дискретизации гибридного видеосигнала в горизонтальном направлении до полного сигнала высокой четкости 1920•1080. Увеличение частоты дискретизации гибридного сигнала происходит с использованием новых программных средств совместно с существующими аппаратными и программными средствами, имеющимися в приемнике, как описано ранее, В заключение полный видеосигнал высокой четкости воспроизводится на дисплее с разрешением 1920•1080 на этапе 58. Этапы 50, 52 и 58 используют известные способы.

Устройство и способы, описанные выше, могут быть применены в ряде конфигураций, чтобы достигнуть улучшенного восстановления изображения для высокочеткого воспроизведения. В зависимости от требований конкретной системы могут быть использованы адаптивные и неадаптивные варианты. Некоторые из этих вариантов рассмотрены ниже.

Неадаптивной стратегией было бы задание фильтрации кадров процессором 22 до планируемой битовой частоты и разрешение обрабатывать все изображения однородно. Другая неадаптивная стратегия должна исходить из предположения, что центр воспроизводимого изображения является наиболее интересной областью. Это также предполагает, что периферия изображения менее интересна и, следовательно, менее важна для зрителя. Коэффициенты фильтров процессора 22 устанавливаются контроллером 28 при помощи параметров, которые являются функциями пространственного положения пикселя, и вся информация изображения обрабатывается однородно.

Адаптивным вариантом является сегментация изображения на области с использованием параметров текстурной модели, локальной видеовариации, измерений цветности или других измерений сложности картинки на основе исходного изображения. Характеристики фильтрации процессора 22 адаптивно модифицируются для различных областей.

Другим подходом является адаптивная модификация характеристик фильтрации процессора 22 как функции от разницы между реальной битовой частотой и планируемой битовой частотой. В этом случае один параметр управляет сменой коэффициентов фильтра для двумерного частотного преобразования.

Другой стратегией является разработка такой двумерной частотной характеристики фильтрации, обеспечиваемой процессором 22, которая совместима с матрицей квантования, используемой кодером 24. Матрица квантования может рассматриваться как фильтр низких частот, который имеет двумерную форму. Для этой стратегии величины коэффициентов фильтра должны быть функцией от размера шага матрицы квантования. Так как размер шага изменяется в соответствии с известным режимом функционирования кодера, соответствующее изменение происходило бы для соответствующих коэффициентов фильтра.

Отмеченные выше варианты иллюстрируют гибкость системы, использующей принципы настоящего изобретения. Такая система предпочтительно функционирует в контексте управления частотой стандарта MPEG2 для расширения возможностей MPEG2-сжатия путем уменьшения искажений при кодировании и другого шума. Универсальность и экономичность при внедрении ТВЧ с использованием настоящего изобретения повышаются. Число программ высокой четкости, передаваемых одним транспондером в спутниковой системе прямой трансляции (т.е. 24 МГц четырехпозиционная фазовая манипуляция), увеличивается с одной до двух, или одна программа высокой четкости с несколькими программами стандартной четкости. В соответствии с принципами настоящего изобретения является достижимой возможность передачи одной программы высокой четкости с несколькими программами стандартной четкости по каналу наземной трансляции 6 МГц. Ранее станции трансляции были ограничены передачей одной программы высокой четкости по одному каналу или нескольких программ стандартной четкости по одному каналу.

Хотя настоящее изобретение описано в контексте систем, передающих и принимающих сигнал высокой четкости, его принципы применимы к другой аппаратуре, такой как системы хранения данных. В таких системах, как цифровой видеодиск (DVD), видеоданные кодируются и сохраняются для воспроизведения в более позднее время. Носитель имеет ограниченный объем

RU 2201654 C2

RU 2201654 C2

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 264 of 431

доступного для хранения пространства. Если кодированная программа, киноизображение или другая видеопоследовательность превышает объем доступного пространства на носителе, дальнейшее кодирование/сжатие с целью уместить программу может создать неприемлемые искажения. Описанное выше изобретение может быть использовано для эффективного кодирования программы до более низкой битовой частоты, позволяющей разместить программу на диске. Или теперь несколько программ могут уместиться на одном диске. Цифровое сохранение на пленке также может обеспечить преимущества, как описано выше.

Формула изобретения:

1. Способ обработки первого и второго видеосигналов соответственно, демонстрирующих первый и второй несхожие форматы изображения, предусматривающий обнаружение присутствия первого или второго видеосигнала, согласно которому A. при обнаружении первого видеосигнала (a) преобразуют первый видеосигнал в другой формат для создания преобразованного сигнала, (b) фильтруют преобразованный сигнал для создания фильтрованного сигнала, (c) повторно преобразуют фильтрованный сигнал в исходный формат первого сигнала для создания повторно преобразованного сигнала, (d) преобразуют повторно преобразованный сигнал до более низкого разрешения для создания сигнала с более низким разрешением, (e) кодируют сигнал с более низким разрешением для создания кодированного сигнала и (f) подают кодированный сигнал на выходной канал, и B. при обнаружении второго видеосигнала (g) фильтруют второй видеосигнал для создания фильтрованного сигнала, (h) преобразуют фильтрованный сигнал до более низкого разрешения для создания сигнала с более низким разрешением, (i) кодируют сигнал с более низким разрешением для создания кодированного сигнала, (j) подают кодированный сигнал на выходной канал.

2. Способ по п. 1, в котором первый видеосигнал является сигналом с чересстрочной разверткой и упомянутый сигнал с чересстрочной разверткой преобразуют в сигнал с построчной разверткой на этапе (a).

3. Способ по п. 1, в котором первый видеосигнал является сигналом прошедшей телекинопреобразование кинопленки и упомянутый сигнал прошедшей телекинопреобразование кинопленки преобразуют в сигнал прошедшей обратное телекинопреобразование кинопленки на этапе (a).

4. Способ по п. 1, в котором второй видеосигнал является сигналом с построчной разверткой.

5. Способ по п. 1, в котором на этапах фильтрации обеспечивают фильтрацию низких частот.

6. Способ по п. 5, в котором на этапах фильтрации обеспечивают двумерную фильтрацию.

7. Способ по п. 1, в котором на этапах фильтрации обеспечивают адаптивную фильтрацию, отрегулированную для кадров группы картинок, или отдельного кадра, или части кадра.

8. Способ по п. 1, в котором на этапах фильтрации обеспечивают временную фильтрацию низких частот и адаптивно изменяют характеристики фильтрации в ответ на характеристики сигнала.

9. Способ по п. 1, в котором этапы фильтрации обеспечивают пространственную фильтрацию низких частот и адаптивно изменяют характеристики фильтрации в ответ на характеристики сигнала.

10. Способ по п. 1, в котором этапы кодирования являются совместимыми согласно международному стандарту сжатия и передачи видеосигнала экспертной группой в области подвижного изображения MPEG2.

11. Способ по п. 1, в котором сигнал с более низким разрешением имеет разрешение 1280•1080 дискретных элементов данных на кадр.

12. Способ по п. 1, в котором первый и второй видеосигналы являются сигналами высокой четкости, имеющими разрешение 1920•1080 дискретных элементов данных на кадр.

13. Способ обработки одного из следующих: видеосигнала с чересстрочной разверткой и сигнала в формате прошедшей телекинопреобразование кинопленки, согласно которому обнаруживают присутствие одного из следующих: видеосигнала с чересстрочной разверткой и сигнала в формате прошедшей телекинопреобразование кинопленки, преобразуют обнаруженный сигнал в одно из следующих: сигнал с построчной разверткой и сигнал в формате прошедшей обратное телекинопреобразование кинопленки, соответственно, для создания преобразованного сигнала, фильтруют преобразованный сигнал для создания фильтрованного сигнала, повторно преобразуют фильтрованный сигнал в один из следующих: сигнал с чересстрочной разверткой и сигнал в формате прошедшей телекинопреобразование кинопленки, соответственно, для создания повторно преобразованного сигнала, преобразуют повторно преобразованный сигнал до более низкого разрешения для создания сигнала с более низким разрешением, кодируют сигнал с более низким разрешением для создания кодированного сигнала и подают кодированный сигнал на выходной канал.

14. Способ по п. 13, в котором этап фильтрации является фильтрацией низких частот и этап кодирования является кодированием согласно международному стандарту сжатия и передачи видеосигнала экспертной группой в области подвижного изображения MPEG2.

15. Способ по п. 13, в котором сигнал с более низким разрешением имеет разрешение 1280•1080 дискретных элементов данных на кадр.

16. Способ обработки не прошедшего телекинопреобразование видеосигнала с построчной разверткой, согласно которому адаптивно фильтруют обнаруженный сигнал для создания фильтрованного сигнала, преобразуют фильтрованный сигнал до более низкого разрешения для создания сигнала с более низким разрешением, кодируют сигнал с более низким разрешением согласно международному стандарту сжатия и передачи видеосигнала экспертной группой в области подвижного изображения MPEG2 для

RU 2201654 C2

RU 2201654 C2

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 265 of 431

создания кодированного сигнала и подают кодированный сигнал на выходной канал.

17. Способ по п. 16, в котором этап фильтрации является фильтрацией низких частот и этап кодирования является кодированием согласно международному стандарту MPEG2.

18. Способ обработки не прошедшего телекинопреобразование видеосигнала с построчной разверткой, согласно которому фильтруют обнаруженный сигнал для создания фильтрованного сигнала, преобразуют фильтрованный сигнал до более низкого разрешения для создания сигнала с более низким разрешением, имеющего разрешение 1280•1080 дискретных элементов на кадр, кодируют сигнал с более низким разрешением для создания кодированного сигнала и подают кодированный сигнал на выходной канал.

19. Способ обработки принятого цифрового видеосигнала в системе обработки видеосигнала высокой четкости, который может иметь более чем одно разрешение изображения, включая разрешение 1280•1080 дискретных элементов данных на кадр, согласно которому декодируют сигнал для создания декодированного сигнала, определяют разрешение изображения декодированного сигнала, преобразуют горизонтальную информацию от декодированного сигнала в другое разрешение, если декодированный сигнал имеет горизонтальное разрешение изображения 1280 дискретных элементов на строку, для создания преобразованного сигнала и подают преобразованный сигнал в устройство вывода.

20. Способ по п. 19, в котором преобразование является повышающим преобразованием и другое разрешение представляет собой 1920 горизонтальных дискретных элементов на строку.

21. Способ по п. 19, в котором преобразование является понижающим преобразованием и другое разрешение является более низким разрешением.

22. Способ по п. 19, в котором принятый цифровой видеосигнал является совместимым согласно международному стандарту сжатия и передачи видеосигнала экспертной группой в области подвижного изображения MPEG2.

23. Способ по п. 16, в котором адаптивная фильтрация не зависит от субдискретизации сигнала, осуществленной на этапе преобразования.

24. Способ по п. 16, в котором адаптивная фильтрация является функцией от параметров сигнала изображения перед фильтрацией.

25. Способ по п. 16, который, начиная с этапа адаптивной фильтрации по этап подачи, предусматривает обработку относительно фиксированного формата кадра изображения.

26. Способ по п. 16, в котором адаптивная фильтрация является адаптивной в пределах кадра изображения.

27. Способ по п. 26, в котором адаптивную фильтрацию выполняют на попиксельной основе.

28. Способ подачи видеоинформации с использованием формата сигнала, причем упомянутый формат задают 1280 элементами картинки на 1080 элементов картинки.

29. Способ по п. 28, в котором упомянутые 1280 элементов картинки представляют горизонтальную информацию и упомянутые 1080 элементов картинки представляют вертикальную информацию.

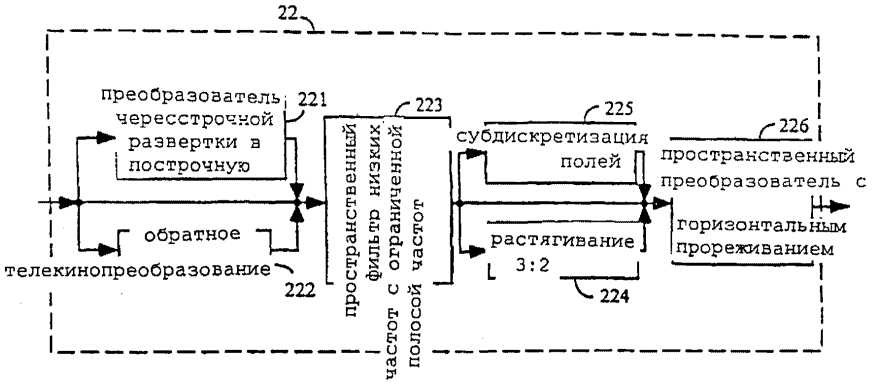
30. Способ по п. 29, в котором видеоинформация является информацией трансляционного спутника.

RU 2201654 C2

RU 2201654 C2

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 266 of 431

0	0	0	1	-3	5	-5	5	-3	1	0	0	0
0	0	1	-1	-3	9	-11	9	-3	-1	1	0	0
0	1	-1	-4	4	6	-13	6	4	-4	-1	1	0
1	-1	-4	1	14	-13	4	-13	14	1	-4	-1	1
-3	-3	4	14	5	-47	61	-47	5	14	4	-3	-3
5	9	6	-13	-47	-55	193	-55	-47	-13	6	9	5
-5	-11	-13	4	61	193	556	193	61	4	-13	-11	-5
5	9	6	-13	-47	-55	193	-55	-47	-13	6	9	5
-3	-3	4	14	5	-47	61	-47	5	14	4	-3	-3
1	-1	-4	1	14	-13	4	-13	14	1	-4	-1	1
0	1	-1	-4	4	6	-13	6	4	-4	-1	1	0
0	0	1	-1	-3	9	-11	9	-3	-1	1	0	0
0	0	0	1	-3	5	-5	5	-3	1	0	0	0

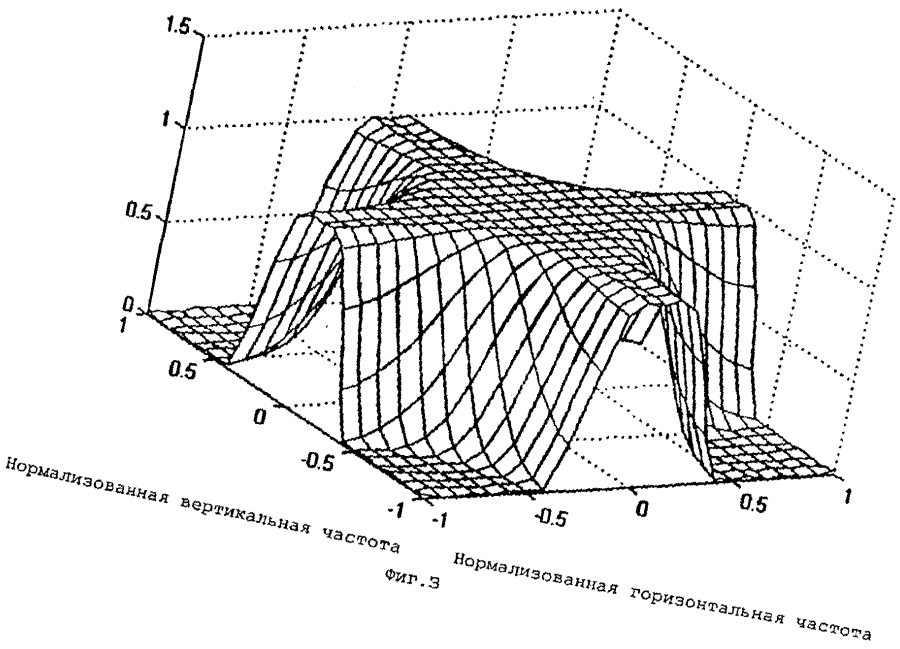


Фиг. 2

RU 2201654 C2

RU 2201654 C2

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 267 of 431

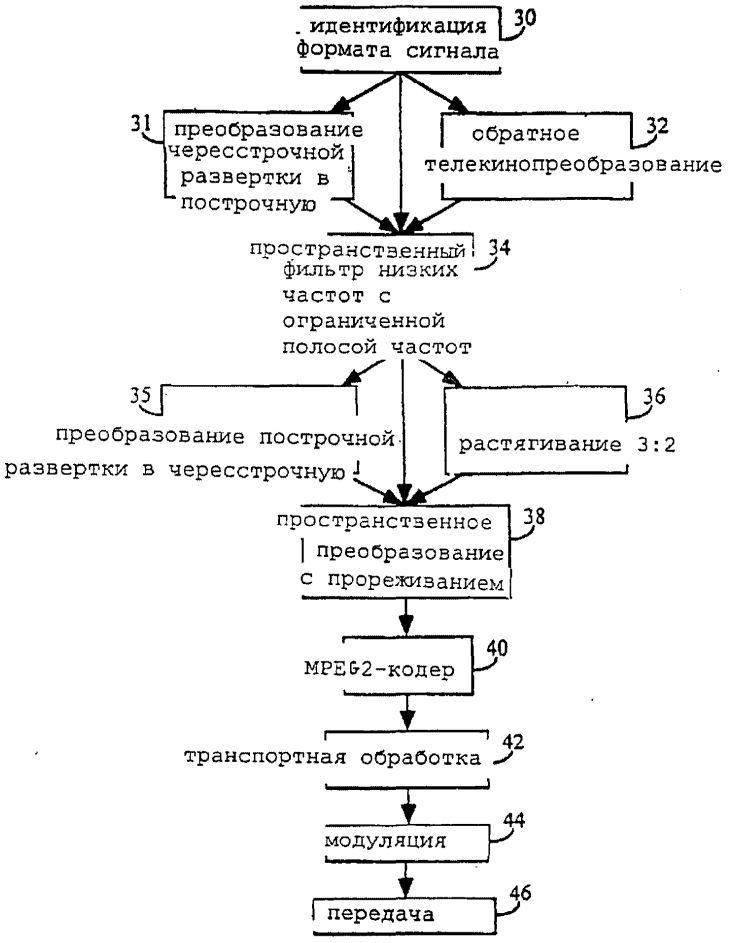


Фиг.3

RU 2201654 C2

RU 2201654 C2

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 268 of 431

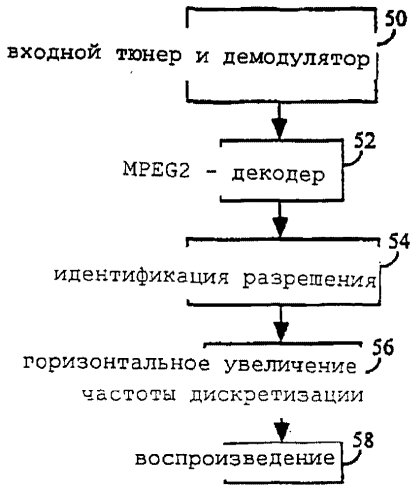


Фиг. 4

RU 2201654 C2

RU 2201654 C2

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 269 of 431



Фиг. 5

RU 2201654 C2

RU 2201654 C2

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 270 of 431

Original document

INFORMATION CARRIER, METHOD AND DEVICE FOR WRITING DATA FILES AND DEVICE FOR READING DATA FROM SUCH INFORMATION CARRIER

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Inventor: TIMMERMANS JOSEF MARIA KAREL (BE)
Applicant: KONINKL PHILIPS ELECTRONICS NV (NL)
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- European:
Application number: SU19915052442 19910918
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- HU216669 (B)
- CA2068883 (C)
- AU642540B (B2)

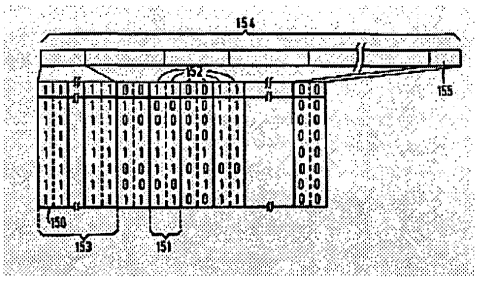
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Abstract not available for RU2073913
Abstract of corresponding document: **WO9205556**

A record carrier (184) is described on which main data files (TV/4, TV,...,256 TV) and a control file (BB; IIDB) have been recorded, the control data in the control file being intended for controlling the reproduction of representations of the main data in the main data file during or after read-out of the main data file. The main data file and the control file are derived from a main data signal and a control data signal respectively in accordance with the same formatting and coding rules. The control



Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 271 of 431

data signal comprises packets (151) of n identical control data bit groups (150), n being an integer greater than or equal to 2. Moreover, a method and device for recording the control and main data are described. In addition, a device for reading the record carrier is disclosed.

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Description of corresponding document:
WO9205556

Translate this text

Record carrier on which a main data file and a control file have been recorded, method of and device for recording the main data file and the control file, and device for reading the record carrier.

The invention relates to a record carrier on which a main data file and a control file have been recorded, the control data in the control file being intended for controlling the reproduction of representations of main data in the main data file during or after read-out of the main data file, the main data file and the control data file being derived from a main data signal and a control data signal respectively in conformity with the same predetermined formatting and encoding rules.

The invention further relates to a method of recording a main data file and a control file on a record carrier, in which prior to recording the main data file is derived from a main data signal in accordance with predetermined formatting and coding rules and in which the control file is derived from a control data signal in accordance with the same formatting and coding rules.

The invention further relates to a device for recording files on a record carrier, the device comprising means for deriving from a main data file to be recorded and a control file to be recorded a main data signal and a control data signal respectively in accordance with predetermined formatting and encoding rules which are identical for both files.

The invention further relates to a device for reading said record carrier, which device comprises means for reading the recorded files, decoding and deformatting means for recovering in conformity with predetermined decoding and deformatting rules the main data signal and the control data signal from the files thus read, a signal processing unit coupled to the decoding and deformatting means to process the main data signal, and a control unit coupled to the decoding and deformatting means to receive the control signal.

Such a record carrier and method and such devices are known, inter alia from the book "Compact Disc Interactive, a designer overview", edited by Philips
International and published byKiuwer (ISBN 9090121219).

This book describes the so called CDI system, which enables main data files, for example picture files, to be recorded on a Compact Disc, a picture data signal being formatted and encoded in accordance with the CD-I standard prior to recording.

Control files, in the form of application programs, are also recorded. Prior to recording the control data signal is converted into the control file in accordance with the same formatting and encoding rules as applied in the conversion of the picture information signal into the main data file. The picture data file thus

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 272 of 431

recorded can be read and representations of the information in the picture data file can be reproduced by means of a so-called CD-I player. The application program is then read first. This application program contains the control information necessary for controlling the reproduction of the representations.

The picture data file is read at a high bit rate, which has the advantage of a short read-out time for the picture data file. However, the high bit rate during reading also means that the control file becomes available at the same high bit rate. Since it is customary that a CD-I player comprises a computer system for processing both the main data file and the control file this does not pose a problem.

The use of such a computer system has the advantage that the CD-I player can be used for a variety of purposes. However, a drawback is that such a computer system is rather expensive. If the CD-I system is used exclusively for storing on a record carrier specific information, such as for example picture information originating from photographic negatives or slides, it may be desirable to have a dedicated read device, which is capable only of reading record carriers on which said specific information has been recorded. For processing the information from the main data file it is then preferred to use a dedicated and hence cheaper data processing unit rather than a computer system.

However, a problem which is then encountered is that a control unit must be used which is capable of reading in the control data from the control file, which is presented at a high bit rate. However, the control functions to be performed by said control unit do not require the use of a control unit with a high signal-processing speed, which means that a control unit with a high signal-processing speed, which is expensive, has to be used merely for reading in the control data.

It is an object of the invention to provide means enabling a comparatively cheap dedicated device for reading the record carrier to be obtained.

With respect to the record carrier this object is achieved in that the control data signal comprises packets of n identical control data bit groups, n being an integer greater than or equal to 2.

With respect to the method said object is achieved in that for deriving the control file a control data signal is employed which comprises packets of n identical control data bit groups each, n being an integer greater than or equal to two.

With respect to the device for recording said object is achieved in that the device comprises means for supplying a control data signal comprising n consecutive identical control data bit groups, n being an integer greater than or equal to two.

With respect to the device for reading said object is achieved in that the control unit comprises selection means for selecting m control data bit groups for each packet received, m being smaller than n.

Recording the control data in the control file as packets of identical control data bit groups substantially reduces the amount of control data becoming available per unit of time during reading. Selecting one bit group for each packet or a limited number of bit groups for each packet significantly reduces the required processing speed of the control unit while reading-in the control data, which enables a control unit having a low processing speed and thus a cheap control unit to be used.

An attractive embodiment of the device for reading the record carrier is characterized in that the selection means comprise clock extraction means for deriving a clock signal having a frequency related to the packet repetition frequency on the basis of one of the recovered signals, synchronization means for synchronizing the clock signals with the packets read, and means for reading-in at least one control data bit group per packet in synchronism with the clock signal.

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 273 of 431

A reliable synchronisation of the clock signal with the packets can be obtained by using an embodiment of the record carrier which is characterized in that the packets are arranged in frames in the control signal and the frames are arranged in data blocks of predetermined length, each block comprising a block synchronization section, each frame starting at a predetermined position relative to the block synchronization section.

An embodiment of a device for reading this record carrier is characterized in that the synchronizing means comprise a block synchronization detector, for detecting block synchronization sections in data blocks accommodating the data of the frames.

When the last-mentioned embodiment of the record carrier is used it is to be preferred to arrange bit groups not containing control data for controlling the reproduction at the beginning of every frame. This has the advantage that during read-in of the control data after detection of a block synchronization section some time expires before the control data to be read in becomes actually available. This makes it possible to effect the read-in of the control data under 'control of a microcomputer which can also be employed for other control tasks. With such a microcomputer it is customary to call a read-in control program in response to the detection of the block synchronization section. Such a call takes some time. However, this is not a drawback because the useful information becomes available only after a waiting time.

A reliable synchronization can also be obtained by means of an embodiment of the record carrier which is characterized in that the packets are arranged in frames, a plurality of consecutive frame synchronization bit groups being arranged at the beginning of each frame, which groups form a bit pattern which deviates from the bit patterns formed by the control data bit groups of the frame.

An embodiment for reading the record carrier is characterized in that the synchronization means comprise a frame synchronization detector for detecting frame synchronization bit groups situated at the beginning of each frame.

A very simple extraction of the clock signal is obtained when a record carrier is used which is characterized in that each control data bit group comprises a synchronization bit having a logic value, the logic values of consecutive control data bit groups alternating with a repetition pattern whose frequency is related to the frequency at which the packets recur.

The use of synchronization bits makes it possible to use a clock signal of a signal value corresponding to the logic value of the synchronizing bits, which results in a very simple clock signal generation.

A further embodiment of the record carrier is characterized in that to each frame bit groups for error-correction purposes are added, which bit groups are in a predetermined relation with the control data bit groups in the frame containing the control data for reproduction.

The use of such a record carrier makes it possible to detect whether the control data has been read in completely in the control unit. This is particularly advantageous when a control unit is used which comprises one microcomputer which in addition to the read in of control data serves to perform further control tasks. In that case the read-in process may be interrupted to perform another control task of higher priority.

However, this means that the control data is not read in completely, but this can be detected simply on the basis of the bit groups added for error-detection purposes. After such a detection a new read-out of the incompletely read-in control data can be initiated.

The invention will now be described in more detail, by way of example, with reference to Figures 1 to 31, in which

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 274 of 431

Figures la,lb and lc show a picture-storage system, a picture retrieval and reproduction system, and a simplified picture retrieval and reproduction system respectively,
Figure 2 shows a suitable format for recording picture information on a record carrier,
Figure 3 illustrates a suitable coding of picture information,
Figure 4 illustrates a suitable residual coding to be used for in the coding of picture information,
Figure 5 illustrates a suitable arrangement of the color information of a picture for a series of coded pictures of increasing resolutions,
Figure 6 shows a format of a subfile containing a residually coded picture,
Figure 7 shows a record carrier on which recorded coded picture lines have been arranged in a suitable manner,
Figure 8 shows a picture composed of picture lines,
Figure 9 illustrates a number of different picture processing functions,
Figure 10 shows an embodiment of a retrieval and reproduction system capable of displaying picture information in accordance with preferential reproduction settings,
Figure 11 shows a suitable format for recording preferential reproduction settings on the record carrier,
Figure 12 shows a suitable format for storing preferential reproduction settings in a non-volatile memory,
Figure 13 shows a mosaic picture composed of sixteen low-resolution images,
Figure 14 shows in greater detail an embodiment of the simplified picture retrieval and reproduction system,
Figure 15 shows an embodiment in which control data groups can be arranged in packets,
Figure 16 shows a data extraction circuit for use in the picture retrieval and reproduction system shown in Fig. 14,
Figure 17 shows in greater detail an embodiment of the picture storage system,
Figure 18 shows a recording unit for use in the picture storage system,
Figure 19 diagrammatically illustrates the CD-ROM XA format,
Figure 20 shows a suitable organisation of the record carrier if the picture information has been recorded in accordance with a CD-I format,
Figures 21, 23 and 24 show suitable configurations of picture lines of absolutely coded pictures for a number of different resolutions if the recorded information has been divided into blocks in accordance with a CD-I format,
Figure 22 shows a picture made up of picture lines to illustrate the configuration shown in Fig. 21,
Figure 25 shows an example of a picture processing unit,
Figures 26 and 27 illustrate picture processing functions to be performed by the picture processing unit,
Figure 28 shows an embodiment of a read device,
Figures 29 and 31 diagrammatically show examples of a simplified picture processing unit, and
Figure 30 illustrates the operation of the simplified picture processing unit shown in Figures 29 and 31.

Figure la shows a picture storage system 12 in which the invention can be used. The picture storage system 12 comprises a picture scanning unit 1 for scanning pictures on a picture carrier 3, for example a strip-shaped photographic negative or slide.

The picture scanning device 1 further comprises a picture coding unit for coding the picture information obtained upon scanning. The coded picture information is recorded on a record carrier 184 by means of a recording unit 5 under control of a control unit 4. Prior to recording the control unit 4 can apply an optional picture processing, for example to enhance, correct or edit the picture representation defined by the coded picture information. For this purpose the control unit may comprise picture processing means which are knownner se. The recording unit 5 may comprise, for example, an optical, a magnetic or a magneto-optical recording device. In view of the high- storage capacity of optical and magneto-optical record carriers it is preferred to use an optical or a magnetooptical recording device.The control unit 4 may comprise a computer system, for example a so-called "personal computer" or a so-called work station with suitable hardware and application software.

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 275 of 431

Figurelb shows a picture retrieval and reproduction system for retrieving and displaying representations of coded pictures stored on the record carrier 184 by means of the picture storage system 12. The picture retrieval and reproduction system 13 comprises a read unit 6 for locating and reading out selected coded pictures under control of a control unit 7. Representations of coded pictures thus read can be displayed on a picture display unit. Such a picture display unit may comprise a display screen 8, which for example forms part of the control unit 7, or an electronic image printer 9 for generating a hard copy 15 of a representation of the read-out coded picture.The picture retrieval and reproduction system 13 may further comprise an additional recording device
Sa, by means of which the coded picture information read by means of the read device 6, after an optional picture processing operation performed by the control unit 7 for the purpose of enhancement, correction or editing. The control unit in the picture retrieval and reproduction system 13 may comprise a computer system, for example a "Personal
Computer", or a work station with suitable hardware and application software. Although such a system is very suitable for the control task to be performed and the optional picture processing it has the drawback that it is comparatively expensive.

In general, it is desirable to have such an expensive computer system for the control unit in conjunction with the electronic image printer 9 because of the complexity of the control and picture processing functions. However, if it is merely desired to display selected coded pictures on a display screen, the computing capacity and storage capacity of a computer system in the form of a personal computer or work station are high in comparison with the control functions to be performed. In that case it is preferred to employ a simplified control unit with a limited computing and storage capacity and a limited data processing speed.

Figure lc shows such a simplified picture retrieval and reproduction system 14. This simplified system 14 comprises a display unit 10 and a picture retrieval and read unit 11 comprising the read unit 6. A control unit for controlling the retrieval and read operation and, if applicable, a limited picture processing can be accommodated in one of the units 10 and 11, but suitably in the unit 11. When the control unit is accommodated in the retrieval and read unit 11 it is possible to employ, amongst others, a standard TV set or monitor unit for the picture display device.

This is an advantage, in particular for consumer uses because the consumer then merely has to purchase the retrieval and read device to display the representations of the pictures.

As a result of their comparatively high cost the picture storage system 12 shown in Fig. la and the picture retrieval and reproduction system 13 shown in Fig. lb are particularly suitable for central uses, for example in photoprocessing laboratories.

For recording coded picture information it is preferred to record the information on the record carrier in a predetermined format and order. Figure 2 shows a suitable format and order, in which files containing coded picture information bear the referencesIP1, ..., IPn. Hereinafter the filesIP1, ...,IPn will be referred to as picture files. Moreover, a plurality of control files BB have been recorded. These files contain control data which is used for controlling the read-out of the coded picture information, for the purpose of performing optional picture processing operations on the picture information read and for the purpose of displaying representations of the coded picture information. It is to be noted that part of the control data may be included in the picture files.Preferably, this part of the control data is the part relating specifically to the control of the read-out, display and picture processing of the coded picture information contained in the relevant picture file. The advantage of this is that the required control data becomes available at the instant at which it is needed, i.e. at the instant at which the picture file is read.

Apart from the picture files Ip and the associated control files BB it may be desirable in a number of cases to record files with additional information, for example audio information or text information. Such audio

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 276 of 431

and/or text information may relate to, for example, coded picture information and can then be reproduced or displayed when the representations of the relevant coded picture information are displayed. The files with additional information are referenced ADD and may be recorded, for example, after the coded picture information.

For every picture stored the picture files contain a plurality of subfiles, which each define a representation of the same scanned picture, the resolutions of the representations defined by these coded pictures being different. In Figure 2 the different subfiles for the picture file IP1 bear the references TV/4, TV, 4TV,16TV, 64TV, 256TV.

The subfile TV defines a representation of the scanned picture with a resolution corresponding substantially to a standard NTSC or PAL TV picture. Such a picture may comprise, for example, 512 lines of 768 pixels each. The subfile TV/4 represents the scanned picture with a resolution which in the horizontal and the vertical direction has been reduced linearly by a factor of 2 relative to the resolution of the picture represented by the subfile TV. The subfiles 4TV, 16TV, 64TV and 256 TV define picture representations whose horizontal and vertical resolution has been increased linearly by a factor of 2, 4, 8 and 16 respectively. Preferably, the subfiles are arranged in such a way that the resolutions of the representations defined by the successive coded pictures increase (linearly) in steps of 2.During reproduction, when the consecutive subfiles are generally read successively, it is then simple to first display a representation of a picture of low resolution and, subsequently, to replace this representation wholly or partly by representations of the same picture of each time increasing resolution. This has the advantage that the waiting time before a picture representation appears on the display screen is minimized. Indeed, on account of the limited amount of information needed for this, the read-out time of a coded picture defining a low-resolution representation is short in comparison with the read-out time of encoded pictures defining higher-resolution representations.

A generally known representation of pictures is that in which the picture is composed of a matrix of small areas of constant luminance value and/or constant color value. In this representation it is customary to select the areas of constant color value to be larger than the areas of constant luminance value.

An area of constant color value will be referred to hereinafter as a color pixel and an area of constant luminance value will be referred to hereinafter as a luminance pixel. A row of color pixels of a width equal to the full picture width will be referred to hereinafter as a color picture line. A row of luminance pixels of a width equal to the full picture width will be referred to hereinafter as a luminance picture line. A picture represented by luminance picture lines and color picture lines can be defined simply by a coded picture by assigning to each luminance pixel and color pixel a digital code specifying the relevant luminance value and color values.

Figure 3 by way of illustration shows the structure of a picture of colorpixels and luminance pixels. The luminance pixels bear the reference signs (Y2,1; ...; YK- 1 R-I) The color pixels bear the reference signs(C1,1; ...;Cx.R). It is to be noted that in
Fig. 3, as is customary, the dimensions of the color pixels in the horizontal and the vertical direction is twice as large as the dimensions of the luminance pixels. This means that the resolution of the color information in the horizontal and the vertical direction is a factor of two lower than the resolution of the luminance information.

A suitable picture coding is that in which a digital code or digital codes is/are assigned to every luminance pixel and every color pixel, the code(s) defining the absolute value of the luminance component Y and the absolute values of the colourdifference components U and V respectively. Such a coding will be referred to hereinafter as an absolute picture coding. Preferably, representations of a number of low-resolution pictures are recorded as absolutely coded pictures. This enables the picture information to be recovered in a simple manner. This is particularly advantageous for the simplified picture retrieval and reproduction

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 277 of 431

system 14, because this enables the price of such a system, which is intended for the consumer market, to be kept low by the use of simple picture decoding systems.

The use of a picture file with a number of absolutely coded pictures of different resolutions simplifies the reproduction of representations of composite pictures, where a representation of a small low-resolution picture is displayed within the outline of a representation of a higher-resolution picture. The reproduction of such a representation of a composite picture is referred to as "Picture in Picture" (or "PIP"). Moreover, recording a plurality of absolutely coded pictures defining representations of the same picture with different resolutions simplifies the reproduction of enlarged representations of details of a coded picture. Such a function is also referred to as the TELE-function (or ZOOMfunction). The availability of absolutely coded pictures with different resolutions implies that for some of the TELE functions and PIP functions the required picture information is directly available and need not be derived by means of additional picture processing operations to be performed by complex circuits.

In the recording of picture information it is customary to record the coded pixels in rows (or lines) or sometimes in columns. Recording in lines is to be preferred because in the customarily used picture display units the picture information should be presented in the form of lines.

When the absolutely coded pictures are recorded in the subfilesTV/16,
TV/4 and TV it is preferred not to record consecutive coded picture lines contiguously.

Such method of arranging the recorded information is frequently referred to as "interleaving". The advantage of such a method is that if a comparatively great part of the information cannot be retrieved owing to defects of the disc or other causes, it reduces the likelihood that two adjacent picture lines in the representation of the coded picture are reproduced incorrectly. Representations with faults in adjacent picture lines are comparatively difficult to restore. This is not case with representations in which erroneously read pixels (or a picture line) are situated between two correctly read picture lines. In that case the erroneously read pixels (or picture line) can be replaced simply by pixels (or a picture line) derived from one or both adjacent picture lines.It is to be noted that erroneously read pixels can also be restored readily by the use of so-called errorcorrection codes. The correction of errors on the basis of such error-correction codes is comparatively intricate and is therefore less suitable for use in the simplified picture retrieval and reproduction system 14, in which the use of complex circuits should be avoided whenever possible in view of the resulting high cost.

In the case that the picture information is recorded on a disc-shaped record carrier with a spiral track the part of the track needed for recording a coded picture will occupy a plurality of turns of the spiral track. In view of a simple restoration of erroneously read picture lines it is then desirable that the coded picture lines defining adjacent picture lines in the representation of the picture to be reproduced do not adjoin each other neither in the track direction (also referred to as tangential direction) nor in a direction transverse to the track (also referred to as radial direction), which will be explained with reference to Figures 7 and 8.

Figure 7 shows a disc-shaped record carrier 70 on which picture 80 composed of consecutive picture lines 11, ..., ln has been recorded in a spiral track 71 in the form of a series of absolutely coded picture lines BLal, BLa3,BLa5, BLa7, BLa9,BLal 1, BLal3,BLa2, BLa4, .. . The absolutely coded picture lines BLal, ..., BLal3 represent the picture lines 11, ..., 113 respectively. The absolutely coded picture lines have been recorded in such a way that the information of consecutive picture lines is not contiguous neither in a radial nor in a tangential direction. The reference numeral 72 refers to an unreadable disc portion, also called disc defect. The defect shown extends over more than one turn of the spiral track 71.Since the coded picture lines defining adjacent picture lines of the representation do not adjoin one another neither radially nor tangentially this prevents coded picture lines which define adjacent picture lines in the representation from being read incorrectly as result of the occurrence of disc defects. It is to be noted that for the sake of clarity the length occupied by the coded picture lines BLa on the recording is shown to be substantially greater

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 278 of 431

than in reality. In practice, it occurs comparatively often that a disc defect occupies a plurality of consecutively recorded coded picture lines.In view of the requirement that adjacent picture lines should not be defined by adjacently recorded coded picture lines the order of the absolutely coded picture lines in the track depends strongly on the length of the turns of the spiral track and on the length required for recording an absolutely coded picture line. Arrangements suitable for recording absolutely coded picture lines will be described in more detail further on in the description.

For high resolutions the storage of absolutely coded picture information has the drawback that the amount of information to be recorded is very large. For such highresolution pictures a residual coding is very suitable. In such a residual coding differences between the signal value of the pixels of the high-resolution picture and the signal value of the corresponding part of the lower-resolution picture are determined and subsequently encoded.

To illustrate this coding method Fig. 4 shows one luminance pixel Y of a low-resolution picture and four luminance pixelsY1,1,; Y2,1,; Y1,2' andY2 2' of the corresponding higher-resolution picture in the case that the horizontal and the vertical resolution is increased by a factor of 2. Instead of the absolute luminance value of the luminance pixelsY1,1,, ...,Y2 2' the residual coding encodes differences (hereinafter referred to as residual values) between the luminance values of the luminance pixelsY, ,', . . ., Y2 2' and the luminance pixel Y. In this way the residual values of a complete picture can be determined both for the luminance and for the color information.As the number of residual values equal to zero or being very small is large in comparison with the number of large residual values a substantial data compression can be obtained by applying an additional coding in which the residual values are non-linearly quantized and are subsequently subjected to, for example, a Huffman coding.

A residually coded picture can be used as a basis for a new residual coding for a picture with further increased resolutions. Thus, by recording one absolutely coded low-resolution picture and a series of residually coded pictures of increasing resolutions in compressed form it is possible to record a plurality of coded pictures defining representations of the same picture with increasing resolutions. In the picture file IP1 shown in Fig. 2 the pictures in the subfiles TV/4 and TV are absolutely coded and the pictures in the subfiles 4Tv, 16TV, 64TV and 256TV are residually coded, with non-linear quantization and Huffman coding. Such a coded picture will be briefly referred to hereinafter as a residually coded picture.

The color information is also coded residually in a way similar to the luminance information. However, the horizontal and the vertical resolution of the consecutive residually coded color information increases by a factor of four instead of by a factor of two as with the luminance information. This means that a picture file containing only residually coded luminance information and no color information (4TV and 64TV) alternates with a picture file containing both residually coded luminance information and residually coded color information(16TV and 256TV), see Fig. 2. Leaving out the color information in the subfiles 4TV and 64TV reduces the required storage capacity and the access time to the coded picture information in the picture file.However, the absence of the color information in the subfiles 4TV and 64TV need not adversely affect the picture quality during reproduction. This is because during the reproduction of a representation of a coded picture for which no color information has been recorded the color information of the next coded picture defining a representation of higher resolution or the color information of the preceding coded picture defining a representation of lower resolution can be utilised. In order to reduce the total access time to the required picture information it is to be preferred to record the color information U, V in the subfiles 16TV and 256TV contiguously to the luminance information Y in the subfiles 4TV and 64TV, as is illustrated for the file IP* in Fig. 2. An even shorter access time to the required highresolution color information is obtained if the color information in the subfiles 16TV and 256TV is divided into a portion U*, V* and a portion U',-V', the portion U*, V* defining color information having a horizontal and vertical resolution which is twice as low as the resolution represented by U*, V* and U', V' together. This is possible, for example, in that for a picture the coded color information of one of the four available pixels of the picture is first recorded in U*, V* and subsequently the coded color information of the other pixels

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 279 of 431

of the picture is recorded, as is illustrated in Figure 5.In this Figure the color pixels belonging to U*, V*(UV11; Guv31; Us51; ...) are represented as shaded blocks and the color pixels belonging to U', V' (UV21;UV41, ...,UV12; UV22; UV2) are represented as non-shaded blocks. The information U*, V* in16Tv and 256TV defines the color information with a horizontal and vertical resolution which is half the resolution of the luminance information defined by the subfiles 4TV and 64TV respectively.Thus, the luminance information in the subfile 4TV and 64 TV respectively together with the color information U*, V* in the subfiles16Tv and 256TV respectively again define a representation whose horizontal and vertical resolution of the color information is equal to half the resolution of the luminance information.This means that the ratio between the resolution of the color information and the luminance information of a representation defined by the combination of the luminance information of a subfile 4TV and 64TV and the color information U*V* of a subfile 16TV and 256TV respectively is equal to the ratio between the resolution of the color information and the luminance information of the representations defined by the subfiles TV/4, TV, 16TV and 256TV as a total, so that representations of all the stored coded pictures with the same resolution ratio between color and luminance information can be displayed.

However, it is to be noted that during the reproduction of the representation of the coded picture recorded by means of the subfile 4TV it is also possible to use the color information of the subfile TV or the complete color information of the subfile16TV.

As already stated, it is customary to record the coded pixels line by line.

When the residual coding described above is used, using a non-linear quantization and Huffman coding, the residual values are represented by means of codes of varying length. This means that the space required for recording the residually coded picture lines is variable. Therefore, the position at which the beginning of the residually coded picture line is recorded is not unambiguously defined by the beginning of recording of the first coded picture line of a coded picture. This complicates the selective read-out of the coded picture lines, for example only those coded picture lines needed to carry out a TELE function. This problem can be mitigated by recording a line number LN (see Fig. 6) at the beginning of each coded picture line BL and line synchronization code LD.The line synchronization code may be, for example, a unique bit combination which does not occur within the series of Huffman codes representing information of the residually coded picture elements. It is to be noted that the addition of the line synchronization codes LD and line numbers LN has the additional advantage that it facilitates the read synchronization and significantly reduces error propagation after an erroneously read residual code.

A very fast retrieval of selected coded picture lines can be achieved in that the addresses at which the recordings of coded picture lines on the record carrier begin are recorded on the record carrier in a separate control file, preferably at the beginning of each subfile. In Fig. 6 these addresses have been indicated, by way of example, asADLN#1, ..., ADLN#1009 in the control fileIIDB at the beginning of the subfile 4TV.

The picture line information in the form of the series of residually coded picture lines is inserted in the section APDB of the subfile 4TV. (The section APDB represents the actual picture information within the subfile 4TV).

Generally, when searching for the starting points of the picture lines on the record carrier during a coarse search process a read element is moved relative to the record carrier to a position at a short distance before the starting point where the recording of the coded picture line begins. Subsequently, a fine search process is carried out in which, while the record carrier is scanned with a speed corresponding to the normal read speed, the beginning of the recording of the selected residually coded picture line is awaited, after which reading of the selected coded picture line is started The accuracy with which the read element can be positioned relative to the record carrier during the coarse search process is limited and in optical data storage systems it is generally much greater than the distances between the positions at which the

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 280 of 431

recordings of successive coded picture lines on the record carrier begin. Therefore, it is preferred to store only the start addresses of a limited number of coded picture lines whose starting points of recording are spaced apart by a distance substantially equal to the accuracy with which the read element can be positioned during a coarse search process. This enables the information of selected coded picture lines within a stored coded picture to be located and read rapidly without an unnecessarily large amount of space being needed for the storage of address data.In the case of a disc-shaped record carrier the average search accuracy during a coarse search process, in which the read element is radially moved over the disc, is by definition equal to half the length of one turn of the disc, which means that the distances between the positions specified by addresses substantially correspond to half the length of one turn of the disc when disc-shaped record carriers are used.

The stored coded pictures generally define a number of pictures in landscape format (i.e. for a faithful reproduction the picture should be displayed in an orientation in which the width of the picture is larger than the height of the picture) and a number of pictures in portrait format (i.e. for a faithful reproduction the picture should be displayed in an orientation in which the height of the picture is larger than the width of the picture).

By way of illustration Figure 1 shows an image carrier with some pictures in landscape format (2a, 2b, 2c and 2d) and one picture in portrait format (2e). On the record carrier all the coded pictures are recorded as though they were representations of pictures in landscape format. This is in order to enable a uniform picture scanning to be used without the necessity to detect whether the scanned picture is of the landscape or portrait type and to change over the scanning and/or picture processing depending upon the detection result. However, this means that during reproduction the representations of portrait size pictures will be displayed in an incorrect rotated position. This can be precluded by providing a possibility to assign a rotation code to the recorded coded pictures, which code indicates whether the representation should be rotated during reproduction and, if this is the case, whether the representation should be rotated through an angle of 90, 180 or 270 degrees. This rotation code can be included in every picture file IP1, ...,Ipn. It is also possible to record these rotation codes in the control file BB or to store these rotation codes in a non-volatile memory arranged in the read unit or connected to this unit.

During reproduction it is then possible to determine on the basis of the rotation code whether the representation to be displayed should be rotated and, if this is the case, a rotation through the desired angle can be performed prior to reproduction. A drawback of including the rotation codes in the picture files IP is that these rotation codes have to be determined already during scanning of the pictures. In practice this means that an operator of the picture storage system should determine for each scanned picture whether the stored picture is to be rotated during reproduction, because the known auxiliary devices are not always capable of detecting whether a scanned picture is of landscape or portrait size and whether the picture is presented to the scanning unit with the correct orientation.This is undesirable in particular because it implies that an operator must be present during recording, which makes it difficult to realise a fully automated picture storage system 12.

If the rotation codes are already available during recording of the coded picture information it will be advantageous to record these codes on the record carrier. In the case of the file organisation shown in Fig. 2 a suitable position for recording the rotation codes is the subfile FPS of the control fileBE. For reasons of user convenience it is desirable to specify, apart from the required rotation, wether instead of a representation of stored coded pictures a representation which is slightly shifted (to the left, right, top or bottom) should be displayed. This is certainly desirable if the display area within which the representation is to be displayed in a display unit is smaller than the dimensions of the representations, because it is possible that an important detail of the picture falls outside the display area.The desired shift can be specified by assigning a translation code to every coded picture. In Figure 9 a suitable translation coding for a picture 90 is defined by means of the coordinates xp and yp of a vertex 91 of the picture 91 to be displayed after translation. By means of a translation code and a magnification code it is possible to specify

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 281 of 431

the magnification factor with which a certain part of the original picture is to be displayed. The reference numeral 93 indicates an enlarged representation of a part of the picture 90, defined by a translation xp, yp and a magnification factor of 2.In addition to the above data it is also possible to include other picture display data in the subfile FPS of the control fileBE, such as for example parameters specifying a color or luminance adaptation to be applied before a representation of the coded picture is displayed.

Moreover, it is advantageous to store the desired sequence in which the pictures must be reproduced in the subfile FPS within the control fileBE.

The afore-mentioned information about the display sequence, rotation, translation, magnification, brightness and color adaptations and other picture processing operations to be performed prior to reproduction of the representation of the coded picture will be referred to hereinafter as preferential reproduction settings. A collection of preferential reproduction settings defining the preferred sequence as well as all the desired picture processing operations for all the coded pictures on a record carrier will be referred to hereinafter as a set of preferential reproduction settings. It may be advantageous to record more than one set of preferential reproduction settings in the file FPS. This enables a different display sequence and other picture processing operations to be selected by different persons, for example persons within a family.It also allows a user to make a choice from different sets of preferential reproduction settings. It is to be noted that when a record carrier of the write-once type is used the sets of preferential reproduction settings can be recorded on the record carrier only if they are available during recording. This requires human intervention during recording. During reading of the record carrier a set of preferential reproduction settings is selected and the representations of the coded pictures can be displayed in conformity with the selected set of preferential reproduction settings.

Figure 10 is a block diagram of an embodiment of a picture retrieval and display system by means of which representations of coded pictures can be displayed in conformity with a selected set of preferential reproduction settings. In this diagram the reference numeral 100 refers to a read unit for reading the record carrier. For the purpose of applying the information being read the read unit 100 is coupled to a control and signal processing unit 101. From the information received from the read device 100 the unit 101 selects the file
FPS containing the set(s) of preferential reproduction setting(s) and stores this (these) set(s) in a control memory 102.By means of a data entry unit 103, for example a remote control device, a user can select a set from the control memory 102 and can subsequently activate the unit 101 to start the read cycle, in which the coded picture information is read in the sequence specified by the selected set of preferential reproduction settings under control of the unit 101. After the coded picture information has been read out this information is processed in accordance with the selected set of preferential reproduction settings and is applied to a display unit 104.

It may occur that after some time the preferential reproduction settings stored on the record carrier are no longer entirely in compliance with the user's wishes or that no or wrong preferential reproduction settings have been recorded on the record carrier. This is problematic in particular if the record carrier is of a type which cannot be overwritten, because the recorded preferential reproduction settings then cannot be adapted.This problem can be mitigated by providing the retrieval and display system in
Fig. 10 with a non-volatile memory 105 in which together with a record carrier identification code a new set of preferential reproduction settings or information about the desired changes of the preferential reproduction settings relative to the set of preferential reproduction settings recorded on the record carrier is stored for the record carrier specified by means of the record carrier identification code. In view of the limited storage capacity of the non-volatile memory 105 it is desirable to record the information necessary for the preferential reproduction settings in a most compact form, for which reason it is preferred to record the information about the changes of the preferential reproduction settings.

Fig. 11 shows by way of example a suitable format 110 of the preferential reproduction settings included in

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 282 of 431

the file FPS on the record carrier. The format 110 comprises a section DID in which the unique record carrier identification code is stored.

Such a code may comprise a large random number generated by means of a randomnumber generator and recorded on the record carrier. The code may comprise a time code indicating the time in years, months, days, hours, minutes, seconds and fractions of seconds. Alternatively, the record carrier identification code may comprise a combination of a time code and a random number. In the format 110 the section DId is followed by sections FPS1, FPS2, ..., FPSn in which a number of different sets of preferential reproduction settings are stored. Each of the preferential reproduction setting sectionsFPS ..., FPSn contains a portion SEL in which a set identification number for each of the different sets of preferential reproduction settings to be selected by different users are specified, and a portion specifying the sequence SEQ in which the representations of the stored pictures are to be reproduced. This portion is followed by the coded sections FIM#1, ..., FIM#n storing for the pictures 1, ..., n preferential processing operations to be performed before the representation of the relevant picture are displayed.

Fig. 12 shows by way of example a suitable format 120 in which the information about the desired adaptations of the set of preferential reproduction settings can be stored in the non-volatile memory 105. The format 120 comprises a section 121 specifying combinations of record carrier identifications and set identification numbers for which information about preferential reproduction settings has been stored. To each of these combinations a pointer is assigned, which pointer is included in the section DIDPOINT and specifies the address of the sections DFPSI, ..., DFPSn in the non-volatile memory 105.

Every section DFPS comprises a portion LSEQ with a code indicating the space (for example in numbers of bytes) required to specify the new sequence. If the portion LSEQ indicates a length not equal to zero LSEQ will be followed by a portion
NSEQ with the data specifying the new display sequence. After NSEQ the new preferential processing operations are specified for every picture with modified preferential processing operations. ROT indicates the section with the rotation code. The sections LTELE and
LPAN specify the length available for the storage of the new data relating to picture magnification (in a sectionNTELE) and picture translation (in a section NPAN). In this way it is possible to select the accuracy with which the picture processing information is to be stored.Thus, it is possible, for example, to define three different lengths indicating three different accuracies. LTELE and LPAN are followed by the portions NTELE and
NPAN. If the information about the picture magnification and picture translation need not be changed this is indicated by the length zero in LTELE and LPAN. By storing only the preferential processing operations for pictures with modified preferential processing operations the space required for the storage of the new preferential reproduction setting is reduced considerably. Apart from the reduction of the required storage space by said recording of the differences it is possible to obtain an additional reduction by specifying the length required for the storage of modified data.When the record carrier is read an adapted set of preferential reproduction settings is derived from the preferential reproduction settings recorded on the record carrier and the differences stored in the memory 105, and this adapted set is stored in the memory 102.

Instead of, or in addition to, the non-volatile memory 105 a changeable memory 106, for example in the form of a magnetic card, EPROM, EEPROM or
NVRAM, can be employed for the storage of preferential reproduction settings in the retrieval and display system shown in Fig. 10.

This has the advantage that a user can display the picture information on a record carrier in accordance with the same preferential reproduction setting on different picture retrieval and display systems to which a changeable memory 106 can be connected.

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 283 of 431

When one of the two or both memories 105 and 106 are used for the storage of preferential reproduction settings it is desirable that a selection is made from the different sets of preferential reproduction settings defined by the sets of preferential reproduction settings on the record carrier and by the modifications of the preferential reproduction settings stored in the memories 105 and 106. For this purpose the unit 101 should comprise selection means. These selection means may be of a type which are operated by the user to make a choice from the various sets of preferential reproduction settings defined for one specific record carrier and selection number by the preferential reproduction setting information stored on the record carrier and in the memories 105 and 106.However, alternatively these selection means may be of a type which, prior to reproduction on the basis of the contents of the memories 105 and 106 and the sets of preferential reproduction settings recorded on the record carrier, determine the sets of preferential reproduction settings available for the relevant record carriers and store them, for example, in the memory 102. Subsequently, one of the available sets of preferential reproduction settings in the memory 102 is selected in accordance with a predetermined selection criterion. Preferably, the selection criterion is such that the highest priority is assigned to the preferential reproduction setting information in the changeable memory 106, medium priority to the preferential reproduction setting information in the nonvolatile memory, and the lowest priority to the preferential reproduction settings on the record carrier.If the unit 101 comprises a computer, automatic selection can be realised by loading the computer with a suitable selection program.

Now reference is made again to the file OV in Fig. 2, which for all the picture files IP1, ..., IPn comprises a subfile TV/16 containing an absolutely coded low resolution picture. Recording a file OV has the advantage that an overview of the coded picture information recorded on the record carrier can be obtained with a minimal access time. This is possible, for example, by successively by displaying the coded pictures in thesubffie TV/16 as representations which wholly or partly fill the display screen, preferably in the sequence defined by the selected set of preferential reproduction settings.However, it is also possible to compose a representation in the form of a so-called mosaic picture from the subfiles, in which mosaic picture a large number of representations of the coded low-resolution pictures contained in the subfiles TV/16 are arranged in the form of a matrix, preferably in an order dictated by the selected set of preferential reproduction settings. By way of illustration Fig. 13 shows a mosaic picture 130 made up of the representations(IM#1, IM#3, ..., IM#26) of sixteen low-resolution subfile pictures.

Fig. 14 shows an embodiment of the picture retrieval and display system of
Fig.lc in more detail. In the present system the picture retrieval and read unit 11 comprises the read unit 6, a control unit 140 and a picture processing unit 141. The read unit 6 supplies the information read from the record carrier to the control unit 140 and to the picture processing unit 141 via a signal path 142. The control unit 140 then selects specific information contained in the control files BB and IIDB from the information read.

The picture processing unit 141 selects picture information from the information read and converts this picture information into a form suitable for the display unit 10. The read unit 6 and the picture processing unit 141 are controlled by the control unit 140 on the basis of the data entered by a user, for example via a data entry unit 143, and on the basis of the control data in the control files BB and IIDB.

In view of the large amount of information for every recorded picture it is preferred to read files containing picture information with a high speed, i.e. with a high bit rate, in order to minimize the read time per picture read. However, this means that the data in the control file is also read with a high bit rate. The control task is performed by the control unit 140. This control task requires only a limited data processing rate, enabling a simple slow low-cost microcomputer having a low data processing rate to be used for this purpose. However, in general such a low-cost microcomputer is not capable of processing the control data which is supplied at a high rate during read-out of the control files BB and IIDB.This is because the rate at which the control data is presented (which rate is substantially equal to the picture information rate) is too high to enable it to be processed by the slow low-cost computer. This problem can be mitigated in that

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 284 of 431

every bit group containing control data is recorded n times (n being an integer greater than or equal to 2) in succession on the record carrier. A group of n times repeatedly recorded bit groups will be referred to hereinafter as a packet. Packets of n identical bit groups are then supplied when the control data is read. Fig. 15 by way of example illustrates the manner in which the control data in the control files BB andIIDB can be supplied by the read unit 6 in the case that n is equal to 2 and the number of bits per bit group is 8.

In Fig. 15 the bit groups bear the reference numeral 150 and the packets bear the reference numeral 151. The number of bits per bit group is eight and the number of bit groups per packet is two.

By repeating identical bit groups n times it is achieved that the rate at which the control data is supplied by the read unit is reduced by a factor of n without the use of additional auxiliary functions. By a suitable choice of the value of n it is thus possible to reduce the rate at which the control data is applied to the slow microcomputer system of the control unit 141 to such an extent that it can be handled by the slow microcomputer system 144. Between the signal path 145 and the microcomputer system 144 a data extraction circuit 145 can be arranged to supply each of the packets 151 of control data to the microcomputer system 144 as one bit group at a rate equal to the bit group repetition rate divided by n.

Such a data extraction circuit 145 may comprise, for example, a register 160 (see Fig. 16a) which is loaded with a clock frequency equal to the bit group repetition rate divided by n. This clock signal can be obtained very simply by using one bit within each bit group 150 as a synchronization bit 152. To the synchronization bits 152 of successive bit groups 150 a logic value may be assigned which alternates with a frequency related to the repetition rate of the packets 151 of bit groups 150. The alternation frequency may be equal to half the repetition rate of the packets (as shown in Fig. 15) or a multiple thereof.

This has the advantage that a clock signal can be used which is derived directly from the synchronization bits.

The data extraction circuit 145 comprises a clock extraction circuit 161 which supplies an alternating clock signal corresponding to the alternating logic values of the synchronization bits to a load control input of the register 160. The register 160 is of a customary type which is loaded with a bit group of each packet 151 under control of the clock signal. The clock extraction circuit 161 also transfers the clock signal to the microcomputer system 144 via the signal line 162. Preferably, the bit groups in the control file are arranged in so-called frames, which bear the reference numeral 154 in Fig. 15. In that case it is desirable that the beginning of each frame 154 can be detected simply.A very simple detection can be achieved by inserting at the beginning of the frames 154 a plurality of frame synchronization groups 153 with synchronization bits 152 which exhibit a predetermined pattern of logic values 150 which differs distinctly from the possible patterns of logic values of the synchronization bits 152 which can occur in the other packets.

Each frame 154 has a portion 155 containing redundant information for the purpose of detecting whether the frame has been read-in correctly by the microcomputer 144. An incorrect read-in may be caused, for example, by a program interrupt, in which the process of reading in the control data is interrupted in order to carry out another control program. Such a control program can be called, for example as a result of the input of data in the data entry unit 143, in order to fetch the entered data from the data entry unit 143. Since an incorrect read-in of data from the control files BB and IIDB is generally caused by a program interrupt this requires that the error correction performed on the basis of the portion 155 is carried out by the microcomputer 144 itself.The data extraction circuit 145 comprises a frame synchronization detector 163 which detects the beginning of each frame on the basis of the synchronization bits 152 in the frame synchronization bit groups 153. After detection of the beginning of the frame the frame synchronization detector 163 supplies a synchronization signal to the microcomputer 144 via a signal line 164. Under control of the signals received via the signal lines 164 and 165 the microcomputer 144 reads in the control data available in the register 160 in an, in principle, customary manner. It is to be noted that, in principle, the functions of the frame synchronization detector 163 and/or the register 160 and/or the clock extraction

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 285 of 431

circuit 161 can also be performed by the microcomputer 144 itself.

In the above described process of reading in the control data from the control files BB and IIDB the clock signal for the register 160 is derived from the synchronization bits 152. However, it is also possible to derive the clock signal for loading the register 160 from a picture information clock signal which is usually generated in the picture processing unit 141 for the purpose of reading in the coded picture information.

This picture information clock signal has a fixed relationship with the bit group repetition rate in the read-out picture files and, consequently, with the bit group repetition rate in the control files BB andIIDB. This is because the control files and picture files have been formatted and coded in the same way. Therefore, the clock signal for loading the register 160 can be derived simply from the picture information clock signal by means of a frequency dividing circuit.

Fig. 16b shows an example of the data extraction circuit 145, which employs a frequency divider 165 for deriving the clock signal for the register 160, which divider derives the clock signal from the picture information clock signal, which is applied to the frequency divider 165 by the signal processing unit 141 via a signal line 166. The clock signal for loading the register 160 must be synchronized with the beginning of the frames 154. This can be realized simply by employing a resettable counting circuit for the frequency divider 165, which counting circuit is reset each time by a reset signal generated upon detection of the beginning of the frames. The reset signal can be the signal supplied by the frame synchronization detector 163 via the signal line 164 in response to every detection of the frame synchronization bit groups 153.

In the case that the information in the control files is arranged in blocks, for example in a manner which is customary with CD-ROM and CD-ROM XA and which will be described hereinafter with reference to Fig. 19, the reset signal for the counter can be derived on the basis of the block synchronization sections (SYNC) situated at the beginning of each block (BLCK). However, this requires that the beginning of each frame 154 is always situated at a fixed position relative to the block synchronization section (SYNC).

This can be achieved simply by selecting the beginning of each frame 154 at the beginning of a block. In the last described method of synchronizing the clock signal for the register 160 no use is made of the frame synchronization bit groups 153 situated at the beginning of each frame 154. However, in that case it is also desirable that the beginning of each frame 154 comprises a number of bit groups not containing any control data. Indeed, upon detection of the beginning of each frame the microcomputer calls a read-in program for controlling the read-in of the applied control data. However, at this instant the microcomputer may be busy performing another control task. Such a control task must be interrupted before the read-in program can be called. This interruption of an active control task and the subsequent call for the read-in program requires some time.Arranging a number of bit groups without any control data at the beginning of each frame 154 ensures with a high reliability that during read-out of the first packet 151 of useful control data in each frame 154 the microcomputer 144 is ready to read in the control data under control of the read-in program. From the above it is evident that the synchronization bit groups 153 at the beginning of every frame may serve a dual purpose, i.e. providing synchronization and realizing a waiting time until the first useful control data is presented.

In the case that the bit groups 153 are used only for realizing the waiting time the logic values of the bits in these bit groups 153 may assume an arbitrary value.

If the bit groups 153 are also used for synchronization purposes it is important that the bit groups 153 exhibit a bit pattern which does not occur in the other bit groups of the frame 154. For this purpose numerous different methods are possible, such as for example the use of non-identical bit groups in a packet or the insertion of additional packets without useful control information between the packets of control data. The lastmentioned method may be, for example, to insert packets comprising only bits of the logic value "0" after every ten packets. When a group of, for example, thirty-two frame synchronization bit

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 286 of 431

groups 153 comprising only bits of the logic value "1" is used, this will guarantee that the pattern formed by the frame synchronization bit groups 153 does not occur in the other packets of the frame 154.

Fig. 17 shows an embodiment of the picture storage system 12 in greater detail. The scanning unit 1 in Fig. 17 comprises a scanning element 170 for scanning the image carrier 3 and for converting the scanned picture information into customary information signals, for example RGB picture signals, representing the scanned picture.

The picture signals at the output of the scanning element define the highest attainable resolution in number of pixels per picture. The information signals supplied by the scanning element 170 are converted into a luminance signal Y and two color-difference signals U and V by means of a customary matrix circuit 171. A coding circuit 172 converts the signals Y, U and V in a customary manner into absolutely coded signals (for the lower-resolution pictures) and residually coded pictures (for the higher-resolution pictures) in accordance with the coding schemes described hereinbefore. The scanning element 170, the matrix circuit 171 and the coding circuit 172 are controlled by means of a customary control circuit 174 on the basis of control commands applied to the control circuit 174 by the control unit 4 via an interface circuit 175.The absolutely and residually coded picture information generated by the coding circuit 172 is applied to the control unit 4 via the interface circuit 175. The control unit 4 may comprise a computer system comprising a display unit 176, a computing and storage unit 177 and a data entry unit 178, for example a keyboard, for data input by the user. In a customary manner the display unit 176 and the data entry unit 178 are coupled to the computing and storage unit 177. The computing and storage unit 177 is further coupled to the picture scanning unit 1 and the recording unit 5 via an interface circuit 179 and 180 respectively.The recording unit 5 comprises a formatting and coding unit 181 which converts the information to be recorded, which information is received from the control unit via an interface circuit 182, into codes which are suitable for recording and which are arranged in a format suitable for recording.

The data which has thus been coded and formatted is applied to a write head 183, which records a corresponding information pattern on the record carrier 184. The recording process is controlled by a control circuit 185 on the basis of the control commands received from the control unit 4 and, if applicable, address information indicating the position of the write head 183 relative to the record carrier 184.

The storage and control unit 177 is loaded with suitable software to arrange the residually coded picture information supplied by the scanning unit 1 in a customary manner in accordance with the afore-mentioned formatting rules and to compose the picture files IP and OV. Moreover, the computing and storage unit 177 has been loaded with software for inserting in the control file, in a customary manner and in accordance with the afore-mentioned formatting rules, the preferential reproduction settings input by an operator together with other automatically generated control data, such as for example a list of addresses at which the various files have been recorded on the record carrier 184.

The computing and storage unit 177 may further have picture processing software enabling the scanned picture information to be processed, for example for the purpose of error correction, such as for example out-of-focus correction and grain removal, or for the purpose of color adaptation or brightness adaptation of the picture.

The files composed by means of the computing and storage unit 177 are applied to the recording unit 5 in the desired sequence in order to be recorded.

Very suitable combinations of a record carrier 184 and a recording unit 5 have been described in detail inter alia in European Patent Applications no. 88203019.0 (PHQ 88.001), 90201309.3 (PHQ 89.016), 8900092.8 (PHN 12.398), 8802233.8 (PHN 12.299), 8901206.3 (PHN 12.571), 90201094.1 (PHN 12.925), 90201582.5 (PHN 12.994), 90200687.3 (PHN 13.148), 90201579.1 (PHN 13.243), and Dutch Patent Applications no.8902358 (PHN 13.088) and 9000327 (PHN 13.242). The record carrier described therein

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 287 of 431

is eminently suited for recording information in accordance with a CD format. A recording device for recording the files on such record carrier is shown diagrammatically in Fig. 18.The shown recording device comprises a formatting circuit 186, which composes the information to be recorded, which has been applied via the interface circuit 182, in accordance with a formatting scheme, for example as customary in the so-called CD-ROM or CD-ROM XA system.

By way of illustration this format is shown broadly in Fig. 19. In accordance with this format the data is arranged in blocks BLCK of a length corresponding to the length of a subcode frame in the CD signal. Each block BLCK comprises a block synchronizing section SYNC, a header section HEAD containing an address in the form of an absolute time code corresponding to the absolute time code in the subcode portion recorded with the block, and if the CD-ROM XA format is used the block BLCK further comprises a subheader section SUBHEAD containing inter alia a file number and a channel number. In addition, each block BLCK comprises a DATA section containing the information to be recorded. Each block BLCK may also comprise a section EDC & CC containing redundant information for the purpose of error detection and error corrections.

The recording unit 5 shown in Fig. 18 further comprises a CIRC coding circuit 187 for interleaving the information and for adding parity codes for the purpose of error detection and error correction (hereinafter also referred to as error correction codes). The CIRC encoding circuit 187 performs the above-mentioned operations upon the formatted information supplied by the formatting circuit 186. After these operations have been performed the information is applied to an EFM modulator 188, in which the information is given a form which lends itself better for recording on the record carrier. Moreover, the EFM modulator 188 adds subcode information, which includes inter alia an absolute time code as address information in the so-called subcode Q channel.

Fig. 20 shows an organization of the record carrier in the case that the information has been recorded in the track 20 in accordance with the CD format described above. Parts corresponding to the organization shown in Fig. 2 bear the same reference numerals.

The recorded information is preceded by a lead-in section LI (also referred to lead-in track), as customary in the recording of CD signals, and is terminated with a customary lead-out section LO (also referred to as lead-out track).

When the information is recorded in CD format it is preferred to include in the control file BB a section recorded in accordance with the CD-I standard. These sections are the "Disk Label & Directory", referenced DL, and the so-called application programs, referenced AF. This enables the recorded picture information to be displayed by means of a standard CD-I system. Preferably, a subfile FPS with the sets of preferential reproduction settings is also included in the application program section AF. In addition to the sections DL and AT the control file BB comprises a subfile IT comprising a section CNTR with control data and a section FPS with the sets of preferential reproduction settings in the format already described with reference to Fig. 15. Preferably, the section IT is recorded in a predetermined area on the record carrier in a section of predetermined length.This is in order to simplify retrieval of the required information by the microcomputer. If the section IT is not large enough to accommodate all the control data a part of the control data can be recorded in a section ITC after the file OV. In that case it is preferred to include a pointer in the section IT to specify the starting address of ITC.

For the case that the information has been recorded in CD format Fig. 21 shows for the absolutely coded subfile TV such an arrangement of the picture lines Y01, Y02, ..., Y16 with absolutely coded luminance information and the picture lines C01, C03, ..., C15 with absolutely coded color information, that successive lines do not adjoin each other in the track direction (also referred to as tangential direction) and in a direction transverse to the track (also

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 288 of 431

referred to as radial direction).

Fig. 22 shows the positions of the picture lines for the associated picture representation. As is shown in Figs. 21 and 22, a number of odd coded luminance picture lines (Y01, Y03, ..., Y15) with coded luminance information are recorded in a section comprising the blocks BLCK #1, #2 and #3, subsequently a number of even coded color picture lines (C01, C05, ..., C13) with coded color information are recorded in a section comprising the blocks BLCK #4 and #5, then the even coded luminance picture lines(Y02, ..., Y16) with coded luminance information are recorded in a section comprising the blocks BLCK #5, ..., #8, and finally the coded even color picture lines (C03, C07,
C15) with coded color information are recorded in a section comprising the blocks BLCK #8 and #9.The coded picture lines in the blocksBLCK#1, ..., BLCK#9 define a contiguous part of the picture representation shown in Fig. 22. A group of sections defining a contiguous part of the representation will be referred to hereinafter as a section group. In a manner similar to that described above, section groups define other contiguous parts of the representation in the subfile TV. The coded picture lines with picture information for the subfiles TV/4 andTV/16 can be arranged in a similar way, as is shown in Figs. 23 and 24.

This arrangement prevents two or more adjacent picture lines in the representation of the read coded picture from being read incorrectly as a result of disc defects. The restoration of representations of pictures in which incorrectly read picture lines adjoin each other is very difficult to realize. This is in contradistinction to the restoration of an incorrectly read picture line situated between two properly read picture lines in the representation. In the last-mentioned case restoration is simple by replacing incorrectly read picture lines by pixels derived from adjacent picture lines.

Fig. 25 shows the picture processing unit 141 in greater detail. The picture processing unit 141 comprises a first detection circuit 250 for detecting the synchronization codes LD and the picture line numbers LN indicating the beginning of each residually coded picture line. A second detection circuit 251 serves for detecting the beginning of each subfile in each picture file with a residually coded picture to indicate the beginning of the sectionIIDB containing the addresses of a number of coded picture lines. It is to be noted that the detection circuits 250 and 251 are needed only for processing the residually coded pictures and not for processing absolutely coded pictures. For the purpose of these detections inputs of the first and the second detection circuit 250 and 251 are connected to the signal path 142.A decoding circuit 252 for decoding the residually coded picture information and a control circuit 253 for controlling the picture processing operation are connected to the signal path 142. The signal path 142 and outputs of the decoding circuit 252 are connected to data inputs of a picture memory 255 via a multiplex circuit 254, to store the read and decoded picture information. Data outputs of the picture memory 255 are connected to the inputs of the decoding circuit 252 and to the inputs of the multiplex circuit 254. The control circuit 253 comprises an address generator 256 for addressing the memory locations in the picture memory 255. The picture processing unit 141 further comprises a second address generator 257 for addressing the memory locations in order to output the content of the picture memory to a signal converter 258.The signal converter 258 is of a customary type which converts the picture information read from the picture memory 255 into a form suitable for application to the picture display unit 10. The decoding circuit 252 may comprise, for example, a Huffman decoding circuit 261a controlled by the control unit 253 and an adder circuit 259. The Huffman decoding circuit 261a decodes the information received via the signal path 142 and subsequently supplies this decoded information to one of the inputs of the adder circuit 259. Another input of the adder circuit 259 is connected to the data outputs of the picture memory 255. The result of the adding operation performed by the adder circuit 259 is applied to the multiplex circuit 254. The control circuit 253 is coupled to the control unit 140 via a control signal path 260. The control circuit 253 may comprise, for example, a programmable control and computing unit. Such a control and computing unit may comprise, for example, a dedicated hardware unit or a microprocessor system loaded with suitable control software, by means of which on the basis of control commands received via the control signal path 260 the address

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 289 of 431

generator 256 and the multiplex circuit 254 are controlled in such a way that a selected portion of the picture information applied via the signal path 142 is loaded into the picture memory. The information thus stored in the picture memory 255 is read with the aid of an address generator 257 and is subsequently applied to the display unit 10 via the signal converter258 in order to be displayed.

In Fig. 26 the reference numerals 261, 262, 263 denote picture representations of the same picture but with different resolutions. The representation 261 comprises 256 picture lines of 384 pixels each. The representation 262 comprises512 picture lines of 768 pixels each and the representation 263 comprises 1024 picture lines of 1536 pixels each. The coded pictures corresponding to the representations 261, 262 and 263 are included in consecutive subfiles TV/4, TV and 4TV of a picture file IP. The capacity of the picture memory 255 shown in Fig. 26 is 512 rows of 768 memory locations (also called memory elements).If a representation should represent the entire coded picture that subfile is selected from the picture file IP, whose number of pixels corresponds to the capacity of the picture memory, which in the present case is the subfile defining the representation 262. This selection can be made on the basis of the setting data, such as picture numbers and resolution order (this is the identification of the subfile resolution), which are stored at the beginning of each subfile in, for example, the header HEAD and the subheader SUBHEAD of the blocks BLCK. For each subfile this data is read in by the control circuit 253 in response to a signal supplied by a block synchronization detector 262a upon detection of the beginning of each block BLCK.

In the case that a representation of an absolutely coded picture is to be reproduced, upon detection of the beginning of the subfile to be selected, the control circuit sets the multiplex circuit 254 to a state in which the signal path 142 is connected to the data inputs of the picture memory 255. Moreover, the address generator 256 is set to a state in which the memory locations are addressed in synchronism with the reception of the successive pixel information, in such a way that the information for the picture lines 11, ..., 1512 is stored in the respective rows rl, ..., r512 of the memory 255. The picture information thus loaded into the memory 255 is read out and is converted into a form suitable for the display unit 10 by means of the signal converter 258. The read-out sequence is determined by the sequence in which the address generator 257 generates the successive addresses.During normal reproduction this sequence is such that the memory is read in a row-by-row fashion, starting with the row rl and starting with column cl within a row. This is possible both in accordance with the interlaced-scan principle and the progressive-scan principle. In the case of read-out according to the interlaced-scan principle all the odd rows of the picture memory 255 are read first and subsequently all the even rows of the picture memory 255 are read. In the case of read-out in accordance with the progressive-scan principle all the rows are read in sequence.

A very attractive alternative for the method of storing the picture information in the picture memory 255 is that in which the picture memory 255 is first filled with picture information from a picture file defining a lower-resolution representation of a picture and subsequently the content of the memory is overwritten with a coded picture defining a higher-resolution representation of the same picture. In the above example this is possible in that during read-out of each coded pixel from the subfile TV/4 each of a group of 2x2 memory elements is each time filled with the signal value defined by this coded pixel. This method is known as the "spatial replica" method.A better picture quality is obtained by filling only one of the memory elements of the 2x2 matrix with the signal value defined by a read-out pixel, and by deriving the other pixels of the 2x2 matrix from adjacent pixels by means of known interpolation techniques. This method is known as the "spatial interpolation" method. After detection of the next subfile (in the present case TV) the content of the picture memory is each time overwritten with the picture information of this subfile in the methods described above. The amount of information in the subfile TV/4 is only a quarter of that in the subfile TV. This results in a substantial reduction of the time after which a first provisional picture is displayed on the display unit. After read-out of the picture file TV/4 this low-resolution picture is overwritten with a representation of the same picture having the desired resolution.As the picture files with coded pictures of successive resolutions succeed one another directly no time is lost in searching for the subfile TV after read-out of the subfile TV/4.

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 290 of 431

In the case that a picture is to be rotated the address generator 256 is set to a state in which the sequence of addressing the memory locations is adapted in accordance with the desired rotation angle. Figs.27b, 27c and 27d illustrate how the picture information is stored in the memory for a rotation through an angle of 270, 180 and 90 degrees respectively. For the sake of clarity these Figures only show the positions of the information of the first two picture lines 11 and 12 of the picture.

In the case that a representation of a small picture is to be displayed within the outline of a full-scan representation of another picture or, if desired, the same picture (PIP function), this can be achieved simply by filling the desired location of the picture memory 255 with the low-resolution picture of the subfile TV/4 without magnification.

When the picture memory 255 is filled the address generator 256 is then set to a state in which the information for memory locations is addressed in which the small picture is to be stored. To illustrate this these memory locations are represented as a frame 264 in Fig.

26. During the picture processing described above the presence of the low-resolution picture in the subfile TV/4 again has the advantage that the picture information required to perform this function is directly available in the picture file IP, so that additional processing is not necessary.

When an enlarged representation of a part of the absolutely coded picture is to be displayed the information of a part of the picture, for example the part corresponding to a frame 265, is selected. The information of each pixel of the selected part is loaded into every memory location of a group of 2x2 memory locations, so that a magnified fullscan representation of low resolution is displayed on the display unit. Instead of repeating each pixel 2x2 times in the memory the memory may be filled in accordance with the spatial-interpolation principle mentioned in the foregoing.

In order to magnify the residually coded pictures the above step is performed first. Subsequently, the part represented by the frame 266 is selected in the subfile 4TV. The part in the frame 266 corresponds to the part within the frame 265 in the representation 262. The control circuit 253 sets the multiplex circuit 254 to a state in which the output of the residual decoding circuit 252 is connected to the data inputs of the memory 255. The address generator 256 is set to a state in which it addresses the picture memory 255 in synchronism with the received coded pixels in the sequence in which the residually coded picture information from the subfile 4TV becomes available.The picture information in the addressed memory locations is applied to the decoding circuit 252 and by means of the adder circuit 259 it is added to the residual value, after which the information thus adapted is loaded into the addressed memory location. The part of the picture information recorded on the record carrier corresponding to the frame 266 is preferably read on the basis of the information in the control fileIIDB. The information in the section IIDB is read in by the control circuit 253 in response to a signal from the detector 250. Subsequently, the address of that coded picture line is selected from this information which is situated shortly before the first coded picture line corresponding to the picture line in the frame 266.After this, the control circuit supplies a command to the control unit 140 via the control signal path 260, which control unit in response to this command initiates a search process in which the part with the selected coded picture line is located. When this part is found the read-out of the picture information is started and the adaptation of the content of the memory 255 is started as soon as the part of the first coded picture line which corresponds to the part of the picture within the frame 266 is reached. The detection of this coded picture line is effected on the basis of the line numbers which together with the line synchronization codes LD have been inserted at the beginning of each coded picture line. The control circuit reads in these line numbers LN in response to a signal from the detector circuit 251.The storage of the address information at the beginning of the subfile 4TV enables a rapid access to the desired information to be obtained. The detection of the read-out of the desired residually coded picture lines is simplified by the presence of the line synchronization codes and line numbers in the subfile 4TV.

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 291 of 431

Fig. 28 shows an embodiment of the read unit 6 by means of which it is possible to read out the coded picture information recorded on the record carrier by means of the recording unit shown in Fig. 18. The shown read unit 6 comprises a customary read head 280 which reads the information patterns on the record carrier 184 by scanning the track 20 and converts the resulting information into corresponding signals. The read unit further comprises a customary positioning unit 284 for moving the read head 280 in a direction transverse to the tracks to a portion of the track 20 specified by a selected address. The movement of the read head 283 is controlled by a control unit 285. The signals converted by the read head 280 are decoded by an EFM decoding circuit 281 and are subsequently applied to a CIRC decoding circuit 282.The CIRC decoding circuit 282 is of a customary type, which restores the original structure of the information which has been interleaved prior to recording and which detects and, if possible, corrects incorrectly read codes. Upon detection of incorrigible errors the CIRC decoding unit supplies a new error flag signal. The information which has been restored and corrected by the CIRC decoding circuit 282 is applied to a deformatting circuit 283 which removes the additional information added by the formatting circuit 186 prior to recording. The EFM demodulating circuit 281, the CIRC decoding circuit 282, and the deformatting circuit 283 are controlled in a customary manner by the control unit 285. The information supplied by the deformatting circuit 283 is applied via an interface circuit 286.The deformatting circuit may comprise an error correction circuit by means of which errors which cannot be corrected by the CIRC decoding circuit can be detected and corrected. This is effected by means of redundant information EDC & ECC added by the formatting circuit 166. The error correction circuit, which is comparatively complex and therefore comparatively expensive, is not necessary. This is because the effects of erroneously read codes in the absolutely coded picture information can be masked simply by replacing the incorrectly read coded pixels and/or a complete coded picture line by picture information derived from one or more adjacent coded pixels or adjacent coded picture lines.Such a correction can be effected simply by means of the signal processing unit 141 shown in Fig. 25, by programming the control circuit 253 so as to be responsive to the error flag signal supplied by the CIRC decoding circuit 282 to control the address generator 256 in such a way that the information of an adjacent pixel is read and, at the same time, the multiplex circuit 254 is set to a state in which the data outputs of the picture memory 255 are connected to the data inputs. Subsequently, the address generator is reset to its previous state and instead of the incorrectly read coded pixel the information read from the picture memory 255 is stored at the addressed memory location.

In the case that a residually coded picture is read the value in the memory 255 is not adapted upon detection of an incorrectly read residual value but remains unchanged. This can be achieved, for example, by causing the control circuit to generate a signal which inhibits writing into the memory 255 when the erroneous residual value is applied.

The capacity of the picture memory 255 is large, so that the cost price of such a memory is comparatively high. The memory capacity may be reduced by arranging between the multiplexer 254 and the picture memory 255 a sample rate converter 290 of a customary type, which reducers the number of pixels per line from 786 to 512.

Fig. 31 shows an example of the sample rate converter 290. The present example comprises a series arrangement of an upsampling and interpolation circuit 310 and a low-pass filter 311, and a downsampling and decimating circuit 312.

The use of the sample rate converter 290 enables a memory of 512 by 512 memory locations to be employed. Since for practical reasons the number of rows and the number of columns of memory locations in a memory are preferably powers of two, this yields a memory of particularly satisfactory dimensions. Moreover, as a result of the reduction of the number of memory locations to 512 per row the required memory readout frequency is reduced, so that less stringent requirements have to be imposed on the read-out speed of the memories used.

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 292 of 431

The usually employed picture tubes have a maximum resolution corresponding to approximately 5 MHz, which corresponds to approximately 500 pixels per line, so that the reduction of the number of memory locations per row has no visible effects on the reproduced picture.

The use of the sample rate converter is also advantageous when portrait-size representations of pictures are to be displayed on a display screen, which will be explained hereinafter with reference to Figs. 30a, 30b, 30c and 30d.

In Fig. 30a the reference numeral 300 refers to the dimensions of a picture in accordance with the PAL TV standard. Such a picture in accordance with the PAL TV standard comprises 575 useful picture lines. During reproduction of the information in the picture memory of 512x512 memory elements 512 of these 575 useful picture lines are utilized. This means that a representation 301 of the coded picture in the picture memory fits completely within aspect ratio of the frame 300 as defined by the PAL TV standard, only a small part of the available display screen area being left unused.

In Fig. 30b the reference numeral 320 denotes a frame having the dimensions of a picture in accordance with the NTSC TV standard. Such a picture in conformity with the NTSC TV standard comprises 431 useful lines. This means that only a limited part of a representation 303 of the coded picture present in the picture memory 255 falls outside the outline of a picture in accordance with the NTSC standard.

Figs. 30a and 30b concern landscape-size reproductions of representations of coded pictures. However, if portrait-size representations of coded pictures are required the problem arises that the height of the picture corresponds to 768 pixels, the number of useful picture lines being 575 in accordance with the PAL TV standard and 485 in accordance with the NTSC TV standard. When a picture memory of 512 rows of memory locations is employed without the use of the sample rate converter 290 this would mean that a coded picture line does not fit in one memory column. However, by the use of the sample rate converter 290 it is achieved that the coded picture lines of 768 coded pixels are converted into coded picture lines of 512 coded pixels, so that a coded picture line can be accommodated in one memory column.This means that during reproduction the height of the representation of the picture stored in the memory 255 substantially corresponds to the height of the picture frames defined in the PAL and NTSC TV standards.

In order to ensure that the ratio between the length and width of the representation of the coded picture stored in the picture memory 255 corresponds to the original ratio it is required to fill only 256 of the 512 columns of the picture memory with picture information. This is possible, for example, by storing only the even or only the odd coded picture lines in the memory 255. However, other methods utilizing interpolation techniques may also be used.

The method of reducing the number of columns in the picture memory employing interpolation techniques yield a picture representation of satisfactory quality.

This is in contradistinction to the method in which only a part of the coded picture lines is stored in the columns of the picture memory.

A drawback of interpolation techniques is that they are comparatively intricate and time-consuming, so that they are less suited for use in the simplified picture retrieval and display system. A method which yields pictures of satisfactory quality in a simple manner will be described hereinafter for the case that the picture memory comprises 512x512 memory locations. This method uses the subfile TV/4 with384x256 coded pixels, instead of the subfile TV with 768x512 coded pixels, for loading the picture memory.

The use of a sample rate converter 20, by means of which the number of pixels per read coded picture line can be reduced and increased, enables the number of pixels per read coded picture line of the subfile TV/4 to be increased from 384 to 512.

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 293 of 431

The 256 available adapted picture lines of 512 coded pixels each are loaded into the memory 255. Thus, 256 columns of 512 memory locations each are filled with picture information. Reading out this information yields an undistorted portrait-size representation, whose height substantially corresponds to the height of the display screen of a PAL or
NTSC TV system, and whose quality is substantially better than that of a portrait-size representation obtained on the basis of a coded picture of 768x512 coded pixels whose width is adapted by using only half (256) the available number of 512 coded picture lines.

By way of illustration Fig. 30c shows a portrait-size representation 304 of the stored coded picture (of256x512 coded pixels) thus obtained within the frame 300 defined by the PAL TV standard. The entire representation falls within the frame defined by the PAL standard. Fig. 30d by way of illustration shows a portrait-size representation of the coded picture thus stored. The representation falls largely within the frame 302 defined by the NTSC TV standard.

As will be apparent from the foregoing the use of a sample rate converter 290 enables the use of a picture memory having equal numbers of rows and columns and corresponding substantially to the number of useful picture lines in accordance with the
NTSC or PAL standard. This means that both in the case of portrait-size and landscapesize representations of coded pictures the height of the representation substantially corresponds to the number of useful picture lines, so that the display screen will be filled correctly for representations of both types.

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Claims of corresponding document: **WO9205556**

Translate this text

Claims:

1. A record carrier on which a main data file and a control file have been recorded, the control data in the control file being intended for controlling the reproduction of representations of main data in the main data file during or after read-out of the main data file, the main data file and the control data file being derived from a main data signal and a control data signal respectively in conformity with the same predetermined formatting and encoding rules, characterized in that the control data signal comprises packets of n identical control data bit groups, n being an integer greater than or equal to 2.

2. A record carrier as claimed in Claim 1, characterized in that the packets are arranged in frames in the control signal and the frames are arranged in data blocks of predetermined length, each block comprising a block synchronization section, each frame starting at a predetermined position relative to the block synchronization section.

3. A record carrier as claimed in Claim 2, characterized in that bit groups not containing control data for controlling the reproduction are arranged at the beginning of every frame.

4. A record carrier as claimed in Claim 3, characterized in that the packets are arranged in frames, a plurality of consecutive frame synchronization bit groups being arranged at the beginning of each frame, which groups form a bit pattern which deviates from the bit patterns formed by the control data bit groups of the frame.

5. A record carrier as claimed in any one of the preceding Claims, characterized in that each control data bit group comprises a synchronization bit having a logic value, the logic values of consecutive control data

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 294 of 431

bit groups alternating with a repetition pattern whose frequency is related to the frequency at which the packets recur.

6. A record carrier as claimed in Claim 2, 3, 4 or 5, characterized in that to each frame bit groups for error-correction purposes are added, which bit groups are in a predetermined relation with the control data bit groups in the frame containing the control data for reproduction.

7. A method of recording a main data file and a control file on a record carrier, in which prior to recording the main data file is derived from a main data signal in accordance with predetermined formatting and coding rules and in which the control file is derived from a control data signal in accordance with the same formatting and coding rules, characterized in that for deriving the control file a control data signal is employed which comprises packets of n identical control data bit groups each, n being an integer greater than or equal to two.

8. A method as claimed in Claim 7, characterized in that the packets are arranged in frames in the control signal and the frames are arranged in data blocks of predetermined length, each block comprising a block synchronization section, each frame starting at a predetermined position relative to the block synchronization section.

9. A method as claimed in Claim 8, characterized in that bit groups not containing control data for controlling the reproduction are arranged at the beginning of every frame.

10. A method as claimed in Claim 7, characterized in that the packets are arranged in frames, a plurality of consecutive frame synchronization bit groups being arranged at the beginning of each frame, which groups form a bit pattern which deviates from the bit patterns formed by the control data bit groups of the frame.

11. A method as claimed in any one of the Claims 7, 8 and 9, characterized in that a synchronization bit having a logic value is assigned to each control data bit group, the logic values of the synchronization bits of consecutive control data bit groups alternating with a repetition pattern whose frequency is related to the frequency at which the packets recur.

12. A method as claimed in any one of the Claims 8, 9, 10 and 11, characterized in that to each frame bit groups for error-correction purposes are added, which bit groups have been derived from the control data bit groups of the relevant frame in accordance with predetermined rules.

13. A device for recording files on a record carrier, the device comprising means for deriving from a main data file to be recorded and a control file to be recorded a main data signal and a control data signal respectively in accordance with predetermined formatting and encoding rules which are identical for both files, characterized in that the device comprises means for supplying a control data signal comprising n consecutive identical control data bit groups, n being an integer greater than or equal to two.

14. A device as claimed in Claim 13, characterized in that the control signal is adapted to arrange packets in frames and to arrange frames in blocks of predetermined length, each block comprising a block synchronization section and each frame beginning at a predetermined position relative to the block synchronization section.

15. A device as claimed in Claim 14, characterized in that each frame begins with bit groups not containing control data for controlling the reproduction.

16. A device as claimed in Claim 13, characterized in that the means for supplying the control data signal comprise means for composing frames from groups of packets and for arranging frame synchronization bit

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 295 of 431

groups at the beginning of each frame, which bit groups form a predetermined bit pattern which deviates from the bit patterns formed by the control data bit groups in the frame.

17. A device as claimed in any one of the Claims 13, 14, 15 and 16, characterized in that the means for supplying the control data signal are adapted to generate packets of bit groups, the logic values of the synchronization bits of bit groups alternating with a repetition pattern which is related to the recurrence pattern of the packets.

18. A device as claimed in Claim 14, 15, 16 or 17, characterized in that the means for supplying the control signal comprise means for adding bit groups to each frame, said added bit groups are in a predetermined relation with the control data bit groups in the frame.

19. A device for reading a record carrier as claimed in Claim 1, which device comprises means for reading the recorded files, decoding and deformatting means for recovering in conformity with predetermined decoding and deformatting rules the main data signal and the control data signal from the files thus read, a signal processing unit coupled to the decoding and deformatting means to process the main data signal, and a control unit coupled to the decoding and deformatting means to receive the control signal, characterized in that the control unit comprises selection means for selecting m control data bit groups for each packet received, m being smaller than n.

20. A device as claimed in Claim 19, characterized in that m is equal to 1.

21. A device as claimed in Claim 19 or 20, characterized in that the selection means comprise clock extraction means for deriving a clock signal having a frequency related to the packet repetition frequency on the basis of one of the recovered signals, synchronization means for synchronizing the clock signals with the packets read, and means for reading-in at least one control data bit group per packet in synchronism with the clock signal.

22. A device as claimed in Claim 21, characterized in that the synchronizing means comprise a block synchronization detector, for detecting block synchronization sections in data blocks accommodating the data of the frames.

23. A device as claimed in Claim 21, characterized in that the synchronization means comprise a frame synchronization detector for detecting frame synchronization bit groups situated at the beginning of each frame.

24. A device as claimed in any one of the Claims 21, 22 and 23, characterized in that the clock extraction means comprise means for deriving the clock signal on the basis of the synchronization bits included in the control data bit groups.

25. A device as claimed in any one of the Claims 19, 20, 21, 22, 23 or 24, characterized in that the control unit comprises error detection means for detecting errors in the selected control data bit groups on the basis of the error detection bit groups, and means for a repeated read-out of frames with control data bit groups in which errors have been detected.

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Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 296 of 431

(19) RU (11) 2 073 913 (13) C1

(51) МПК[6] G 11 B 27/00

РОССИЙСКОЕ АГЕНТСТВО
ПО ПАТЕНТАМ И ТОВАРНЫМ ЗНАКАМ

(12) ОПИСАНИЕ ИЗОБРЕТЕНИЯ К ПАТЕНТУ РОССИЙСКОЙ ФЕДЕРАЦИИ

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(71) Заявитель:
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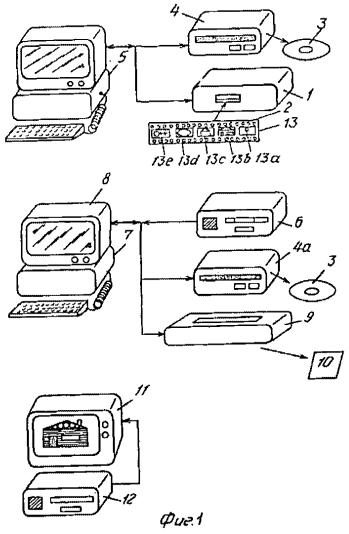
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(54) НОСИТЕЛЬ ЗАПИСИ, СПОСОБ И УСТРОЙСТВО ДЛЯ ЗАПИСИ ИНФОРМАЦИОННЫХ ФАЙЛОВ И УСТРОЙСТВО ДЛЯ ВОСПРОИЗВЕДЕНИЯ ИНФОРМАЦИИ С ТАКОГО НОСИТЕЛЯ ЗАПИСИ

(57) Реферат:

Изобретение относится к области накопления информации, в частности, к носителю записи, на который записаны файл основных данных и файл управления, способу и устройству для записи файла основных данных и файла управления, и устройству для считывания носителя записи. Сущность изобретения: описан носитель записи содержит файлы основных данных и файл управления, причем данные управления в файле управления предназначены для управления воспроизведением представлений основных данных в файле основных данных во время или после считывания файла основных данных. Файл основных данных и файл управления получены из сигнала основных данных и сигнала данных управления получены соответственно по одним и тем же правилам форматирования и кодирования. Сигнал данных управления содержит пакеты из идентичных групп битов данных управления, причем - целое число большее или равное двум. Кроме того, описаны способ и устройство для записи основных данных и данных управления и дополнительно раскрыто устройство для считывания носителя записи. 4 с. и 7 з.п. ф-лы, 8 ил.



Фиг.1

RU 2073913 C1

RU 2073913 C1

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 297 of 431

(19) **RU** (11) **2 073 913** (13) **C1**

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FOR PATENTS AND TRADEMARKS

(12) ABSTRACT OF INVENTION

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(71) Applicant:
N.V.Filips Gloehlampenfabriken (NL)

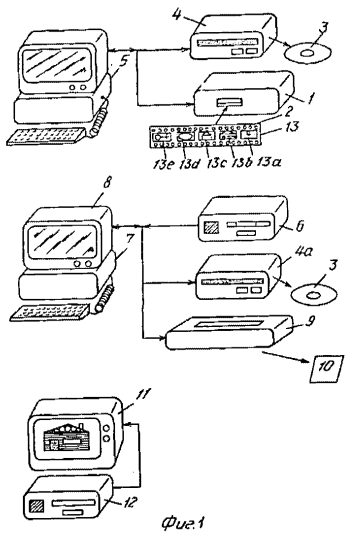
(72) Inventor: Zhozef Marija Karel Timmermans[BE]

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N.V.Filips Gloehlampenfabriken (NL)

(54) INFORMATION CARRIER, METHOD AND DEVICE FOR WRITING DATA FILES AND DEVICE FOR READING DATA FROM SUCH INFORMATION CARRIER

(57) Abstract:

FIELD: data storage devices. SUBSTANCE: information carrier stores data file and control data file. Control data in control data file are designed for control of reading of data representations from data file during or after reading of data file. Data file and control data file are generated using identical rules of format and encoding. Control data signal contains packets of at least two identical groups of control data bits. In addition invention specification describes method and device for writing data and control data and device for reading data from such information carrier. EFFECT: increased functional capabilities. 11 cl, 8 dwg



Фиг.1

RU 2073913 C1

RU 2073913 C1

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 298 of 431

Изобретение относится к области накопления информации, в частности, к носителю записи, на который записаны файл основных данных и файл управления, причем данные управления в файле управления предназначены для управления воспроизведением основных данных в файле основных данных, к способу записи файла основных данных и данных управления на носителе записи, к устройству для записи файлов на носителе записи и к устройству для воспроизведения с такого носителя.

Известен носитель записи, на дорожках которого записаны файлы основных и управляющих данных, и соответствующее устройство для воспроизведения информации с такого носителя, содержащее блок воспроизведения, блок декодирования и восстановления данных, блок обработки и управляющий блок (1), а также способ и устройство для записи информационных файлов в виде последовательных кадров на носителе (2).

Если система используется исключительно для хранения на носителе записи специфичной информации, например, как изображения с фотонегативов или слайдов, может оказаться желательным использовать специальное считывающее устройство только для этого, для считывания такой информации. Для обработки информации файла основных данных тогда предпочитают использовать специальный, и значит, более дешевый блок обработки, а не компьютерную систему.

Однако при этом возникает проблема в том, что нужно использовать блок управления, который может считывать информацию управления с файла управления, которая выдается с высокой скоростью. Однако функции управления, выполняемые блоком управления, не требуют использования такой высокой скорости, а это значит, что приходится использовать дорогой блок управления с высокой скоростью обработки всего лишь для ввода данных управления.

Целью изобретения является дать средства, позволяющие использовать сравнительно дешевое специальное устройство для считывания носителя записи.

Касательно носителя записи эта цель достигается за счет того, что сигнал данных управления содержит пакеты из n идентичных групп битов данных управления, причем n целое число, большее или равное двум.

Касательно способа указанная цель достигается тем, что для получения файла управления используют сигнал данных управления который содержит пакеты из n идентичных групп битов данных управления, причем n целое число, большее или равное двум.

Касательно устройства записи, указанная цель достигается за счет того, что устройство содержит средства для выдачи сигнала управления, содержащего n последовательных идентичных групп битов данных управления, причем n являются целым числом, большим или равным двум.

Касательно устройства для воспроизведения, эта цель достигается за счет того, что блок управления содержит средства селекции для выбора m групп битов данных управления для каждого принятого пакета, причем m меньше n.

Запись данных управления в файл в виде пакетов идентичных групп битов данных управления значительно снижает количество данных управления за единицу времени при считывании. Селекция одной групп битов для каждого пакета, или ограниченного количества групп битов для каждого пакета значительно снижает потребную скорость обработки блока управления при вводе данных управления, что позволяет использовать блок управления, имеющий малую скорость обработки, а значит, дешевый блок.

Предпочтительный пример выполнения устройства для считывания носителя записи отличается тем, что средства селекции содержат средства извлечения синхронизации для получения сигнала синхронизации, имеющего частоту, связанную с частотой повторения пакетов, на основе одного из восстановленных сигналов, средства синхронизации для синхронизации сигнализации со считываемыми пакетами, и средства для ввода по меньшей мере одной группы битов данных управления на пакет синхронно с сигналом синхронизации.

Надежная синхронизация сигнала синхронизации с пакетами может быть получена за счет использования воплощения носителя записи которое отличается тем, что пакеты расположены в кадрах в сигнале управления, а кадры расположены в блоках данных заранее заданной длины, каждый блок содержит секцию синхронизацию блока, каждый кадр начинается в заранее заданном положении относительно секции синхронизации блока.

Пример выполнения устройства для считывания этого носителя записи отличается тем, что средства синхронизации содержат детектор синхронизации блока для обнаружения секций синхронизации блоков в блоках данных, содержащих данные кадров.

Если используется последнее упомянутое выполнение носителя записи, предпочтительно располагать группы битов, не содержащие данных управления для управления воспроизведением, в начале каждого кадра. Это дает то преимущество, что во время ввода данных управления после обнаруживания секции синхронизации блока, некоторое время проходит до того, как данные управления, подлежащие вводу, фактически оказываются в распоряжении. Это позволяет осуществить ввод данных управления с управлением от микрокомпьютера, который также может использоваться для других операций управления. С таким микрокомпьютером обыкновенно опрашивают программу ввода в ответ на обнаружение секции синхронизации блока. Такой опрос требует некоторого времени. Однако, это не является недостатком, потому что полезная информация появляется в наличии лишь после времени ожидания.

Надежная синхронизация может также быть получена посредством выполнения носителя записи, который отличается тем, что пакеты расположены в кадрах, причем множество последовательных групп битов синхронизации кадра расположено в начале каждого кадра, каковые группы образуют узор битов, который отличается от узоров битов,

RU 2073913 C1

RU 2073913 C1

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 299 of 431

образованных группами битов данных управления кадра.

Воплощение для считывания носителя записи отличается тем, что средства синхронизации содержат детектор синхронизации кадров для обнаружения групп битов синхронизации кадров, расположенных в начале каждого кадра.

Очень простое выделение сигнала синхронизации получают, когда используют носитель записи, отличающийся тем, что каждая группа битов содержит бит синхронизации, имеющий логическую величину, и логические величины последовательных групп битов данных очередуются с узором повторения, частота которого связана с частотой, с которой повторяются пакеты.

Использование битов синхронизации делает возможным использовать сигнал синхронизации с величиной сигнала, соответствующей логической величине битов синхронизации, что в результате дает очень простую генерацию сигналов синхронизации.

Следующие выполнение носителя записи отличается тем, что каждому кадру приданы группы битов для целей исправления ошибок, причем группы битов находятся в заранее заданном соотношении с группами битов данных управления в кадре, содержащем данные управления для воспроизведения.

Использование такого носителя записи делает возможным обнаружение, были ли полностью введены данные управления в блок управления. Это особенно предпочтительного, если используется блок управления, который содержит один микрокомпьютер, который дополнительно к вводу данных управления служит для выполнения других функций управления. В этом случае ввод данных управления может быть прерван для выполнения другой функции с большим приоритетом. Однако это значит, что данные управления не введены полностью, но это может быть просто обнаружено на основе групп битов добавленных для обнаружения ошибок. После такого обнаружения может быть инициирован новый ввод неполностью введенных данных управления.

Ниже изобретение подробнее описывается со ссылкой на чертежи, где показано: фиг. система хранения изображений, система поиска и воспроизведения изображений, и упрощенная система поиска и воспроизведения изображений, соответственно, фиг. 2 пример выполнения системы поиска и воспроизведения изображений, способное воспроизводить информацию изображения соответственно предпочтительными установками воспроизведения, фиг. 3 более подробное изображение упрощенного выполнения системы поиска и воспроизведения изображений, фиг. 4 схема извлечение данных для использования в системе поиска и воспроизведения изображений по фиг. 3, фиг. 5 более подробное изображение выполнения системы хранения изображений, фиг. 6 пример блока обработки изображения, фиг. 7 выполнение считывающего устройства, фиг. 8 - блок-схема примера выполнения упрощенного блока обработки изображений.

Фиг. 1 показывает систему хранения изображений, в которой может использоваться изобретение. Система содержит блок 1 сканирование изображения с носителя 2 изображений, например, с ленты, несущей фотонегативы или слайды. Блок 1 содержит блок кодирования для кодирования информации, полученной при сканировании. Закодированная информация изображения записывается на носитель 3 записи посредством блока 4 записи при управлении от блока 5 управления. Перед записью блок 5 может при желании производить обработку изображения, например, повысить контрастность, исправить или отредактировать изображение, имеющее вид закодированной информации изображения. Блок 4 записи может содержать, например, оптическое, магнитное или магнитооптическое записывающее устройство. В виде высокой емкости хранимой информации оптических и магнитооптических носителей записи предпочтительно использовать оптическое или магнитооптическое устройство записи. Блок 5 управления может содержать компьютерную систему, например, так называемый "персональный компьютер" или так называемое рабочее место с соответствующей аппаратурой и программным обеспечением.

Фиг. 1 показывает систему поиска и воспроизведения изображений для отыскивания и воспроизведения закодированных изображений, хранимых на носителе 3. Система содержит считывающий блок 6 при управлении от блока 7 управления. Воспроизведение считанных, таким образом, кодированных изображений может производиться на блоке дисплея, экран 8 которого, например, является частью блока 7 управления или электронным принтером 9 изображений для получения бумажной копии 10 воспроизводимого кодированного изображения. Система может содержать добавочное устройство 4а, посредством которого закодированная информация изображения проходит обработку в блоке 7 управления с целью повышения контраста, исправляя или редактирования. Устройство управления в системе поиска и воспроизведения изображений может содержать компьютерную систему, например, "персональный компьютер", или рабочее место с соответствующей аппаратурой и программным обеспечением.

Вообще желательно иметь такую дорогую компьютерную систему для блока управления в сочетании с электронным печатным устройством 9 изображения вследствие сложности функций управления и обработки изображений. Однако, если желают лишь воспроизводить выбранные кодированные изображения на экране дисплея, компьютерная производительность и емкость памяти персонального компьютера или рабочего места высока по сравнению с функциями управления, которые нужно выполнять. В таком случае предпочитают использовать упрощенный блок управления с ограниченной компьютерной производительностью и емкостью памяти и ограниченной скоростью обработки данных.

Фиг. 1 показывает такую упрощенную систему поиска и воспроизведения изображения. Это упрощенная система содержит дисплей 11 и блок 12 поиска и

RU 2073913 C1

RU 2073913 C1

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 300 of 431

считывания, содержащий блок 6 считывания. Блок управления поиском и операцией считывания может быть размещен в одном из блоков 11 или 12, но удобнее в блоке 12, тогда можно среди прочих вы качестве дисплея использовать стандартный телевизор или монитор.

Для записи закодированной информации изображения предпочитают записывать информацию на носителе записи в заранее определенном формате и порядке. Файлы, содержащие закодированную информацию изображению, названы файлами изображения. Кроме того, записаны несколько файлов управления, которые используются для управления считыванием закодированной информации изображений, для целей обработки при необходимости, считываемой информации и с целью воспроизведения закодированной информации изображения. Следует заметить, что часть данных управления может быть включена в файлы изображения. Предпочтительно эта часть данных управления является частью, специально предназначенной для управления считыванием, воспроизведением и обработкой закодированной информации изображения, содержащейся в соответствующем файле изображения. Преимущество здесь то, что требуемые данные управления имеются в распоряжении тогда, когда они нужны, т.е. тогда, когда считывается файл изображения.

Отдельно от файлов изображения и связанных с ними файлов управления может быть желательным в ряде случаев записывать файлы с добавочной информацией, например, звуковой информацией или текстовой информацией. Такая звуковая и/или текстовая информация может относиться, например, к закодированной информации изображения и может воспроизводиться одновременно с воспроизведением соответствующей информации изображения. Файлы с добавочной информацией могут быть записаны, например, после закодированной информации изображения.

Для каждого хранимого изображения файлы изображения содержат несколько субфайлов, каждый из которых определяет представление одной и той же сканированной картинки, но разрешение этих представлений различное. Предпочтительно субфайлы расположены таким образом, что разрешения представлений, определяемых последовательными кодированными изображениями, увеличиваются (линейно) ступенями в два раза. При воспроизведения, когда последовательно расположенные субфайлы и считываются друг с другом, относительно просто сначала воспроизвести изображение с малой разрешающей способностью, а затем заменять изображение полностью или частично тем же изображением, каждый раз увеличивая разрешение. Эта дает то преимущество, что время ожидания до появления изображения на экране уменьшается. Действительно, вследствие ограниченного количества информации, которое для этого нужно, время считывания закодированного изображения представления с низким разрешением является коротким по сравнению с временем считывания закодированных изображений, имеющих большее разрешение.

Общеизвестно представление изображений в таком виде, что изображение состоит из матрицы малых площадей постоянной яркости и/или постоянной цветности. В этом представлении обычно выбирают площади с постоянной величиной плотности, которые больше, чем площади с постоянной величиной яркости.

Площадь с постоянной величиной цветности далее будет называться пикселем цветности, а площадь с постоянной величиной яркости будет называться пикселем яркости. Ряд пикселей цвета с шириной, равной полной ширине изображения далее будет называться цветной строкой изображения. Ряд пикселей яркости с шириной, равной полной ширине изображения далее будет называться яркостной строкой изображения. Изображение, представленной яркостными строками изображения и цветными строками изображениями может быть просто определено кодированным изображением, если назначить каждому пикселю яркости и каждому пикселю цветности цифровой код, указывающий соответствующую величину яркости и величины цветности.

Подходящим кодированием для изображения является такое, когда цифровой код или цифровые коды приписаны каждому пикселю яркости и каждому пикселю цветности, причем коды определяют абсолютную величину составляющей яркости и абсолютные величины цветоразностных составляющих. Такое кодирование далее будет называться абсолютным кодированием изображения. Предпочтительно представления нескольких изображений с низким разрешением записываются в виде абсолютно закодированных изображений. Это позволяет просто восстановить информацию изображения. Это особенно выгодно для упрощенного поиска изображения и воспроизведения, потому что это позволяет снизить стоимость такой системы, предназначенной для широкого потребителя, за счет использования простых систем декодирования.

Использование файла изображения с несколькими абсолютно кодированными изображениями с различным разрешением упрощает воспроизведение составных изображений, где представление малого изображения с низким разрешением изображается внутри представления изображения более высокого разрешения. Воспроизведение такого представления составного изображения называется "Картинка в картинке" (P1P). Кроме того, запись нескольких абсолютно кодированных изображений, представляющих одно и тоже изображение с различным разрешением, упрощает воспроизведение увеличенных представлений деталей закодированного изображения. Такая функция называется функцией ТЕЛЕ (или ЗУМ). Наличие абсолютно закодированных изображений с различным разрешением предполагает, что для некоторых ТЕЛЕ функций или P1P функций нужная информация изображения прямо доступна и не должна получаться за счет дополнительных обработки изображения с помощью сложных схем.

При записи принято записывать

RU 2073913 C1

RU 2073913 C1

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 301 of 431

закодированные пиксели рядами (или строками), или иногда столбцами. Запись в строки предпочтительна, потому что в обычно используемых дисплеях информация изображения должна быть в форме строк.

Когда абсолютно кодированное изображение записывается в субфайлах, предпочтительно не записывать слитно последовательные кодированные строки изображения. Способы расположения записанной информации часто называются "тасовкой", или "чересстрочными". Преимущество такого способа заключается в том, что сравнительно большая часть информация не может быть использована вследствие дефектов диска или других причин, при таком способе снижается вероятность неправильного воспроизведения двух соседних строк изображения. Изображения с дефектами в соседних строках сравнительно трудно восстановить. Другое дело, когда неправильно считанные пиксели или строки изображения. Дефектная строка просто может быть заменена на соседнюю. Нужно отметить, что неправильно считанные пиксели также могут быть легко восстановлены использованием так называемых кодов коррекции ошибок. Коррекция ошибок на основе таких кодов сравнительно сложна, и поэтому менее пригодна для использования упрощенной системе поиска и воспроизведения, в которой использование сложных схем следует избегать для снижения стоимости.

В случае, когда информация изображения записывается на дисковом носителе записи со спиральной дорожкой, часть дорожки, нужная для записи кодированного изображения, занимает несколько витков спиральной дорожки. Ввиду простоты восстановления неправильно считанных строк изображения тогда желательно, чтобы кодированные строки изображения, относящиеся к соседним строкам в самом изображении не были бы соседними друг с другом на носителе записи ни в продольном направлении (вдоль дорожки), также называемом тангенциальным, касательным направлением, ни в направлении поперек дорожки (также называемом радиальным направлением).

Для высоких разрешений хранение абсолютно закодированной информации изображения имеет недостаток в том, что количество подлежащей записи информации очень велико. Для таких изображений высокого разрешения очень подходит остаточное кодирование. В таком остаточном кодировании определяют разности величины сигнала пикселей изображения высокого разрешения и величины сигнала соответствующей части изображения с меньшим разрешением и затем кодируют их.

Остаточные величины всего изображения могут быть определены как для яркостной, так и для цветностной информации. Так как количество остаточных величин равных или близких к нулю велико по сравнению с количеством больших остаточных величин, можно получить значительное сокращение объема информации применением добавочного кодирования, при котором остаточные величины нелинейно квантизируют и затем подвергают, например, кодированию по Хаффману.

Остаточно закодированное изображение может использоваться в качестве основы для остаточного кодирования для изображения с еще более высоким разрешением. Таким образом, записав одно абсолютно закодированное изображение низкого разрешения и серию остаточно закодированных изображений увеличивающегося разрешения в сокращенной форме можно записать множество закодированных изображений, представляющих то же изображение с увеличивающимся разрешением.

Информация цветности также кодируется остаточно подобно информации яркости. Однако горизонтальное и вертикальное разрешение последовательных остаточно закодированных изображений увеличивается в четыре раза, а не в два раза, как это делается с информацией яркости.

Обычно записывают кодированные пиксели строка за строкой.

Когда используется остаточное кодирование с использованием нелинейной квантизации и кодирования Хаффмана, остаточные величины представлены посредством кодов переменной длины. Это значит, что место, требуемое для записи остаточно закодированного изображения, не определено началом записи первой кодированной строки изображения. Это усложняет селективное считывание кодированных строк изображения, например, только тех строк изображения, которые необходимы для осуществления функции ТЕЛЕ.

Очень быстрое отыскание выбранных строк изображения может быть достигнуто за счет того, что адреса, под которыми начинаются записи кодированных строк изображения, записаны на носителе записи в отдельном файле управления, предпочтительно в начале каждого субфайла.

Вообще, при поиске начальных точек строк изображения на носителе записи в процессе грубого поиска считывающий элемент передвигают относительно носителя записи в положение на малом расстоянии перед начальной точкой, где начинается запись кодированной строки изображения. Затем производится точный процесс поиска, в котором при сканировании носителя записи со скоростью, соответствующей нормальной скорости считывания, ожидают начала выбранной кодированной записи строки, после чего начинают считывание выбранной кодированной строки изображения. Точность, с которой считывающий элемент может позиционироваться относительно носителя записи в процессе грубого поиска, ограничена, и в системах оптического хранения данных она в общем случае гораздо больше расстояний между положениями, в которых начинаются записи последовательных кодированных строк изображения на носителе записи. Поэтому предпочитают хранить только стартовые адреса ограниченного количества кодированного строк изображения, начальные точки которых разнесены друг от друга на расстояние практически равное точности, с которой считывающий элемент может быть установлен в процессе грубого поиска. Это позволяет найти информацию выбранных кодированных строк изображения в

RU 2073913 C1

RU 2073913 C1

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 302 of 431

запомненной кодированной картине и быстро считать ее без расходования слишком большого места для хранения адресных данных. В случае дискового носителя записи средняя точность поиска в процессе грубого поиска, при котором считывающий элемент движется над диском в радиальном направлении, по определению равно половине длины одного оборота диска, что обозначает, что расстояния между положениями, указанными адресами практически соответствуют половине длины одного оборота диска при использовании дискового носителя записи.

Запомненные кодированные изображения в общем случае определяют несколько изображений ландшафтного формата (т. е. для правильного воспроизведения изображение должно индицироваться в ориентации, когда ширина изображения превышает его высоту) и несколько изображений портретного формата (т.е. для правильного воспроизведения ориентации должна быть такой, что высота изображения больше его ширины).

На фиг. 1 для примера показаны носитель изображений с несколькими изображениями в ландшафтном формате (13а, 13в, 13с, 13о) и одно изображение в портретном формате (13е). На носителе все кодированные изображения записаны, как если бы они представляли изображения в ландшафтном формате, для того, чтобы позволить одинаковое сканирование изображений без необходимости различать, какого типа изображение на самом деле при сканировании и/или обработке изображения. Однако, это обозначает, что при воспроизведении все изображения будут одинаковые портретные форматы будут представлены лежащими на боку. Это можно предотвратить, если предусмотреть возможность назначения кода поворота при записи, который обозначает, нужно ли повернуть изображение при воспроизведении на угол 90, 180 или 270 градусов. Этот код поворота может присутствовать в каждом файле изображения. Также возможно записывать коды поворота в файле управления или хранить эти коды поворота в не теряющей информацию памяти, находящейся в блоке считывания или соединенной с ним.

При воспроизведении тогда можно на основе кода поворота определить, нужно ли поворачивать воспроизводимое изображение, и если нужно, то произвести поворот на нужный угол до воспроизведения. Недостаток размещения кода поворота в файлах изображения заключается в том, что эти коды поворота приходится определять уже в процессе считывания изображений. На практике это обозначает, что необходимость поворота приходится определять и вводить оператору, потому что известные устройства воспроизведения не всегда в состоянии определить, что нужно делать с изображением, чтобы оно получилось в правильной ориентации. Это нежелательно, в особенности потому, что при этом оператору всегда нужно находиться на рабочем месте при записи, что затрудняет реализацию полностью автоматизированной системы хранения изображений.

Если коды поворота уже имеются при записи кодированной информации изображения, предпочтительно записывать эти коды на носителе записи. Для удобства потребителя желательно указывать, кроме необходимости поворота, также необходимость небольшого сдвига при воспроизведении (влево, вправо, вверх или вниз). Это особенно желательно, если площадь дисплея меньше размеров изображений, так как при этом важная деталь изображения может оказаться за краем экрана. Желаемый сдвиг может быть задан назначение кода сдвига в каждом закодированном изображении.

Фиг. 2 показывает блок-схему выполнения системы поиска и воспроизведения изображений, посредством которого закодированные изображения могут быть воспроизведены соответственно выбранному набору предпочтительных установок. Для выдачи считываемой информации блок 14 воспроизведения соединен с блоком 15 управления и обработки сигнала. Из полученной информации блок 15 выбирает файл, содержащий набор или наборы предпочтительных установок и запоминает их в памяти 16 управления. Посредством блока 17 ввода, например, устройства дистанционного управления, пользователь может выбрать набор из памяти и затем включить блок 15 в режим цикла считывания, в котором закодированная информация изображения считывается в последовательности, заданной выбранном набором предпочтительных установок при управлении от блока 15. После того, как кодированная информация изображения была считана, эта информация обрабатывается соответственно выбранному набору предпочтительных установок и выдается на блок 18 дисплея.

Через некоторое время может оказаться, что предпочтительные установки, записанные на носителе записи, уже не очень удовлетворяют нуждам пользователя, или же на носителе записи нет этих установок, или они неправильные. Возникает проблема, особенно, если носитель записи не может быть переписан на нем ничего изменить нельзя. Проблема может быть сглажена, если в системе поиска и воспроизведения предусмотрена не теряющая информации память 19, в которую вместе с кодом идентификации носителя записи записывают новый набор предпочтительных установок, или информацию с желательных изменениях предпочтительных установок воспроизведения относительно записанных на носителе записи для данного носителя с определенным кодом идентификации. Ввиду ограниченной емкости памяти 19 желательно записывать на ней информацию в максимально компактной форме, поэтому предпочтительной является запись лишь изменений имеющихся предпочтительных установок воспроизведения.

Вместо или дополнительно к не теряющей информацию памяти 19 может применяться сменная память 20, например, в форме магнитной карточки, стираемой постоянной памяти типа EPROM, EEPROM или NVRAM для хранения предпочтительных установок в системе поиска и воспроизведения.

Это дает то преимущество, что пользователь может воспроизводить

RU 2073913 C1

RU 2073913 C1

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 303 of 431

информацию изображений на носителе записи соответственно с одними и теми же предпочтительными установками на различных системах поиска и воспроизведения изображений, с которыми может быть соединена сменная память 20. Если используется для хранения предпочтительных установок воспроизведения одна из двух или обе памяти 19, 20, желательно производить выбор из различных наборов предпочтительных установок, определяемых набором предпочтительных установок, записанным на носителе и модификациями запомненных установок. Для этой цели блок 15 должен содержать средства выбора. Эти средства могут быть типа, управляемого пользователем для выбора из различных наборов установок для одного конкретного носителя записи и номера выбора информации установок, записанной на носителе записи и в устройствах памяти. Однако альтернативно эти средства выбора могут быть типа, который перед воспроизведением на основании содержимого устройства памяти и наборов предпочтительных установок на носителе записи определяют наборы предпочтительных установок, подходящие для соответствующих носителей и заложить, например, в память 16. Затем один из имеющихся наборов предпочтительных установок в памяти 16 выбирают соответственно заранее заданному критерию выбора. Предпочтительно критерий выбора таков, что высший приоритет назначается информации предпочтительных установок в сменной памяти 20, средний приоритет информации в не теряющей информации памяти, а низший приоритет предпочтительным установкам, записанным на носителе записи. Если блок 15 содержит компьютер, то автоматический выбор может производиться посредством загрузки в него подходящей программы выбора.

Фиг. 3 показывает воплощение системы поиска и считывания изображений по фиг. 1 более подробно, в данной системе блок 21 поиска и считывания содержит блок 6 считывания, блок 22 управления и блок 23 обработки изображения. Блок считывания 6 выдает информацию, считанную с носителя записи, в блок 22 управления и в блок 23 обработки изображения. Блок 22 управления затем выбирает специфичную информацию, содержащуюся в файлах управления. Блок 23 обработки изображения из считанной информации выбирает информацию изображения и преобразует эту информацию изображения в форму, подходящую для блока 11 дисплея. Блок считывания 6 и блок 23 обработки информации управляются блоком 22 на основе данных, введенных пользователем, например, через блок 24 ввода данных, и на основе данных управления в файлах управления.

Ввиду большого количества информации для каждого записанного изображения предпочтительно считывать файлы, содержащие информацию изображения, с высокой скоростью, т. е. количеством битов в единицу времени, чтобы уменьшить время считывания изображения. Однако, это значит, данные в файле управления также считываются с высокой скоростью. Функции управления выполняются блоком 22 управления. Эти функции требуют лишь невысокой скорости обработки данных позволяющей использовать для этого дешевый и простой микрокомпьютер с малой скоростью обработки. Однако в общем случае такой дешевый микрокомпьютер не способен обрабатывать информацию управления, подаваемую с высокой скоростью считывания файлов управления, потому что скорость, с которой данные управления подаются (которая практически равна скорости информации изображения) слишком высока для обработки дешевым микропроцессором, работающим с малой скоростью. Эта проблема может быть сглажена за счет того, что каждая группа битов, содержащая данные управления записывается n раз (n целое число большее или равное двум) последовательно на носителе записи. Группа, повторно записанная n раз на носителе, далее будет называться пакетом. Пакеты с n идентичными группами выдаются при считывании информации управления.

Посредством повторения идентичных групп n раз достигают того, что скорость подачи данных управления с блока считывания уменьшается в n раз без использования добавочных функций. Соответствующим выбором величины n, таким образом, можно снизить скорость выдачи данных управления к медленно работающей микрокомпьютерной системе блока 23 управления до такой степени, что они могут обрабатываться медленно действующим микрокомпьютером 25. Между сигнальной шиной 26 и микрокомпьютерной системой 25 может быть установлена схема 27 извлечения данных, чтобы выдавать каждый из пакетов данных управления на микрокомпьютер в виде одной группы битов со скоростью, равной скорости повторения групп битов, деленной на.

Такая схема 27 извлечения данных может, например, содержать регистр 28 (см. фиг. 4А, В), который загружается с частотой синхронизации, равной частоте повторения групп битов, деленной на Биту синхронизации последовательных групп битов может быть назначена логическая величина, которая меняется с частотой, связанной с частотой повторения пакетов групп битов. Частота чередования может быть равна половине частоты повторения пакетов или в целое число раз больше. Это имеет то преимущество, последовательность синхронизации получается прямо из битов синхронизации.

Схема 72 извлечения данных содержит схему 29 извлечения синхронизации, которая подает чередующийся сигнал синхронизации, соответствующей чередующимся логическим величинам битов синхронизации, на вход управления загрузкой регистра 28. Регистр 28 загружается группой битов каждого пакета под управлением сигнала синхронизации. Схема 29 также переносит сигнал синхронизации на микрокомпьютерную систему 25. Предпочтительно группы битов в файле управления размещены в так называемых кадрах. Очень простое обнаружение начала кадра может быть достигнуто вставлением в начале кадров нескольких групп синхронизации кадров с битами синхронизации, которые составляют

RU 2073913 C1

RU 2073913 C1

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 304 of 431

определенный рисунок логических величин, которые явно отличаются от возможного рисунка логических величин битов синхронизации, которые могут встретиться в других пакетах.

Каждый кадр имеет часть, содержащую избыточную информацию, с целью обнаружения, правильно ли был считан кадр микрокомпьютерной системой. Неправильный ввод может быть следствием, например, прерывания программы, на время которого прерывается считывание данных управления, чтобы выполнить другую программу управления. Такая программа управления может быть, например, вызвана в результате ввода данных в блок ввода данных 143, чтобы получить данные из блока 24 ввода. Так как неправильный ввод данных из файлов управления обычно вызывается прерыванием программы, то требуется, чтобы исправление ошибок на основе части кадра производилось бы самим микрокомпьютером. Схема 27 содержит детектор 30 синхронизации кадров, который обнаруживает начало каждого кадра на основе битов синхронизации в группах битов синхронизации кадров. После обнаружения начала кадра детектор 30 выдает сигнал синхронизации на микрокомпьютер, который вводит данные управления, имеющиеся на регистре 28 в принципе обычно образом. Следует отметить, что в принципе функции детектора 30 и/или регистра 27 и/или схемы 29 могут также выполняться и самим микрокомпьютером.

В описанном выше процессе считывания данных управления из файлов управления сигнал синхронизации для регистра 28 получают из битов синхронизации. Однако, также возможно получать сигналы синхронизации для загрузки регистра 28 от сигнала синхронизации информации изображения, который обычно вырабатывается в блоке 23 обработки изображения для ввода кодированной информации изображения. Сигнал синхронизации информации изображения имеет жесткую связь с частотой повторения групп при считывании файлов изображения и, следовательно, с частотой повторения групп в файлах управления. Это потому, что файлы управления и файлы изображения форматируются и кодируются одинаковым образом. Поэтому сигнал синхронизации для загрузки регистра 28 может быть получен простым делением частоты сигнала синхронизации изображения в соответствующей схеме.

Фиг. 4 показывает пример схемы 27 извлечения данных, которая использует делитель 31 частоты для получения сигнала синхронизации для регистра 28. Сигнал синхронизации для загрузки регистра 28 должен быть привязан к началу кадров. Это может быть реализовано простым использованием счетчика в качестве делителя частоты: счетчик обнуляется каждый раз сигналом обнуления при обнаружении начала кадров.

Если информация в файлах управления расположена блоками, например так, как обычно делают в устройствах памяти типа CD-ROM и CD-ROM XA, сигнал обнуления для счетчика может быть получен на основе секций блочной синхронизации, расположенных в начале каждого блока. Однако, это требует, чтобы начало каждого кадра всегда находилось в фиксированном положении относительно секций блочной синхронизации. Это может быть достигнуто просто селектированием начала каждого кадра в начале блока. В последнем иллюстрированном способе синхронизации сигнала синхронизации для регистра 28 не использовали группы синхронизации кадров, находящихся в начале каждого кадра. Однако в этом случае также желательно, чтобы начало каждого кадра содержало некоторое количество групп битов, не содержащих данных управления. Действительно, при обнаружении начала каждого кадра, микрокомпьютер вызывает программу вводя для управления вводом имеющихся данных управления. Однако, в этот момент микрокомпьютер может быть занят выполнением другой задачи управления. Такая задача должна быть прервана, прежде чем будет вызвана программа ввода. Это прерывание активной задачи управления и последующей вызов программы ввода требует некоторого времени. Расположив несколько групп битов без данных управления в начале каждого кадра, с высокой вероятностью обеспечивают, что при считывании первого пакета полезных данных управления в каждом кадре микрокомпьютер будет готов ввести данные управления при управлении программой ввода. Из вышеуказанного следует, что группа битов синхронизации в начале каждого кадра могут служить двум целям, т.е. давать синхронизацию и создавать время ожидания до поступления первых полезных данных управления.

Если группы битов также используются для целей синхронизации, то важно, чтобы группы битов имели бы логический рисунок, который не встречается в других группах битов кадра. Для этой цели годятся разные способы, например, использование неидентичных групп битов в пакете, или вставление добавочных пакетов без полезной информации управления между пакетами данных управления. Например, вставлять пакеты, состоящие только из логических нулей после каждых десяти пакетов. Если, например, используется группа из тридцати двух групп битов синхронизации кадров только из логических единиц, это обеспечит, что узор, образованный группами битов синхронизации кадров не встретится в других пакетах кадра.

Фиг. 5 показывает воплощение системы хранения изображений более подробно. Блок 1 сканирования содержит сканирующий элемент 32 для сканирования носителя 2 изображений и для преобразования информации изображения в обычные сигналы информации, например, сигналы изображения. Сигналы изображения с выхода сканирующего элемента определяют самое высокое возможное разрешение в количестве пикселей на изображение. Сигналы информации сканирующего элемента преобразуются в сигнал яркости и два цветоразностных сигнала посредством обычной матричной схемы 33. Схема 34 кодирования преобразует сигналы обычным образом в абсолютно закодированные сигналы (для изображений с низким разрешением) и остаточно кодированные

RU 2073913 C1

RU 2073913 C1

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 305 of 431

сигналы изображения (для более высоких разрешений). Сканирующий элемент, матричная схема и схема кодирования управляются с помощью обычной схемы 35 управления на основе команд управления, подаваемых схему управления с блока 5 управления через интерфейс 36. Блок 5 управления может содержать компьютерную систему из блока 36 дисплея, блока 37 компьютера и памяти и блока 38 ввода, например, клавиатуры, для ввода данных пользователем. Обычным образом блок дисплея и блок ввода данных соединены с блоком компьютера и памяти, и далее соединен с блоком 1 сканирования изображения и блоком 4 записи через схему 39, 40 интерфейса 3 соответственно. Блок записи содержит форматирующий и кодирующий блок 41, который преобразует подлежащую записи информацию (которая получается с блока управления через интерфейс 42), в коды, которые подходят для записи и которые расположены в формате, подходящем для записи. Данные, которые были таким образом закодированы и заформатированы, подаются на записывающую головку 43, которая записывает соответствующий информационный узор на носителе записи 44. Процесс записи управляется схемой 45 на основе команд, получаемых с блока управления 4 и, если применимо, адресной информацией, показывающей положение записывающей головки относительно носителя записи.

Блок 37 управления и памяти загружается подходящим программным материалом для расположения остаточно закодированной информации изображения с блока 1 сканирования обычным образом в соответствии с упомянутыми выше правилами форматирования. Кроме того блок 37 компьютера памяти загружен программой для вставления в файл управления, обычным образом и в соответствии с указанными выше правилами форматирования, предпочтительных установок воспроизведения от оператора вместе с другими автоматически генерируемыми данными управления, такими, например, как список адресов, под которыми были записаны различные файлы на носителе записи.

Блок 37 может далее иметь программу обработки сигнала изображения, позволяющую обрабатывать информацию со сканирующего устройства, например, с целью исправления ошибок, например, ошибок фокусировки и устранения зернистости, или с целью коррекции цвета или яркости изображения.

Файлы, составленные посредством блока 37 подаются на блок 4 записи в желаемой последовательности их записи.

Устройство записи файлов содержит схему 46 форматирования, которая собирает подлежащую записи информацию, поданную через интерфейс 42 в соответствии со схемой форматирования, например, как обычно в так называемых системах CD-ROM или CD-ROM XA (фиг. 6).

Блок записи, показанный на фиг. 5, содержит схему 47 кодирования для создания "тасовки" или чересстрочной структуры и для добавления кодов четкости для обнаружения ошибок и исправления их (далее называемых кодами коррекции ошибок).

После выполнения этих операций информация подается на модулятор 48, в котором информации придается форма, которая лучше подходит для записи на носителе записи. Кроме того модулятор 48 добавляет субкодовую информацию, которая среди прочего содержит код абсолютного времени в качестве адресной информации в так называемом субкодовом канале.

Фиг. 6 показывает блок 23 обработки изображения более подробно. Блок 23 содержит первую схему 49 детектора для обнаружения кодов синхронизации и номеров строк изображения, показывающих начало каждой остаточной закодированной строки изображения. Вторая схема 50 детектора служит для обнаружения начала каждого субфайла в каждом файле изображения с остаточно закодированным изображением для индикации начала секции, содержащей адреса некоторого количества кодированных строк изображения. Следует заметить, что схемы детекторов нужны только для обработки остаточно закодированных изображений, а не для обработки абсолютно закодированных изображений. Схема 51 декодирования для остаточно закодированной информации изображения и схема 52 управления для управления операцией также соединены с сигнальной шиной 26. Эта шина и выходы схемы декодирования соединены на входы данных памяти 53 изображения через мультиплексную схему 54. Выходы данных памяти изображения соединены со входами схемы декодирования и со входами мультиплексной схемы. Схема 52 управления содержит генератор 55 адреса для адресования ячеек памяти изображения. Блок обработки изображения далее содержит второй генератор 56 адреса для адресования ячеек памяти, чтобы выдать содержимое памяти изображения на преобразователь 57 сигнала. Схема 51 декодирования может содержать, например, декодирующее устройство 58 для кодов Хаффмана с управлением от блока 52 управления и сумматор 59. Другой вход сумматора соединен с выходами данных памяти 55 изображения. Результат операции суммирования подается на схему 54 мультиплекса. Схема 52 управления соединена с блоком 22 управления шиной управляющих сигналов. Схема управления 4 может содержать, например, программируемый блок управления и компьютера. Такой блок может содержать, например, жестко смонтированную логическую схему или микропроцессорную систему, загруженную подходящей программой, посредством которой, на основе команд управления принятых через шину 26 управления, генератор 55 адреса и схема 54 мультиплексора управляются таким образом, что выбранная часть информации изображения, подаваемая на шине 26, загружается в память изображения. Хранимая таким образом информация в памяти изображения считывается с помощью генератора 56 адреса и затем подается на блок 11 дисплея через преобразователь 57 сигнала.

Фиг. 7 показывает пример выполнения блока 6 считывания. Блок считывания

RU 2073913 C1

RU 2073913 C1

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 306 of 431

содержит обычную считывающую головку 60, которая считывает узоры информации на носителе 44. Обычный блок 61 позиционирования обеспечивает движение головки в направлении поперек дорожек к части дорожки, заданной выбранным адресом под контролем блоке 62 управления. Сигналы, преобразованные головкой, декодируются схемой 63 EFM и затем подаются на декодирующую схему 64, который восстанавливает первоначальную структуру информации, которая была "перетасована" перед записью, и которая обнаруживает, и если возможно, исправляет, неправильно считанные кода. После обнаружения неисправимых ошибок блок декодирования выдает сигнал флажка новой ошибки. Информация, которая была восстановлена и исправлена схемой декодирования, подается на схему 65 деформатирования, которая удаляет добавочную информацию, добавленную схемой форматирования перед записью. Схема 63 EFM демодулирования, схема декодирования C1RC 64 и схема деформатирования управляются обычным образом блоком 62. Информация, выдаваемая схемой деформатирования, подается через схему 66 интерфейса. Схема деформатирования может содержать схему исправления ошибок, посредством которой могут исправляться ошибки, которые не могут быть исправлены схемой 64 декодирования. Это осуществляется посредством избыточной информации, добавленной схемой форматирования.

Емкость памяти 53 изображения велика, так что стоимость такой памяти сравнительно высока. Емкость памяти может быть уменьшена посредством установки между мультиплексором 54 и памятью 53 изображения простого преобразователя 67 частоты выборок обычного типа, что снижает количество пикселей в строке с 786 до 512.

Фиг. 8 показывает пример преобразователя частоты выборок. Данный пример содержит последовательное включение воспроизводящей и интерполирующей схемы 68, фильтра 69 нижних частот и формирующей выборки и уменьшающей их количество схемы 70.

Использование преобразователя 67 частоты выборок позволяет использовать память изображения емкостью 512x512 ячеек. Так как для практических целей количество рядов и столбцов памяти предпочтительно является степенью двойки, это дает память особенно подходящих размеров. Кроме того, в результате уменьшения количества ячеек памяти до 512 в ряду, снижается требуемая скорость считывания, так что менее строгие требования ставятся на скорость считывания из памяти.

Обычно используемые трубки-преобразователи изображения имеют максимальное разрешение приблизительно соответствующее 5 МГц, что соответствует примерно 500 пикселям в строке, так что уменьшение количества ячеек памяти в ряду не имеет видимого влияния на качество изображения при воспроизведении.

При использовании преобразователя 67 частоты выборок достигают того, кодированные строки изображения из 768 пикселей преобразуются в кодированные строки изображения, состоящие из 512 кодированных пикселей, так что кодированная строка изображения в одном столбце памяти. Это значит, что при воспроизведении изображения, хранимого в памяти 53, его высота в основном будет соответствовать высота кадров изображения по телевизионным стандартам ПАЛ и НТСЦ.

Чтобы обеспечить, что отношение между высотой и шириной представления закодированного изображения, хранимого в памяти 53, соответствовало бы первоначальному отношению, информация изображения должна заполнить только 256 из 512 столбцов памяти изображения. Это можно, например, осуществить запоминанием только четных или только нечетных закодированных строк изображения в памяти. Однако могут использоваться и другие способы с применением техники интерполяции.

Способ уменьшения количества столбцов в памяти изображения с использованием интерполяции дает удовлетворительное качество изображения. Оно лучше, чем при использовании лишь части кодированных строк изображения для подачи их в столбцы памяти изображения.

Недостаток интерполяции заключается в том, что она сравнительно сложна и расходует время, так что она меньше подходит для упрощенной системы поиска и воспроизведения изображений.

Использование преобразователя частоты выборок позволяет использовать память изображения с равным количеством рядов и столбцов и соответствующей в основном количеству используемых строк изображения по стандарту ПАЛ или НТСЦ. Это означает, что как в случае портретного, так и ландшафтного формате воспроизведения кодированных изображений, высота картинок практически соответствует количеству используемых строк изображения, так что экран дисплея будет правильно заполнен для изображений обоих типов.

Формула изобретения:

1. Носитель записи, содержащий информационные дорожки, на которых записаны файлы основных и управляющих данных, полученные в соответствии с аналогичными правилами форматирования и кодирования, отличающийся тем, что файл управляющих данных, записанный на информационных дорожках носителя записи, содержит пакеты в виде n идентичных групп бит управляющих данных в каждом пакете, где n ≥2 целое число.

2. Носитель записи по п. 1, отличающийся тем, что последовательные группы бит синхронизации кадров, расположенные на информационных дорожках в начале каждого кадра, образуют образец бит, отличающийся от образца бит, образованного группами бит управляющих данных этого кадра.

3. Носитель записи по п. 1, отличающийся тем, что каждая группа бит управляющих данных на информационных дорожках носителя записи содержит бит синхронизации с чередованием логических значений бит синхронизации последовательных групп бит управляющих данных с образцом повторения, частота которого связана с частотой повторения идентичных пакетов данных, расположенных на информационных

RU 2073913 C1

RU 2073913 C1

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 307 of 431

дорожках носителя записи.

4. Способ записи информационных файлов на носителе записи, заключающийся в формировании перед записью файлов основных и управляющих данных в соответствии с аналогичными правилами форматирования и кодирования и записи полученных сигналов основных и управляющих данных последовательно в виде кадров на носителе записи, отличающийся тем, что файл управляющих данных перед записью формируют из пакетов в виде n идентичных групп бит управляющих данных в каждом пакете, где n ≥2 целое число.

5. Способ по п. 4, отличающийся тем, что последовательные группы бит синхронизации записывают в виде образца бит, отличающегося от образца бит, сформированного группами бит управляющих данных кадра.

6. Способ по п. 4, отличающийся тем, что для каждой группы бит управляющих данных записывают бит синхронизации последовательных групп бит управляющих данных с образцом повторения, частота которого связана с частотой повторения одинаковых пакетов данных.

7. Устройство для записи информации на носителе записи, содержащее блок обработки записываемой информации, выход которого соединен с записывающей головкой, сопряженной с носителем записи, а выход с входной шиной и с управляющим блоком, выполненным с возможностью формирования из подлежащих записи файла основных данных и файла управления соответствующих сигналов с заданными правилами форматирования и кодирования, отличающееся тем, что управляющий блок выполнен с возможностью формирования сигналов управляющих данных в виде n последовательных идентичных групп бит, где n ≥2 целое число.

8. Устройство для воспроизведения информации с носителя записи, содержащее последовательно соединенные блок воспроизведения записанных файлов, блок декодирования и восстановления сигналов основных данных и данных управления и блок обработки, а также управляющий блок, связанный с блоком декодирования и восстановления и с блоком обработки, отличающееся тем, что в него введен блок выделения пакетов управляющих данных из m групп бит управляющих данных, где m < n, n > 2 количество записанных последовательных идентичных групп управляющих данных, включенный между выходом блока воспроизведения и дополнительным входом управляющего блока.

9. Устройство по п. 8, отличающееся тем, что m 1.

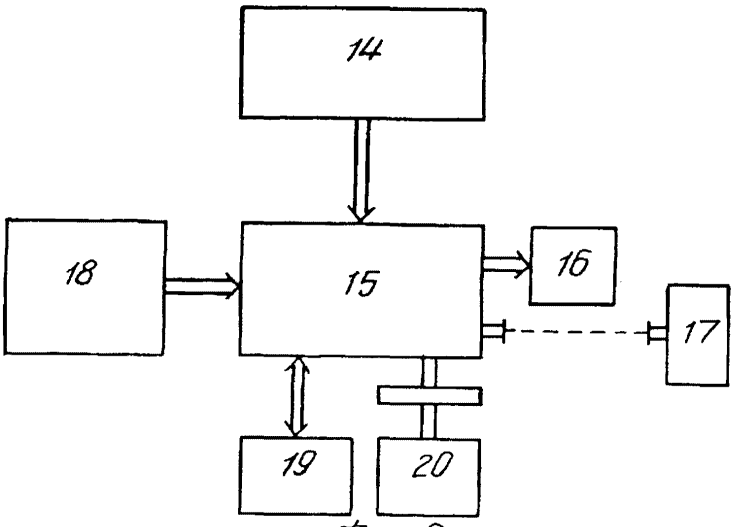
10. Устройство по п. 8 или 9, отличающееся тем, что блок выделения пакетов управляющих данных выполнен в виде блока формирования чередующихся синхросигналов с частотой, связанной с частотой повторения пакетов на основе одного из восстановленных сигналов, детектора синхронизации кадров, определяющего группы бит синхронизации кадров, находящиеся в начале каждого кадра, и делителя частоты, формирующего синхросигнал на основе бит синхронизации, входящих в группы бит управляющих данных, при этом выход блока формирования чередующихся синхросигналов соединен с управляющим входом делителя частоты, а информационные входы и выходы блока формирования чередующихся синхросигналов детектора синхронизации кадров и делителя частоты являются соответственно входами и выходами блока выделения пакетов управляющих данных.

11. Устройство по п. 8 или 9, отличающееся тем, что блок выделения пакетов управляющих данных выполнен в виде детектора синхронизации кадров, делителя частоты, управляющий вход которого соединен с выходом детектора синхронизации кадров, и регистра, управляющий вход которого соединен с выходом делителя частоты, при этом входы детектора синхронизации кадров, делителя частоты и регистра, а также выходы детектора синхронизации кадров и делителя частоты являются входом, а также выходами блока выделения пакетов управляющих данных соответственно.

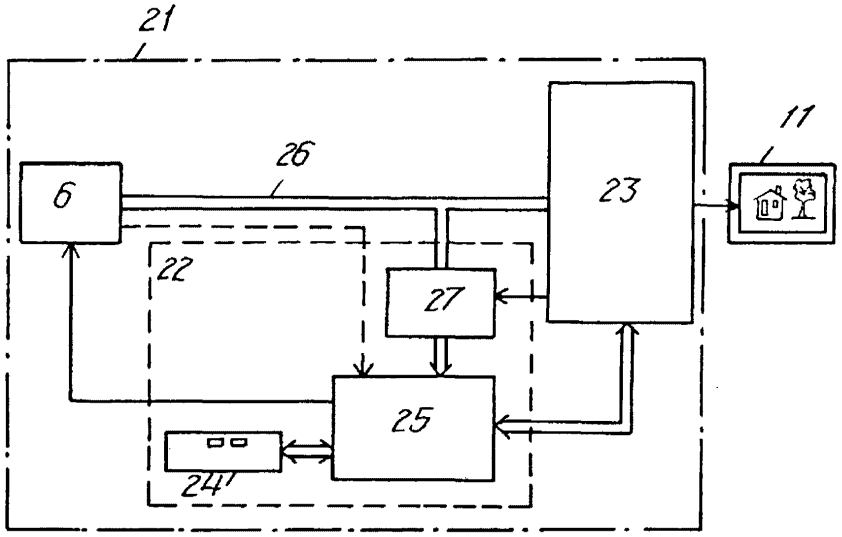
RU 2073913 C1

RU 2073913 C1

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 308 of 431



Фиг. 2

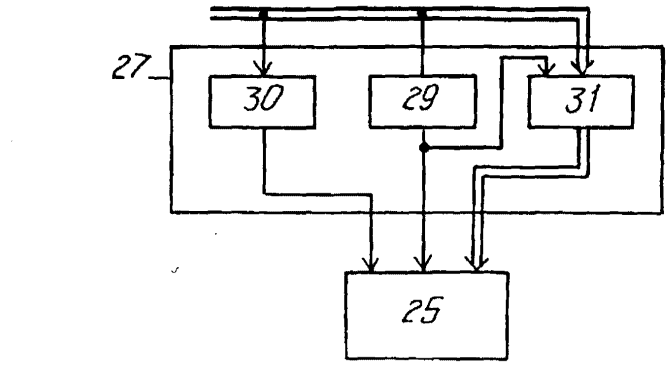


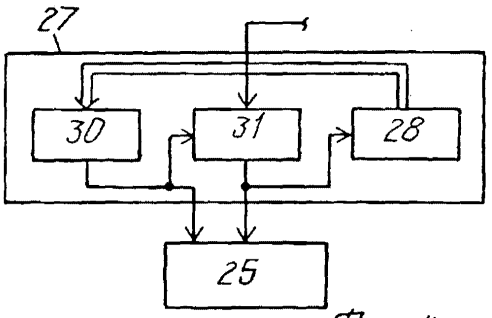
Фиг. 3

RU 2073913 C1

RU 2073913 C1

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 309 of 431



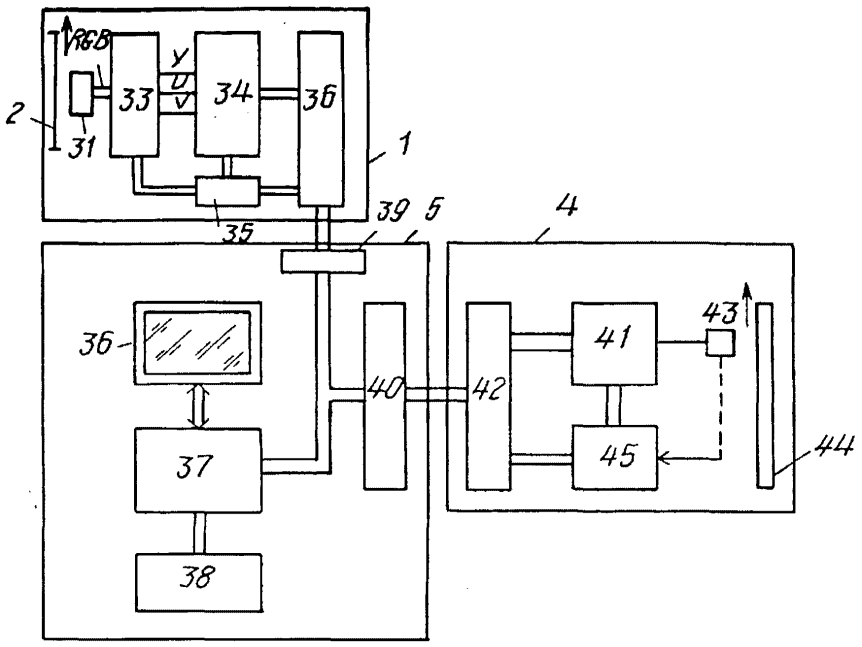


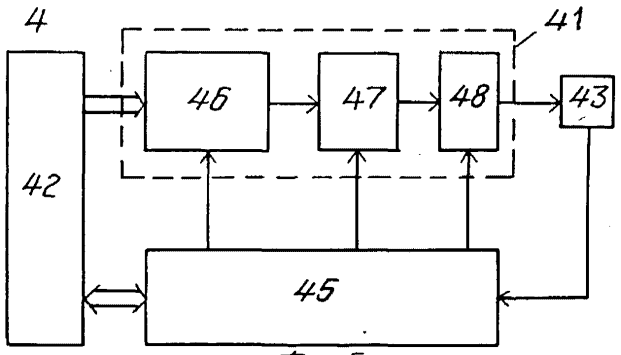
Фиг. 4

RU 2073913 C1

RU 2073913 C1

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 310 of 431



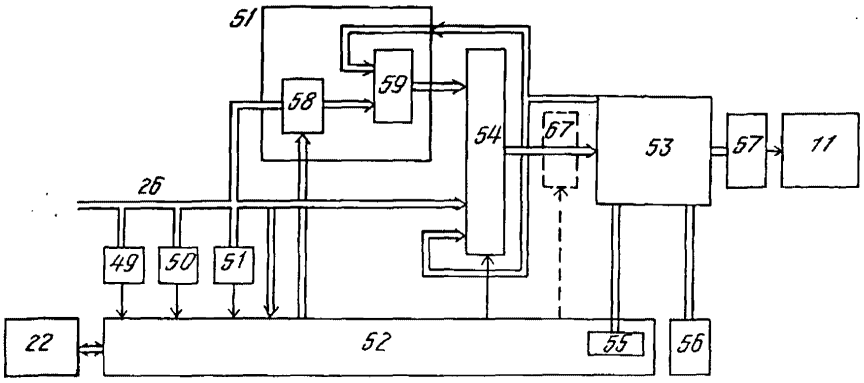


Фиг.5

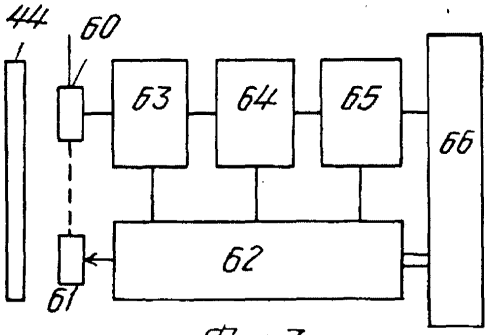
RU 2073913 C1

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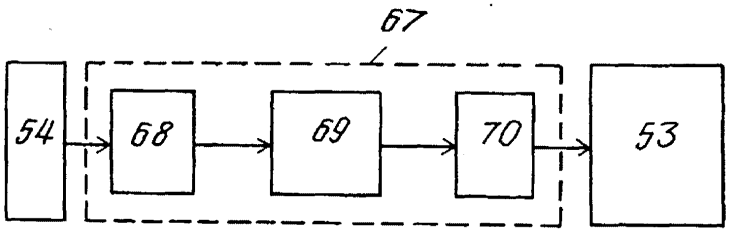
Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 311 of 431



Фиг.6



Фиг.7



Фиг.8

RU 2073913 C1

RU 2073913 C1

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 312 of 431

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Dip. Law. Konstantin Sikachin, TMA, DA, PA, L
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Moscow
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Samara
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PA - Patent Attorney
EPA - Eurasian Patent Attorney
TMA - Trademark Attorney
DA - Design Attorney
L - Lawyer
V - Valuer

TAMPEREEN PATENTTITOIMISTO OY
HERMIANKATU 12 B
FIN-33720 TAMPERE
FINLAND
Attn.: Timo Pursiainen

VIA DHL

Date: **10 December 2007**

YourRef: **TP104439 TPU/EIP**
OurRef: **2412-133925RU/8132**
Country: **RUSSIA**
ApplNo: **2005137172**
PatNo:

In the name of:
NOKIA CORPORATION

TAMPEREEN PATENTTITOIMISTO OY
13. 12. 2007

Dear Sirs,

We are pleased to enclose herewith the Decision on Patent Grant (hereinafter referred to as the Decision) issued by the RF Patent Office with respect to the group of inventions characterized in the set of claims amended by the Applicant.

With issuance of the Decision any further amendments of the set of allowed claims become impossible in proceedings on the present application, but may be affected in a divisional application filed before a patent granted for this application is registered in the State Patent Register. Such registration normally takes place about two months after issuance fees are paid, however, the Applicant is strongly recommended to inform us before payment of the issuance fees about the intention to file a divisional application, since no extensions or postponing of the registration date are possible.

The examiner cited several documents in the Decision on Grant under the index (56). All of them are available in English except of the Russian publications RU 2201654 C1 and RU 2073913. However, these

We wish you Merry Christmas and a happy and prosperous New Year!

publications correspond to publications WO 99/33273 and WO 92/05556 respectively, which are also available in English.

Please, let us know if you need any further commentary or advice regarding prosecution of the present application.

Please be informed that in accordance with the current Russian Patent Law the payment of Grant and Renewal fees should be effected is not later than **02 January 2008**.

The Grant fee amounts to **400** US$, our fee is **200** US$. The Renewal fees payable from the third year of patent duration should be paid for the period from **26 April 2006** till **26 April 2009** in the amount of **350** US$, our fee is **190** US$.

Please bear in mind that if the fees are not paid before the above date the payment in question is possible within six months from said date but with a fine of 50%.

We look forward to your consent to payment of the fees by **28 December 2007**.

Yours sincerely,

Yury Kuznetsov
Partner
Patent Attorney

Encl.: [x] Decision of Grant
[X] Translation
[x] Invoice

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ФИПС
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ОТДЕЛ 09

Форма № 01 ИЗ-2005
10

На № 2412-133925RU/8132 от 23.10.2007

(21) Наш № 2005137172/09(041483)

При переписке просим ссылаться на номер заявки и сообщить дату получения данной корреспонденции

[x] (74)

129010, Москва,
ул. Б. Спасская, 25, стр.3,
ООО "Юридическая фирма
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пат.пов. Ю.Д.Кузнецову, рег.N 595

РЕШЕНИЕ О ВЫДАЧЕ

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(24) Дата начала отсчета срока действия патента 26.04.2004

(85) Дата начала рассмотрения международной заявки на национальной фазе 30.11.2005

ПРИОРИТЕТ УСТАНОВЛЕН ПО ДАТЕ

[ ] (22) подачи заявки

[ ] (23) поступления дополнительных материалов от
к ранее поданной заявке № от

[ ] (62) [ ] приоритета изобретения по первоначальной заявке № от ,
из которой данная заявка выделена
[ ] подачи первоначальной заявки № от ,
из которой данная заявка выделена

[ ] (66) подачи ранее поданной заявки № от

[x] (30) подачи первой(ых) заявки(ок) в государстве-участнике Парижской конвенции

	(31) Номер первой(ых) заявки	(32) Дата подачи первой(ых) заявки	(33) Код страны	Пункт формулы
1.	10/426,928	30.04.2003	US	

(86) Заявка № PCT/FI2004/050051 от 26.04.2004 (96) Заявка № EA

(87) Номер публикации и дата публикации заявки PCT WO2004/098194 от 11.11.2004

(72) Автор(ы) ХАННУКСЕЛА Миска, ВАН Е-Куй, FI

(73) Патентообладатель(и) НОКИА КОРПОРЕЙШН, FI

(54) Название изобретения Способ кодирования последовательностей картинок

Date G&P: 02/11/2007



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(см. на обороте)

10 2	дом 23.10.2007	091501

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 315 of 431

Форма № 01а

(21) 2005137172/09

(51) МПК
H04N 7/26 (2006.01)

(57)

1. Способ кодирования последовательностей картинок в битовый поток, причем каждая картинка содержит информацию одной или более секций, при котором упомянутое кодирование последовательностей картинок содержит этапы, на которых:

определяют параметры в наборе параметров последовательности;

определяют параметры в наборе параметров картинки и

определяют, по меньшей мере, один параметр картинки в заголовке секции, причем этот параметр картинки остается неизмененным, по меньшей мере, во всех заголовках секций одной картинки;

при этом упомянутое определение, по меньшей мере, одного параметра картинки в заголовке секции содержит задание ссылки на набор параметров картинки.

2. Способ по п. 1, в котором набор параметров картинки включается с помощью ссылки в набор параметров последовательности.

3. Способ по п. 1, в котором параметр картинки выбирают из группы информации о счете картинки по порядку, номере кадра и идентификаторе независимо декодируемой картинки.

4. Способ по п. 1, в котором набор параметров последовательности и набор параметров картинки передается реже,чем один раз на каждую картинку.

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 316 of 431

5. Способ декодирования последовательностей картинок из битового потока, причем параметры заданы в наборе параметров и каждая картинка содержит информацию одной или более секций, при этом способ содержит этапы, на которых:

распознают набор параметров последовательности и формируют, по меньшей мере, один параметр последовательности, относящийся к последовательности, с помощью упомянутого набора параметров;

распознают набор параметров картинки и формируют, по меньшей мере, один первый параметр картинки, относящийся картинке, с помощью упомянутого набора параметров;

формируют, по меньшей мере, один второй параметр картинки с помощью информации заголовка секции, причем этот, по меньшей мере, один второй параметр картинки остается неизмененным, по меньшей мере, во всех заголовках секций одной картинки;

при этом упомянутый, по меньшей мере, один параметр картинки в заголовке секции содержит ссылку на набор параметров картинки;

декодируют последовательность картинок, используя упомянутый, по меньшей мере, второй параметр картинки.

6. Способ по п. 5, в котором набор параметров картинки включается с помощью ссылки в набор параметров последовательности.

7. Способ по п. 5, в котором второй параметр картинки выбирают из группы информации о счете картинки по порядку, номере кадра и идентификаторе независимо декодируемой картинки.

8. Кодер для кодирования последовательностей картинок в битовый поток, причем каждая картинка содержит информацию одной или более секций, при этом кодер содержит

средство для определения параметров в наборе параметров последовательности;

средство для определения параметров в наборе параметров картинки и

средство для определения, по меньшей мере, одного параметра картинки в заголовке секции, причем этот параметр картинки остается неизменным, по меньшей мере, во всех заголовках секций одной картинки;

при этом упомянутое средство для определения, по меньшей мере, одного параметра картинки в заголовке секции выполнено с возможностью задания ссылки на набор параметров картинки.

9. Декодер для декодирования последовательностей картинок из битового потока, причем параметры заданы в наборе параметров и каждая картинка содержит информацию одной или более секций, при этом декодер содержит

средство для распознавания набора параметров последовательности и формирования, по меньшей мере, одного параметра последовательности, относящегося к последовательности, с помощью упомянутого набора параметров;

средство для распознавания набора параметров картинки и формирования, по меньшей мере, одного первого параметра картинки, относящегося к картинке, с помощью упомянутого набора параметров;

средство для формирования, по меньшей мере, одного второго параметра картинки с помощью информации заголовка секции, причем этот, по меньшей мере,один второй параметр картинки остается неизмененным, по меньшей мере, во всех заголовках секций одной картинки, упомянутое средство для формирования, по меньшей мере, одного второго параметра картинки с помощью информации заголовка секции выполнено с возможностью использования ссылки на набор параметров картинки, включенной в заголовок секции, для определения упомянутого, по меньшей мере, одного второго параметра картинки; и

средство для декодирования последовательностей картинок с использованием упомянутого, по меньшей мере, второго параметра картинки.

10. Система, содержащая кодер для кодирования последовательностей картинок в битовый поток и декодер для декодирования последовательностей картинок из битового потока, причем каждая картинка содержит информацию одной или более секций, при этом кодер содержит

средство для определения параметров в наборе параметров последовательности;

средство для определения параметров в наборе параметров картинки и

средство для определения, по меньшей мере, одного параметра картинки в заголовке секции, причем этот параметр картинки остается неизменным, по меньшей мере, во всех заголовках секций одной картинки;

при этом упомянутое средство для определения, по меньшей мере, одного параметра картинки в заголовке секции выполнено с возможностью задания ссылки на набор параметров картинки;

и декодер содержит

средство для распознавания набора параметров последовательности и формирования, по меньшей мере, одного параметра последовательности, относящегося к последовательности, с помощью упомянутого набора параметров;

средство для распознавания набора параметров картинки и формирования, по меньшей мере, одного первого параметра картинки, относящегося к картинке, с помощью упомянутого набора параметров;

средство для формирования, по меньшей мере, одного второго параметра картинки с помощью информации заголовка секции, причем этот, по меньшей мере, один второй параметр картинки остается неизменным, по меньшей мере, во всех заголовках секций одной картинки, упомянутое средство формирования, по меньшей мере, одного второго параметра картинки с помощью информации заголовка секции выполнено с возможностью использования ссылки на набор параметров картинки, включенной в заголовок секции, для определения упомянутого, по меньшей мере, одного второго параметра картинки; и

средство для декодирования последовательности картинок с использованием упомянутого, по меньшей мере, второго параметра картинки.

11. Система по п. 10, в которой набор параметров сохраняется в кодере и декодере.

12. Передающее устройство, содержащее кодер для кодирования последовательностей картинок в битовый поток, причем каждая картинка содержит информацию одной или более секций, при этом кодер содержит

средство для определения параметров в наборе параметров последовательности;

средство для определения параметров в наборе параметров картинки и

средство для определения, по меньшей мере, одного параметра картинки в заголовке секции, причем этот параметр картинки остается неизменным, по меньшей мере, во всех заголовках секций одной картинки;

при этом упомянутое средство для определения, по меньшей мере, одного параметра картинки в заголовке секции выполнено с возможностью задания ссылки на набор параметров картинки.

13. Приемное устройство, содержащее декодер для декодирования последовательностей картинок из битового потока, причем параметры заданы в наборе параметров и каждая картинка содержит информацию одной или более секций, при этом декодер содержит

средство для распознавания набора параметров последовательности и формирования, по меньшей мере, одного параметра последовательности, относящегося к последовательности, с помощью набора параметров;

средство для распознавания набора параметров картинки и формирования, по меньшей мере, одного первого параметра картинки, относящегося к картинке, с помощью набора параметров;

средство для формирования, по меньшей мере, одного второго параметра картинки с помощью информации заголовка секции, причем этот, по меньшей мере, один второй параметр картинки остается неизмененным, по меньшей мере, во всех заголовках секций одной картинки, упомянутое средство для формирования, по меньшей мере, одного второго параметра картинки с помощью информации заголовка секции выполнено с возможностью использования ссылки на набор параметров картинки, включенной в заголовок секции, для определения упомянутого, по меньшей мере, одного второго параметра картинки; и

средство для декодирования последовательностей картинок с использованием упомянутого, по меньшей мере, одного второго параметра картинки.

14. Битовый поток, содержащий

кодированные картинки;

параметры последовательности в наборе параметров последовательности;

параметры картинки в наборе параметров картинки;

информацию секции, содержащую заголовок секции, и,

по меньшей мере, один параметр картинки в заголовке секции, причем этот параметр картинки остается неизменным по меньшей во всех заголовках секций одной кодированной картинки, упомянутый, по меньшей мере, один параметр картинки в заголовке секции содержит ссылку на набор параметров картинки.

15. Битовый поток по п. 14, в котором заголовок секции включается с помощью ссылки в набор параметров картинки.

16. Битовый поток по п. 14, в котором набор параметров картинки включается с помощью ссылки в набор параметров последовательности.

17. Битовый поток по п. 14, в котором параметр картинки выбирается из группы информации о счете картинки по порядку, номере кадра и идентификаторе независимо декодируемой картинки.

18. Машиночитаемый носитель, включающий в себя программное обеспечение, содержащее машиноисполняемые этапы для кодирования последовательностей картинок в битовый поток, причем каждая картинка содержит информацию одной или более секций, при этом программное обеспечение содержит машиноисполняемые этапы для:

определения параметров в наборе параметров последовательности;

определения параметров в наборе параметров картинки и

определения, по меньшей мере, одного параметра картинки в заголовке секции, причем этот параметр картинки остается неизменным, по меньшей мере, во всех заголовках секций одной картинки;

при этом упомянутое определение, по меньшей мере, одного параметра картинки в заголовке секции содержит задание ссылки на набор параметров картинки.

19. Машиночитаемый носитель, включающий в себя программное обеспечение, содержащее машиноисполняемые этапы для декодирования последовательностей картинок из битового потока, причем параметры заданы в наборе параметров, и каждая картинка содержит информацию одной или более секций, при этом программное обеспечение содержит машиноисполняемые этапы для

распознавания набора параметров последовательности и формирования, по меньшей мере, одного параметра последовательности, относящегося к последовательности, с помощью упомянутого набора параметров;

распознавания набора параметров картинки и формирования по меньшей мере одного первого параметра картинки, относящегося к картинке, с помощью упомянутого набора параметров;

формирования, по меньшей мере, одного второго параметра картинки с помощью информации заголовка секции, причем этот, по меньшей мере, один второй параметр картинки остается неизменным, по меньшей мере, во всех заголовках секций одной картинки, упомянутое формирование, по меньшей мере, одного второго параметра картинки с помощью информации заголовка секции содержит использование ссылки на набор параметров картинки, включенной в заголовок секции, для определения упомянутого, по меньшей мере, одного второго параметра картинки; и

декодирование последовательностей картинок с использованием упомянутого, по меньшей мере, одного второго параметра набора картинки.

(56) US 5838265 A1, 17.11.1998
RU 2201654 C2, 27.03.2003
EP 0322123 A3, 28.06.1989
US 6414608 A, 02.07.2002

WO 02/15589 A1, 21.02.2002
RU 2073913 C1, 20.02.1997

При публикации сведений о выдаче патента будут использованы описание и чертежи в первоначальной редакции заявителя.

Приложение: Реферат, скорректированный экспертизой на 1 л. в 1 экз.

Зам. заведующего отделом
электрорадиотехники С.В.Махотина

Евдокимова 499 240 35 66

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 323 of 431

Приложение к решению о выдаче патента на изобретение

К заявке № 2005137172/09

(54) Способ кодирования последовательностей картинок

Реферат

(57) Изобретение относится к способу кодирования последовательностей картинок в битовый поток, в котором параметры заданы в наборе параметров и каждая картинка содержит информацию об одной или нескольких секций. Способ содержит определение параметров в наборе параметров последовательности; определение параметров в наборе параметров картинки и определение по меньшей мере одного параметра картинки в заголовке секции. Параметр картинки остается неизменным по меньшей мере во всех заголовках секций одной картинки. Технический результат – повышение эффективности сжатия при передачи параметров, относящихся к информации о кодированной картинке. 12 н.п. и 9 з.п. ф-лы, 4 ил, 4 табл.

Референт В.Г. Евдокимова

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 324 of 431

TRANSLATION

DECISION ON GRANT OF A PATENT FOR INVENTION

(21) Application № **2005137172/09(041483)**. (22) Date of filing the application **26 April 2004**
(24) Date from which industrial property rights may have effect **26 April 2004**
(85) Date of commencement of the national phase **30 November 2005**

PRIORITY IS FIXED ON DATE

☐ (22) Date of filing the application
☐ (23) Date of filing of additional materials of to the earlier application №
☐ (62) ☐ priority date of the application № of from which the present application has been divided up
☐ filing date of the application № of from which the present application has been divided up
☐ (66) Filing date of the earlier application №
☒ (30) Data relating to priority under the Paris Convention

(31) Number assigned to priority application	(32) Date of filing priority application	(33) Country code	Claim
10/426,928	**30 April 2003**	**US**	

(86) PCT Application number and date **FI2004/050051** of **26 April 2004**.
(87) PCT Publication number and date **WO 2004/098194** of **11 November 2005**.

(72) Inventor(s) **HANNUKSELA, Miska, FI; WANG, Ye-Kui, FI**
(73) Assignee(s) **NOKIA CORPORATION, FI**
(51) IPC **H04N 7/26** (2006.01)
(54) Title **METHOD FOR CODING SEQUENCES OF PICTURES**

The Department of Electrical and Radio Engineering, based on the results of substantive examination of the patent application conducted with respect to the set of claims amended by the Applicant, has revealed the compliance of the claimed group of inventions with the requirements of patentability, set forth by Article 4 of the acting Patent Law of the Russian Federation, and decided to grant the Patent of the Russian Federation for the group of inventions with the set of claims presented in sheets 2-6.

(21) 2005137172/09

(57)

1. A method for encoding sequences of pictures into a bitstream, wherein each picture comprises information of one or more slices, the encoding comprising:

defining parameters in a sequence parameter set;

defining parameters in a picture parameter set; and

defining at least one picture parameter in a slice header, the picture parameter remaining unchanged at least in all slice headers of one picture;

said defining at least one picture parameter in a slice header comprising providing a reference to a picture parameter set.

2. The method according to claim 1, wherein the picture parameter set is included with a reference to a sequence parameter set.

3. The method according to claim 1, wherein the picture parameter is selected from a group of information of a picture order count, a frame number and an identifier of an independently decodable picture.

4. The method according to claim 1, wherein the sequence parameter set and picture parameter set being transmitted less often than once per each picture.

5. A method for decoding sequences of pictures from a bitstream, wherein parameters are defined in a parameter set and each picture comprises information of one or more slices, the method comprising:

recognizing a sequence parameter set and forming at least one sequence parameter pertaining to a sequence using the parameter set;

recognizing a picture parameter set and forming at least one first picture parameter pertaining to a picture using the parameter set;

forming at least one second picture parameter using information of a slice header, the at least one second picture parameter remaining unchanged at least in all slice headers of one picture;

said at least one picture parameter in the slice header comprising a reference to a picture parameter set;

decoding sequences of pictures by using the at least one second picture parameter.

6. The method according to claim 5, wherein the picture parameter set is included with a reference to a sequence parameter set.

7. The method according to claim 5, wherein the second picture parameter is selected from a group of information of a picture order count, a frame number and an identifier of an independently decodable picture.

8. An encoder for encoding sequences of pictures into a bitstream, wherein parameters are defined in a parameter set and each picture comprises information of one or more slices, the encoder comprising:

means for defining parameters in a sequence parameter set;

means for defining parameters in a picture parameter set; and

means for defining at least one picture parameter in a slice header, the picture parameter remaining unchanged at least in all slice headers of one picture;

said means for defining at least one picture parameter in a slice header being adapted to provide a reference to a picture parameter set.

9. A decoder for decoding sequences of pictures from a bitstream, wherein parameters are defined in a parameter set and each picture comprises information of one or more slices, the decoder comprising:

means for recognizing a sequence parameter set and forming at least one sequence parameter pertaining to a sequence using the parameter set;

means for recognizing a picture parameter set and forming at least one first picture parameter pertaining to a picture using the parameter set;

means for forming at least one second picture parameter using information of a slice header, the at least one second picture parameter remaining unchanged at least in all slice headers of one picture, said means for forming at least one second picture parameter using information of a slice header being adapted to use a reference to a picture parameter set included in the slice header to determine said at least one second picture parameter; and

means for decoding sequences of pictures by using the at least one second picture parameter.

10. A system comprising an encoder for encoding sequences of pictures into a bitstream, a decoder for decoding sequences of pictures from the bitstream, wherein parameters are defined in a parameter set and each picture comprises information of one or more slices, the encoder comprising:

means for defining parameters in a sequence parameter set;

means for defining parameters in a picture parameter set; and

means for defining at least one picture parameter in a slice header, the picture parameter remaining unchanged at least in all slice headers of one picture;

said means for defining at least one picture parameter in a slice header being adapted to provide a reference to a picture parameter set; and the decoder comprising

means for recognizing a sequence parameter set and forming at least one sequence parameter pertaining to a sequence using the parameter set;

means for recognizing a picture parameter set and forming at least one first picture parameter pertaining to a picture using the parameter set;

means for forming at least one second picture parameter using information of a slice header, the at least one second picture parameter remaining unchanged at least in all slice headers of one picture, said means for forming at least one second picture parameter using information of a slice header being adapted to use a reference to a picture parameter set included in the slice header to determine said at least one second picture parameter; and

means for decoding sequences of pictures by using the at least one second picture parameter.

11. The system according to claim 10, wherein a parameter set is stored in both the encoder and the decoder.

12. A transmitting device comprising an encoder for encoding sequences of pictures into a bitstream, wherein parameters are defined in a parameter set and each picture comprises information of one or more slices, the encoder comprising:

means for defining parameters in a sequence parameter set;

means for defining parameters in a picture parameter set; and

means for defining at least one picture parameter in a slice header, the picture parameter remaining unchanged at least in all slice headers of one picture;

said means for defining at least one picture parameter in a slice header being adapted to provide a reference to a picture parameter set.

13. A receiving device comprising a decoder for decoding sequences of pictures from a bitstream, wherein parameters are defined in a parameter set and each picture comprises information of one or more slices, the decoder comprising:

means for recognizing a sequence parameter set and forming at least one sequence parameter pertaining to a sequence using the parameter set;

means for recognizing a picture parameter set and forming at least one first picture parameter pertaining to a picture using the parameter set;

means for forming at least one second picture parameter using information of a slice header, the at least one second picture parameter remaining unchanged at least in all slice headers of one picture, said means for forming at least one second picture parameter using information of a slice

header being adapted to use a reference to a picture parameter set included in the slice header to determine said at least one second picture parameter; and

means for using the at least one second picture parameter in decoding.

14. A bitstream comprising:

encoded pictures;

sequence parameters in a sequence parameter set;

picture parameters in a picture parameter set;

information of a slice comprising a slice header; and

at least one picture parameter in the slice header, the picture parameter remaining unchanged at least in all slice headers of one encoded picture, said at least one picture parameter in the slice header comprising a reference to a picture parameter set.

15. The bitstream according to claim 14, wherein the slice header is included with a reference to a picture parameter set.

16. The bitstream according to claim 14, wherein the picture parameter set is included with a reference to a sequence parameter set.

17. The bitstream according to claim 14, wherein the picture parameter is selected from a group of information of a picture order count, a frame number and an identifier of an independently decodable picture.

18. A machine-readable medium including a software program comprising machine executable steps for encoding sequences of pictures into a bitstream, wherein parameters are defined in a parameter set and each picture comprises information of one or more slices, the software program comprising machine executable steps for:

defining parameters in a sequence parameter set;

defining parameters in a picture parameter set; and

defining at least one picture parameter in a slice header, the picture parameter remaining unchanged at least in all slice headers of one picture;

said defining at least one picture parameter in a slice header comprising providing a reference to a picture parameter set.

19. A machine-readable medium including a software program comprising machine executable steps for decoding sequences of pictures from a bitstream, wherein parameters are defined in a parameter set and each picture comprises information of one or more slices, the software program comprising machine executable steps for:

recognizing a sequence parameter set and forming at least one sequence parameter pertaining to a sequence using the parameter set;

recognizing a picture parameter set and forming at least one first picture parameter pertaining to a picture using the parameter set;

forming at least one second picture parameter using information of a slice header, the at least one second picture parameter remaining unchanged at least in all slice headers of one picture, said forming at least one second picture parameter using information of a slice header comprising using a reference to a picture parameter set included in the slice header to determine said at least one second picture parameter; and

decoding the sequences of pictures by using the at least one second picture parameter.

(56) US 5838265 A1, 17 November 1998
RU 2201654 C1, 27 March 2003 (also published as WO 99/33273)
EP 0322123 A3, 28 June 1989
US 6414608 A, 02 July 2002
WO 02/15589 A1, 21 February 2002
RU 2073913 C1, 20 February 1997 (also published as WO 92/05556, EP 0500913, US 6134200)

When publishing information on issuance of the patent the original specification and figures will be used.

Enclosure: abstract corrected by the Examiner on 1 sheet.

Deputy Chief of the Department of Electrical and Radio Engineering — Makhotina S.V.

For application 2005137172/09

(54) Electronic ink processing

Abstract

(57) The invention relates to the method for encoding sequences of pictures into a bitstream, wherein parameters are defined in a parameter set and each picture comprises information of one or more slices. The method comprises defining parameters in a sequence parameter set; defining parameters in a picture parameter set; and defining at least one picture parameter in a slice header. The picture parameter remains unchanged at least in all slice headers of one picture. The advantageous effect consists in improved compression efficiency in transmission of parameters relating to the encoded picture information.

12 independent claims, 9 dependent claims, 4 figures, 4 tables

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
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P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/426,928	04/30/2003	Miska Hannuksela	915-005.053	6259

7590 01/31/2008

Ware, Fressola, Van Der Sluys & Adolphson, LLP
Building Five, Bradford Green
755 Main Street
P.O. Box 224
Monroe, CT 06468

EXAMINER	
PHILIPPE, GIMS S	
ART UNIT	PAPER NUMBER
2621	

MAIL DATE	DELIVERY MODE
01/31/2008	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

PTOL-90A (Rev. 04/07)

Office Action Summary	Application No.	Applicant(s)	
	10/426,928	HANNUKSELA ET AL.	
	Examiner	Art Unit	
	Gims S. Philippe	2621	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *09 November 2007*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-25* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-25* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *1/11/08*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 333 of 431

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on November 9 2007 has been entered.

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

3. Claims 1-25 are rejected under 35 U.S.C. 102(e) as being anticipated by Visharam et al. (US Patent Application Publication no. 2004/0010802 A1).

Regarding claims 1, 6, 10-12, 14, 15-16, and 20-25, Visharam discloses the same encoder/decoder, software programs with machine executable steps and method for encoding sequences of pictures into a bitstream wherein parameters are defined in a

parameter set and each picture comprises information on one or more slices (See figs. 5, 9, 10A, 10B, and [0033 to 0037]), and comprising defining parameters in a sequence parameter set for a sequence of pictures (See [0042], lines 2-7), defining parameters in a picture parameter set for a picture (See [0042], lines 11-14), and defining at least one picture parameter in a slice header, the picture parameter remaining unchanged at least in all slice headers of one picture (See [0042], lines 7-11). The applicant should note that the step of identifying the picture parameter in the slice header will help in decoding as noted in [0022]. Also the step of defining the picture parameter in the slice header is met in [0067-0068].

As per claims 2, 7, and 17, Visharam further discloses a slice header included with a reference to a picture parameter set (See [0040, 0041]).

As per claims 3, 8, and 18, Visharam further discloses the picture parameter set included with reference to a sequence parameter set (See [0042]).

As per claims 4, 9, and 19, Visharam further discloses the picture parameter selected from a group of information of a picture order count, a frame number and an identifier of an independently decodable picture (See fig. 5, items 500 and 502, fig. 11, and [0037]).

As per claim 5, Visharam further discloses the sequence parameter set and picture parameter set are transmitted less often than once per each picture (See [0046-0048]).

As per claim 13, Visharam further discloses storing the parameter set in both the encoder and the decoder (See [0022] and [0070]).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Gims S. Philippe whose telephone number is (571) 272-7336. The examiner can normally be reached on M-F (10:30-7:00).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Dastouri Mehrdad can be reached on (571) 272-7418. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Gims S Philippe
Primary Examiner
Art Unit 2621

GSP

January 18, 2008

FORM PTO-1449 INFORMATION DISCLOSURE STATEMENT	ATTY DOCKET NO. 915-005.053	SERIAL NO. 10/426,928
	APPLICANT: M. HANNUKSELA, et al.	
	FILING DATE: April 30, 2003	ART UNIT: 2621

OIPE IAP67 JAN 17 2008 PATENT & TRADEMARK OFFICE

UNITED STATES PATENT DOCUMENTS

EXAM. INITIAL		DOCUMENT NUMBER	DATE	INVENTOR/ASSIGNEE	CLASS	SUBCLASS	FILING DATE IF APPROPRIATE
/GP/		6,414,608	Jul. 2, 2002	*Nishida et al.*			

FOREIGN PATENT DOCUMENTS

		DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES/NO
/GP/		WO 02/15589	Feb. 21, 2002	PCT			
/GP/		RU 2201654	Mar. 27, 2003	Russia			
/GP/		RU 2073913	Feb. 20, 1997	Russia			

OTHER DOCUMENTS (INCLUDING AUTHOR, TITLE, DATE, PERTINENT PAGES, ETC.)

Examiner (To be assigned) /Gims Philippe/	Date: 01/17/2008

Index of Claims

Application/Control No.	Applicant(s)/Patent under Reexamination
10/426,928	HANNUKSELA ET AL.
Examiner	**Art Unit**
Gims S. Philippe	2621

√	Rejected	–	(Through numeral) Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

Claim		Date
Final	Original	1/18/08
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Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 339 of 431

Search Notes	Application/Control No.	Applicant(s)/Patent under Reexamination	
	10/426,928	HANNUKSELA ET AL.	
	Examiner	Art Unit	
	Gims S. Philippe	2621	

SEARCHED			
Class	Subclass	Date	Examiner

INTERFERENCE SEARCHED			
Class	Subclass	Date	Examiner

SEARCH NOTES (INCLUDING SEARCH STRATEGY)		
	DATE	EXMR
Updated previously searched areas	1/18/2008	GP

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 340 of 431

OIPE
JUN 04 2008
PATENT & TRADEMARK OFFICE

PATENT
Attorney Docket No. 915-005.053

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In Re Application Of:

Miska HANNUKSELA et al.	:	Confirmation No.: **6259**
Application Serial No.: **10/426,928**	:	Group/Art Unit: **2621**
Filing Date: **April 30, 2003**	:	Examiner: **Gims S. PHILIPPE**

Title: ***Method for Coding Sequences of Pictures***

Commissioner of Patents
Mail Stop: **AMENDMENT**
P.O. Box 1450
Alexandria, VA 22313-1450

AMENDMENT IN RESPONSE TO NON-FINAL OFFICIAL ACTION

Sir:

In response to the non-final Official Action of January 31, 2008, please amend the above-captioned patent application as follows:

I hereby certify that this communication is being deposited with the United States Postal Service today, June 2, 2008, in an envelope with sufficient postage as first-class mail addressed to the Commissioner of Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

Lissette Ramos

IN THE CLAIMS:

Please amend the claims as follows:

1. (previously presented) A method for encoding sequences of pictures into a bitstream, wherein parameters are defined in a parameter set and each picture comprises information of one or more slices, the method comprising:

- defining parameters in a sequence parameter set for a sequence of pictures;
- defining parameters in a picture parameter set for a picture; and
- defining at least one picture parameter in a slice header, the picture parameter remaining unchanged at least in all slice headers of one picture.

2. (original) The method according to claim 1, wherein the slice header is included with a reference to a picture parameter set.

3. (original) The method according to claim 1, wherein the picture parameter set is included with a reference to a sequence parameter set.

4. (currently amended) The method according to claim 1, wherein the picture parameter is selected from a group of information of a picture order count, and a frame number ~~and an identifier of an independently decodable picture~~.

5. (original) The method according to claim 1, wherein the sequence parameter set and picture parameter set are transmitted less often than once per each picture.

6. (original) A method for decoding sequences of pictures from a bitstream, wherein parameters are defined in a parameter set and each picture comprises information of one or more slices, the method comprising:

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 342 of 431

- recognizing a sequence parameter set and forming at least one sequence parameter pertaining to a sequence using the parameter set;
- recognizing a picture parameter set and forming at least one first picture parameter pertaining to a picture using the parameter set;
- forming at least one second picture parameter using information of a slice header, the at least one second picture parameter remaining unchanged at least in all slice headers of one picture; and
- using the at least one second picture parameter in decoding.

7. (original) The method according to claim 6, wherein the slice header is included with a reference to a picture parameter set.

8. (original) The method according to claim 6, wherein the picture parameter set is included with a reference to a sequence parameter set.

9. (currently amended) The method according to claim 6, wherein the second picture parameter is selected from a group of information of a picture order count, and a frame number ~~and an identifier of an independently decodable picture~~.

10. (previously presented) An encoder for encoding sequences of pictures into a bitstream, wherein parameters are defined in a parameter set and each picture comprises information of one or more slices, the encoder comprising:

- a processor configured for:
- defining parameters in a sequence parameter set for a sequence of pictures;
- defining parameters in a picture parameter set for a picture; and
- defining at least one picture parameter in a slice header, the picture parameter remaining unchanged at least in all slice headers of one picture.

11. (previously presented) A decoder for decoding sequences of pictures from a bitstream, wherein parameters are defined in a parameter set and each picture comprises information of one or more slices, the decoder comprising:

- a processor configured for:
- recognizing a sequence parameter set for a sequence of pictures and forming at least one sequence parameter pertaining to a sequence using the parameter set for a picture;
- recognizing a picture parameter set and forming at least one first picture parameter pertaining to a picture using the parameter set;
- forming at least one second picture parameter using information of a slice header, the at least one second picture parameter remaining unchanged at least in all slice headers of one picture; and
- using the at least one second picture parameter in decoding.

12. (previously presented) A system comprising an encoder for encoding sequences of pictures into a bitstream, a decoder for decoding sequences of pictures from the bitstream, wherein parameters are defined in a parameter set and each picture comprises information of one or more slices, the encoder comprising:

- a processor configured for:
- defining parameters in a sequence parameter set for a sequence of pictures;
- defining parameters in a picture parameter set for a picture; and
- defining at least one picture parameter in a slice header, the picture parameter remaining unchanged at least in all slice headers of one picture;

and the decoder comprising:

- a processor configured for:
- recognizing a sequence parameter set for a sequence of pictures and forming at least one sequence parameter pertaining to a sequence using the parameter set;

- recognizing a picture parameter set for a picture and forming at least one first picture parameter pertaining to a picture using the parameter set;
- forming at least one second picture parameter using information of a slice header, the at least one second picture parameter remaining unchanged at least in all slice headers of one picture; and
- using the at least one second picture parameter in decoding.

13. (original) The system according to claim 12, wherein a parameter set is stored in both the encoder and the decoder.

14. (previously presented) A transmitting device comprising an encoder for encoding sequences of pictures into a bitstream, wherein parameters are defined in a parameter set and each picture comprises information of one or more slices, the encoder comprising:

- a processor configured for:
- defining parameters in a sequence parameter set for a sequence of pictures;
- defining parameters in a picture parameter set for a picture; and
- defining at least one picture parameter in a slice header, the picture parameter remaining unchanged at least in all slice headers of one picture.

15. (previously presented) A receiving device comprising a decoder for decoding sequences of pictures from a bitstream, wherein parameters are defined in a parameter set and each picture comprises information of one or more slices, the decoder comprising:

- a processor configured for:
- recognizing a sequence parameter set for a sequence of pictures and forming at least one sequence parameter pertaining to a sequence using the parameter set;

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 345 of 431

- recognizing a picture parameter set for a picture and forming at least one first picture parameter pertaining to a picture using the parameter set;
- forming at least one second picture parameter using information of a slice header, the at least one second picture parameter remaining unchanged at least in all slice headers of one picture; and
- using the at least one second picture parameter in decoding.

16. (previously presented) A bitstream comprising:
- encoded pictures;
- sequence parameters in a sequence parameter set for a sequence of pictures;
- picture parameters in a picture parameter set for a picture;
- information of a slice comprising a slice header; and
- at least one picture parameter in the slice header, the picture parameter remaining unchanged at least in all slice headers of one encoded picture.

17. (original) The bitstream according to claim 16, wherein the slice header is included with a reference to a picture parameter set.

18. (original) The bitstream according to claim 16, wherein the picture parameter set is included with a reference to a sequence parameter set.

19. (currently amended) The bitstream according to claim 16, wherein the picture parameter is selected from a group of information of a picture order count~~,~~ and a frame number ~~and an identifier of an independently decodable picture~~.

20. (previously presented) A software program product comprising machine executable steps stored on a readable medium for execution on a processor, the machine executable steps for encoding sequences of pictures into a bitstream, wherein

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 346 of 431

parameters are defined in a parameter set and each picture comprises information of one or more slices, the software program product comprising:

- defining parameters in a sequence parameter set for a sequence of pictures;
- defining parameters in a picture parameter set for a picture; and
- defining at least one picture parameter in a slice header, the picture parameter remaining unchanged at least in all slice headers of one picture.

21. (previously presented) A software program product comprising machine executable steps stored on a readable medium for execution on a processor, the machine executable steps for decoding sequences of pictures from a bitstream, wherein parameters are defined in a parameter set and each picture comprises information of one or more slices, the software program comprising:

- recognizing a sequence parameter set for a sequence of pictures and forming at least one sequence parameter pertaining to a sequence using the parameter set;
- recognizing a picture parameter set for a picture and forming at least one first picture parameter pertaining to a picture using the parameter set;
- forming at least one second picture parameter using information of a slice header, the at least one second picture parameter remaining unchanged at least in all slice headers of one picture; and
- using the at least one second picture parameter in decoding.

22. (previously presented) A storage medium including a software program comprising machine executable steps for encoding sequences of pictures into a bitstream, wherein parameters are defined in a parameter set and each picture comprises information of one or more slices, the software program comprising machine executable instructions for:

- defining parameters in a sequence parameter set for a sequence of pictures;
- defining parameters in a picture parameter set for a picture; and

- defining at least one picture parameter in a slice header, the picture parameter remaining unchanged at least in all slice headers of one picture.

23. (previously presented) A storage medium including a software program comprising machine executable steps for decoding sequences of pictures from a bitstream, wherein parameters are defined in a parameter set and each picture comprises information of one or more slices, the software program comprising machine executable instructions for:

- recognizing a sequence parameter set and forming at least one sequence parameter pertaining to a sequence using the parameter set for a sequence of pictures;
- recognizing a picture parameter set and forming at least one first picture parameter pertaining to a picture using the parameter set for a picture;
- forming at least one second picture parameter using information of a slice header, the at least one second picture parameter remaining unchanged at least in all slice headers of one picture; and
- using the at least one second picture parameter in decoding.

24. (previously presented) An encoder for encoding sequences of pictures into a bitstream, wherein parameters are defined in a parameter set and each picture comprises information of one or more slices, the encoder comprising:

- means for defining parameters in a sequence parameter set for a sequence of pictures;
- means for defining parameters in a picture parameter set for a picture; and
- means for defining at least one picture parameter in a slice header, the picture parameter remaining unchanged at least in all slice headers of one picture.

25. (previously presented) A decoder for decoding sequences of pictures from a bitstream, wherein parameters are defined in a parameter set and each picture comprises information of one or more slices, the decoder comprising:

- means for recognizing a sequence parameter set for a sequence of pictures and forming at least one sequence parameter pertaining to a sequence using the parameter set for a picture;
- means for recognizing a picture parameter set and forming at least one first picture parameter pertaining to a picture using the parameter set;
- means for forming at least one second picture parameter using information of a slice header, the at least one second picture parameter remaining unchanged at least in all slice headers of one picture; and
- means for using the at least one second picture parameter in decoding.

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 349 of 431

REMARKS

In response to the Official Action of January 31, 2008, claims 4, 9, and 19 have been amended in a manner which is believed to particularly point out and distinctly claim the invention; specifically, deleting the phrase "an identifier of an independently decodable picture". No new matter is added.

Claim Rejections - 35 USC §102

At section 3, claims 1-25 are rejected under 35 USC §102(e) as anticipated in view of US patent application publication 2004/0010802, Visharam, et al (hereinafter Visharam).

It is asserted with respect to claim 1 that Visharam discloses the same method for encoding sequences of pictures into a bitstream, wherein parameters are defined in a parameter set and each picture comprises information on one or more slices, as well as the specific actions recited in claim 1. For the reasons set forth below, applicant respectfully requests reconsideration of the rejection of claim 1.

More specifically, the Examiner argues that paragraph [0042] of Visharam discloses the three features recited in claim 1; namely, defining parameters in a sequence parameter set for a sequence of pictures; defining parameters in a picture parameter set for a picture; and defining at least one picture parameter in a slice header, the picture parameter remaining unchanged at least in all slice headers of one picture.

Further, the Office argues that the step of identifying the picture parameter in the slice header will help in decoding as noted in paragraph [0022] of Visharam.

Paragraph [0022] states:

> "At the generic adaptation layer 105, a GAL interface 106 receives slices from the VCL encoder 104 and creates a set of GAL units that have a NAL-independent format. That is, GAL units include enough information to allow a NAL of any transport system type to package data according to the syntax required by a corresponding transport system. As will be

> discussed in more detail below, the GAL units may include structural units that provide information about the structure of the media data, media data units that include the media data coded by the VCL encoder 104, and parameter set units that include parameter sets associated with the media data. A parameter set defines a group of parameter values that control the decoding of the VCL data. In one embodiment, the GAL units also include supplemental enhanced information (SEI) message units that include SEI messages associated with the media data. An SEI message contains auxiliary information about the media data." (emphases added)

It is respectfully submitted that paragraph [0022] of Visharam does not disclose that the parameter set units or parameter sets are included in the slice headers. Furthermore, it is not disclosed that a slice header may contain a picture parameter remaining unchanged at least in sliced headers of one picture.

In this regard, applicant refers to the very paragraph [0042] relied upon by the Office which states:

> "In one embodiment (not shown), the set 502 also contains parameter set units and SEI message units. A parameter set element defines a set of parameter values that control the decoding of VCL data. In one embodiment, parameters are associated with levels in the media data structure according to the lowest level at which they may vary. For example, a GOP parameter value like picture size may change between GOPs but not at any lower levels. Hence, in one embodiment, all of the pictures and slices in a single GOP use the same GOP parameter value while a slice parameter may vary for every slice. In one embodiment, each parameter set is assigned a unique identifier, which is constant throughout a video sequence, and each slice unit references a corresponding parameter set identifier."

It is explicitly stated in paragraph [0042] that a group of pictures (GOP) parameter value does not vary at levels lower than the GOP. Therefore, all of the

pictures and slices in a particular GOP use the same GOP parameter value. It is therefore respectfully submitted that the above-referenced paragraph does not state that each slice header of one picture contains the same picture parameter.

It is therefore respectfully submitted that Visharam does not anticipate claim 1 since it does not disclose defining at least one picture parameter in a slice header where the picture parameter remains unchanged at least in all slice headers of one picture.

For similar reasons as those presented above with respect to claim 1, it is respectfully submitted that independent encoder claim 10, independent decoder claim 11, independent system claim 12, independent transmitting device claim 14, independent receiving device 15, independent bitstream claim 16, independent software program product claim 20, independent software program product claim 21, independent storage medium claims 22 and 23, independent encoder claim 24, and independent decoder claim 25 are also not anticipated by Visharam since they all recite features corresponding to those discussed above which are not found in Visharam.

Dependent claims 2-9, 13, and 17-19 are also believed to be not anticipated by Visharam at least in view of such dependency.

Furthermore, with respect to claims 4, 9, and 19, the Office asserts that Visharam further discloses the picture parameter being selected from a group of information of a picture order count, a frame number, and an identifier of an independently decodable picture, citing Figures 5 and 11 and paragraph [0037] of Visharam.

Paragraph [0037] of Visharam discusses Figure 5, including referenced items 500 and 502 and it is there seen that Visharam does not disclose picture order count or a frame number. Claims 4, 9, and 19 have been amended to only refer to a group of information of a picture order count and a frame number and therefore, it is respectfully submitted that amended claims 4, 9, and 19 are further not anticipated by Visharam.

In view of the foregoing, it is respectfully submitted that the present application as amended is in condition for allowance and such action is earnestly solicited.

Respectfully submitted,

Dated: June 2, 2008

Alfred A. Fressola
Attorney for Applicant
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Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 353 of 431

IFW

Attorney Docket No. 915-005.053 **PATENT**



IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of: **Miska HANNUKSELA et al.**

Application No.: **10/426,928** Group No.: **2621**

Filed: **April 30, 2003** Examiner: **Gims S. PHILIPPE**

For: ***Method for Coding Sequences of Pictures***

Commissioner of Patents
Mail Stop: **AMENDMENT**
P.O. Box 1450
Alexandria, VA 22313-1450

AMENDMENT TRANSMITTAL

1. Transmitted herewith is an amendment for this application.

STATUS

2. Applicant is
   - ☐ a small entity. A statement:
     - ☐ is attached.
     - ☐ was already filed.
   - ☒ other than a small entity.

06/04/2008 NNGUYEN1 00000011 10426928
01 FC:1251 120.00 OP

CERTIFICATE OF MAILING/TRANSMISSION UNDER 37 C.F.R. §1.8(a)

I hereby certify that this correspondence is, on the date shown below, being:

MAILING
☒ deposited with the United States Postal Service with sufficient postage as first-class mail, in an envelope addressed to the Commissioner for Patents, Alexandria, VA 22313-1450.

Date: June 2, 2008

FACSIMILE
☐ transmitted by facsimile to the U.S. Patent and Trademark Office.

Signature

Lissette Ramos
(type or print name of person certifying)

EXTENSION OF TERM

NOTE: "Extension of Time in Patent Cases (Supplement Amendments) - If a timely and complete response has been filed after a Non-Final Office Action, an extension of time is not required to permit filing and/or entry of an additional amendment after expiration of the shortened statutory period.

If a timely response has been filed after a Final Office Action, an extension of time is required to permit filing and/or entry of a Notice of Appeal or filing and/or entry of an additional amendment after expiration of the shortened statutory period unless the timely-filed response placed the application in condition for allowance. Of course, if a Notice of Appeal has been filed within the shortened statutory period, the period has ceased to run." Notice of December 10, 1985 (1061 O.G. 34-35).

NOTE: See 37 C.F.R. §1.645 for extensions of time in interference proceedings, and 37 C.F.R. §1.550(c) for extensions of time in reexamination proceedings.

3. The proceedings herein are for a patent application and the provisions of 37 C.F.R. §1.136 apply.

(complete (a) or (b), as applicable)

(a) ☒ Applicant petitions for an extension of time under 37 C.F.R. §1.136 (fees: 37 C.F.R. §1.17(a)(1)-(4)) for the total number of months checked below:

Extension (months)	Fee for other than small entity	Fee for small entity
☒ one month	$ 120.00	$ 60.00
☐ two months	$ 460.00	$230.00
☐ three months	$1,020.00	$510.00
☐ four months	$1,480.00	$740.00

Fee: $ 120.00

If an additional extension of time is required, please consider this a petition therefor.

(check and complete the next item, if applicable)

☐ An extension for ____ months has already been secured. The fee paid therefor of $_____ is deducted from the total fee due for the total months of extension now requested.

Extension fee due with this request $ 120.00

OR

(b) ☐ Applicant believes that no extension of term is required. However, this conditional petition is being made to provide for the possibility that applicant has inadvertently overlooked the need for a petition for extension of time.

FEE FOR CLAIMS

4. The fee for claims (37 C.F.R. §1.16(b)-(d)) has been calculated as shown below:

(Col. 1)			(Col. 2)		(Col. 3)	SMALL ENTITY			OTHER THAN A SMALL ENTITY	
CLAIMS REMAINING AFTER AMENDMENT			HIGHEST NO. PREVIOUSLY PAID FOR		PRESENT EXTRA	ADDIT. RATE	FEE	*OR*	ADDIT. RATE	FEE
TOTAL:	**25**	MINUS	25	=	0	x $ 25=	$		x $50=$	
INDEP:	**14**	MINUS	14	=	0	x $ 105=	$		x $210=$	
☐ FIRST PRESENTATION OF MULTIPLE DEP. CLAIM						+$145=$			+$290=$	
						TOTAL ADDL. FEE	$		TOTAL ADDL. FEE	$

WARNING: "After final rejection or action (§1.113) amendments may be made canceling claims or complying with any requirement of form which has been made." 37 C.F.R. §1.116(a) (emphasis added).

(complete (c) or (d), as applicable)

(c) ☒ No additional fee for claims is required.

OR

(d) ☐ Total additional fee for claims required is $_____.

FEE PAYMENT

5. ☒ Attached is a check in the sum of $**120.00**.
☐ Authorization is hereby made to charge the amount of $ _____
to Deposit Account No. _____
☐ to credit card as shown on the attached credit card information authorization Form PTO-2038.

*WARNING: Credit card information should **not** be included on this form as it may become public.*

☐ Charge any additional fees required by this paper or credit any overpayment in the manner authorized above.

A duplicate of this request is attached.

FEE DEFICIENCY

NOTE: If there is a fee deficiency and there is no authorization to charge an account, additional fees are necessary to cover the additional time consumed in making up the original deficiency. If the maximum six-month period has expired before the deficiency is noted and corrected, the application is held abandoned. In those instances where authorization to charge is included, processing delays are encountered in returning the papers to the PTO Finance Branch in order to apply these charges prior to action on the cases. Authorization to charge the deposit account for any fee deficiency should be checked. See the Notice of April 7, 1986 (1065 O.G. 31-33).

6. ☒ If any additional extension and/or fee is required, charge Account No. **23-0442**

AND/OR

☒ If any additional fee for claims is required, charge Account No. **23-0442**.

Date: June 2, 2008

Reg. No.: 27,550

Telephone No.: (203) 261-1234

Customer No.: 004955

Signature of Practitioner

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PTO/SB/06 (07-06)
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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 10/426,928	Filing Date 04/30/2003	☐ To be Mailed

APPLICATION AS FILED – PART I

	(Column 1)	(Column 2)	SMALL ENTITY ☐		OR	OTHER THAN SMALL ENTITY	
FOR	NUMBER FILED	NUMBER EXTRA	RATE ($)	FEE ($)		RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	X $ =		OR	X $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X $ =			X $ =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $250 ($125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).						
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL			TOTAL	

APPLICATION AS AMENDED – PART II

		(Column 1)		(Column 2)	(Column 3)	SMALL ENTITY		OR	OTHER THAN SMALL ENTITY	
	06/04/2008	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)		RATE ($)	ADDITIONAL FEE ($)
AMENDMENT	Total (37 CFR 1.16(i))	* 25	Minus	** 23	= 2	X $ =		OR	X $50=	100
	Independent (37 CFR 1.16(h))	* 12	Minus	***12	= 0	X $ =		OR	X $210=	0
	☐ Application Size Fee (37 CFR 1.16(s))									
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	**100**

		(Column 1)		(Column 2)	(Column 3)					
		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)		RATE ($)	ADDITIONAL FEE ($)
AMENDMENT	Total (37 CFR 1.16(i))	*	Minus	**	=	X $ =		OR	X $ =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	X $ =		OR	X $ =	
	☐ Application Size Fee (37 CFR 1.16(s))									
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

Legal Instrument Examiner:
/MARQUITA D. JONES/

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/426,928	04/30/2003	Miska Hannuksela	915-005.053	6259

7590 10/08/2008

Ware, Fressola, Van Der Sluys & Adolphson, LLP
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EXAMINER	
PHILIPPE, GIMS S	
ART UNIT	PAPER NUMBER
2621	

MAIL DATE	DELIVERY MODE
10/08/2008	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

PTOL-90A (Rev. 04/07)

Office Action Summary	Application No.	Applicant(s)	
	10/426,928	HANNUKSELA ET AL.	
	Examiner	Art Unit	
	Gims S. Philippe	2621	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *04 June 2008*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-25* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-25* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 360 of 431

Response to Amendment

1. Applicant's amendment received on June 10th 2008 has been fully considered and entered, but the arguments are moot in view of the new ground(s) of rejection.

Specification

2. The specification is objected to as failing to provide proper antecedent basis for the claimed subject matter. See 37 CFR 1.75(d)(1) and MPEP § 608.01(o). Correction of the following is required: There is no support in the Specification for "readable medium for execution on a processor". There is no support for “storage medium including software program”.

Claim Rejections - 35 USC § 101

3. 35 U.S.C. 101 reads as follows:

> Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

The USPTO “Interim Guidelines for Examination of Patent Applications for Patent Subject Matter Eligibility” (Official Gazette notice of 22 November 2005 <http://www.uspto.gov/web/offices/com/sol/og/2005/week47/og200547.htm>), Annex IV, reads as follows:

> Descriptive material can be characterized as either "functional descriptive material" or "nonfunctional descriptive material." In this context, "functional descriptive material" consists of data structures and computer programs which impart functionality when employed as a computer component. (The definition of "data structure" is "a physical or logical relationship among data elements, designed to support specific data manipulation functions." The New IEEE

> Standard Dictionary of Electrical and Electronics Terms 308 (5th ed. 1993).) "Nonfunctional descriptive material" includes but is not limited to music, literary works and a compilation or mere arrangement of data.
>
> When functional descriptive material is recorded on some computer-readable medium it becomes structurally and functionally interrelated to the medium and will be statutory in most cases since use of technology permits the function of the descriptive material to be realized. Compare In re Lowry, 32 F.3d 1579, 1583-84, 32 USPQ2d 1031, 1035 (Fed. Cir. 1994) (claim to data structure stored on a computer readable medium that increases computer efficiency held statutory) and Warmerdam, 33 F.3d at 1360-61, 31 USPQ2d at 1759 (claim to computer having a specific data structure stored in memory held statutory product-by-process claim) with Warmerdam, 33 F.3d at 1361, 31 USPQ2d at 1760 (claim to a data structure per se held nonstatutory).
>
> In contrast, a claimed computer-readable medium encoded with a computer program is a computer element which defines structural and functional interrelationships between the computer program and the rest of the computer which permit the computer program's functionality to be realized, and is thus statutory. See Lowry, 32 F.3d at 1583-84, 32 USPQ2d at 1035.

4. Claims 20-23 are rejected under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject matter as follows.

Claim 20-23 define a software program product comprising machine executable steps stored on a readable medium embodying functional descriptive material. However, the claim does not define a computer-readable medium or memory and is thus non-statutory for that reason (i.e., “When functional descriptive material is recorded on some computer-readable medium it becomes structurally and functionally interrelated to the medium and will be statutory in most cases since use of technology permits the function of the descriptive material to be realized” - Guidelines Annex IV). That is, the scope of the presently claimed [a computer program, an algorithm, a

medium, a program providing medium, a memory, etc - whatever is claimed] can range from paper on which the program is written, to a program simply contemplated and memorized by a person. The examiner suggests amending the claim to embody the program on "computer-readable medium" or equivalent in order to make the claim statutory. Any amendment to the claim should be commensurate with its corresponding disclosure.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

6. Claims 1-25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Visharam et al. (US Patent Application no. 2004/0010802 A1) in view of Joch et al. (US Patent no. 7227901).

Regarding claims 1, 6, 10-12, 14, 15-16, and 20-25, Visharam discloses the same encoder/decoder, software programs with machine executable steps and method for encoding sequences of pictures into a bitstream wherein parameters are defined in a parameter set and each picture comprises information on one or more slices (See figs. 5, 9, 10A, 10B, and [0033 to 0037]), and comprising defining parameters in a sequence

parameter set for a sequence of pictures (See [0042], lines 2-7), defining parameters in a picture parameter set for a picture (See [0042], lines 11-14), and defining at least one picture parameter in a slice header (See [0042], lines 7-11). The applicant should note that the step of identifying the picture parameter in the slice header will help in decoding as noted in [0022]. Also the step of defining the picture parameter in the slice header is met in [0067-0068].

It is noted that although Visharam provides a slice header with parameter (See [0039-0040]) is silent about the picture parameter remaining unchanged at least in all slice headers of one picture.

However, Joch et al. discloses a method for encoding sequences of pictures comprising the steps of defining at least one picture parameter in a slice header, the picture parameter remaining unchanged at least in all slice headers of one picture (See Joch fig. 2, items 27, 31, 29, and col. 9, lines 34-52).

Therefore, it is considered obvious that one skilled in the art at the time of the invention would recognize the advantage of modifying Visharam's slice header by incorporating Joch' step of defining at least one picture parameter in a slice header, the picture parameter remaining unchanged at least in all slice headers of one picture. The motivation for performing such a modification in Visharam is to facilitate the decoding of the picture based on the setting of the picture parameter in the slice in order to facilitate the reconstruction of a macroblock of a slice (See Joch col. 9, lines 60-64 and col. 10, lines 13-21).

As per claims 2, 7, and 17, Visharam further discloses a slice header included with a reference to a picture parameter set (See [0040, 0041]).

As per claims 3, 8, and 18, Visharam further discloses the picture parameter set included with reference to a sequence parameter set (See [0042]).

As per claims 4, 9, and 19, Visharam further discloses the picture parameter selected from a group of information of a picture order count, a frame number and an identifier of an independently decodable picture (See fig. 5, items 500 and 502, fig. 11, and [0037]).

As per claim 5, Visharam further discloses the sequence parameter set and picture parameter set are transmitted less often than once per each picture (See [0046-0048]).

As per claim 13, Visharam further discloses storing the parameter set in both the encoder and the decoder (See [0022] and [0070]).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Gims S. Philippe whose telephone number is (571) 272-7336. The examiner can normally be reached on M-F (10:30-7:00).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mehrdad Dastouri can be reached on (571) 272-7418. The fax phone

number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Gims S Philippe
Primary Examiner
Art Unit 2621

/Gims S Philippe/
Primary Examiner, Art Unit 2621

Notice of References Cited	Application/Control No. 10/426,928	Applicant(s)/Patent Under Reexamination HANNUKSELA ET AL.	
	Examiner Gims S. Philippe	Art Unit 2621	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-7,227,901	06-2007	Joch et al.	375/240.29
	B	US-			
	C	US-			
	D	US-			
	E	US-			
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 367 of 431

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

BIB DATA SHEET

CONFIRMATION NO. 6259

SERIAL NUMBER	FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
10/426,928	04/30/2003 RULE	348	2621	915-005.053

APPLICANTS

Miska Hannuksela, Tampere, FINLAND;
Ye-Kui Wang, Tampere, FINLAND;

** CONTINUING DATA **********

** FOREIGN APPLICATIONS **********

** IF REQUIRED, FOREIGN FILING LICENSE GRANTED **
06/23/2003

Foreign Priority claimed	35 USC 119(a-d) conditions met	Verified and Acknowledged	Met after Allowance	STATE OR COUNTRY	SHEETS DRAWINGS	TOTAL CLAIMS	INDEPENDENT CLAIMS
❑ Yes ☑ No	❑ Yes ☑ No	/GIMS S PHILIPPE/ Examiner's Signature	❑ /g.p./ Initials	FINLAND	4	23	12

ADDRESS

Ware, Fressola, Van Der Sluys & Adolphson, LLP
Building Five, Bradford Green
755 Main Street
P.O. Box 224
Monroe, CT 06468
UNITED STATES

TITLE

Method for coding sequences of pictures

FILING FEE RECEIVED	FEES: Authority has been given in Paper	
2210	No._____ to charge/credit DEPOSIT ACCOUNT No._____ for following:	❑ All Fees ❑ 1.16 Fees (Filing) ❑ 1.17 Fees (Processing Ext. of time) ❑ 1.18 Fees (Issue) ❑ Other _____ ❑ Credit

BIB (Rev. 05/07).

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	10426928	HANNUKSELA ET AL.
	Examiner	Art Unit
	Gims S Philippe	2621

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	09/29/2008								
	1	✓								
	2	✓								
	3	✓								
	4	✓								
	5	✓								
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	22	✓								
	23	✓								
	24	✓								
	25	✓								

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 369 of 431

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	10426928	HANNUKSELA ET AL.
	Examiner	Art Unit
	Gims S Philippe	2621

SEARCHED			
Class	Subclass	Date	Examiner
375	240.29, 240.10	9/29/08	GP

SEARCH NOTES		
Search Notes	Date	Examiner
Updated previously searched areas	9/29/08	GP

INTERFERENCE SEARCH			
Class	Subclass	Date	Examiner

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 370 of 431



PATENT
Attorney Docket No. 915-005.053

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In Re Application Of:

Miska HANNUKSELA et al.	:	Confirmation No.: **6259**
Application Serial No.: **10/426,928**	:	Group/Art Unit: **2621**
Filing Date: **April 30, 2003**	:	Examiner: **Gims S. PHILIPPE**

Title: ***Method for Coding Sequences of Pictures***

Commissioner of Patents
Mail Stop: **AMENDMENT**
P.O. Box 1450
Alexandria, VA 22313-1450

AMENDMENT

Sir:

In response to the non-final Official Action of October 8, 2008, please amend the above-captioned patent application as follows:

CERTIFICATE OF MAILING

I hereby certify that this communication is being deposited with the United States Postal Service today, **February 9, 2009**, in an envelope with sufficient postage as first-class mail addressed to the Commissioner of Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

Kathleen Sipos

Kathleen Sipos

IN THE CLAIMS:

Please amend the claims as follows:

1. (previously presented) A method for encoding sequences of pictures into a bitstream, wherein parameters are defined in a parameter set and each picture comprises information of one or more slices, the method comprising:

- defining parameters in a sequence parameter set for a sequence of pictures;
- defining parameters in a picture parameter set for a picture; and
- defining at least one picture parameter in a slice header, the picture parameter remaining unchanged at least in all slice headers of one picture.

2. (original) The method according to claim 1, wherein the slice header is included with a reference to a picture parameter set.

3. (original) The method according to claim 1, wherein the picture parameter set is included with a reference to a sequence parameter set.

4. (previously presented) The method according to claim 1, wherein the picture parameter is selected from a group of information of a picture order count and a frame number.

5. (original) The method according to claim 1, wherein the sequence parameter set and picture parameter set are transmitted less often than once per each picture.

6. (original) A method for decoding sequences of pictures from a bitstream, wherein parameters are defined in a parameter set and each picture comprises information of one or more slices, the method comprising:

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 372 of 431

- recognizing a sequence parameter set and forming at least one sequence parameter pertaining to a sequence using the parameter set;
- recognizing a picture parameter set and forming at least one first picture parameter pertaining to a picture using the parameter set;
- forming at least one second picture parameter using information of a slice header, the at least one second picture parameter remaining unchanged at least in all slice headers of one picture; and
- using the at least one second picture parameter in decoding.

7. (original) The method according to claim 6, wherein the slice header is included with a reference to a picture parameter set.

8. (original) The method according to claim 6, wherein the picture parameter set is included with a reference to a sequence parameter set.

9. (previously presented) The method according to claim 6, wherein the second picture parameter is selected from a group of information of a picture order count and a frame number.

10. (previously presented) An encoder for encoding sequences of pictures into a bitstream, wherein parameters are defined in a parameter set and each picture comprises information of one or more slices, the encoder comprising:

- a processor configured for:
- defining parameters in a sequence parameter set for a sequence of pictures;
- defining parameters in a picture parameter set for a picture; and
- defining at least one picture parameter in a slice header, the picture parameter remaining unchanged at least in all slice headers of one picture.

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 373 of 431

11. (previously presented) A decoder for decoding sequences of pictures from a bitstream, wherein parameters are defined in a parameter set and each picture comprises information of one or more slices, the decoder comprising:

- a processor configured for:
- recognizing a sequence parameter set for a sequence of pictures and forming at least one sequence parameter pertaining to a sequence using the parameter set for a picture;
- recognizing a picture parameter set and forming at least one first picture parameter pertaining to a picture using the parameter set;
- forming at least one second picture parameter using information of a slice header, the at least one second picture parameter remaining unchanged at least in all slice headers of one picture; and
- using the at least one second picture parameter in decoding.

12. (previously presented) A system comprising an encoder for encoding sequences of pictures into a bitstream, a decoder for decoding sequences of pictures from the bitstream, wherein parameters are defined in a parameter set and each picture comprises information of one or more slices, the encoder comprising:

- a processor configured for:
- defining parameters in a sequence parameter set for a sequence of pictures;
- defining parameters in a picture parameter set for a picture; and
- defining at least one picture parameter in a slice header, the picture parameter remaining unchanged at least in all slice headers of one picture;

and the decoder comprising:

- a processor configured for:
- recognizing a sequence parameter set for a sequence of pictures and forming at least one sequence parameter pertaining to a sequence using the parameter set;
- recognizing a picture parameter set for a picture and forming at least one first picture parameter pertaining to a picture using the parameter set;

- forming at least one second picture parameter using information of a slice header, the at least one second picture parameter remaining unchanged at least in all slice headers of one picture; and
- using the at least one second picture parameter in decoding.

13. (original) The system according to claim 12, wherein a parameter set is stored in both the encoder and the decoder.

14. (previously presented) A transmitting device comprising an encoder for encoding sequences of pictures into a bitstream, wherein parameters are defined in a parameter set and each picture comprises information of one or more slices, the encoder comprising:

- a processor configured for:
- defining parameters in a sequence parameter set for a sequence of pictures;
- defining parameters in a picture parameter set for a picture; and
- defining at least one picture parameter in a slice header, the picture parameter remaining unchanged at least in all slice headers of one picture.

15. (previously presented) A receiving device comprising a decoder for decoding sequences of pictures from a bitstream, wherein parameters are defined in a parameter set and each picture comprises information of one or more slices, the decoder comprising:

- a processor configured for:
- recognizing a sequence parameter set for a sequence of pictures and forming at least one sequence parameter pertaining to a sequence using the parameter set;
- recognizing a picture parameter set for a picture and forming at least one first picture parameter pertaining to a picture using the parameter set;

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 375 of 431

- forming at least one second picture parameter using information of a slice header, the at least one second picture parameter remaining unchanged at least in all slice headers of one picture; and
- using the at least one second picture parameter in decoding.

16. (previously presented) A bitstream comprising:

- encoded pictures;
- sequence parameters in a sequence parameter set for a sequence of pictures;
- picture parameters in a picture parameter set for a picture;
- information of a slice comprising a slice header; and
- at least one picture parameter in the slice header, the picture parameter remaining unchanged at least in all slice headers of one encoded picture.

17. (original) The bitstream according to claim 16, wherein the slice header is included with a reference to a picture parameter set.

18. (original) The bitstream according to claim 16, wherein the picture parameter set is included with a reference to a sequence parameter set.

19. (previously presented) The bitstream according to claim 16, wherein the picture parameter is selected from a group of information of a picture order count and a frame number.

20. (currently amended) A software program product comprising machine executable steps stored on a computer readable medium for execution on a processor, the machine executable steps for encoding sequences of pictures into a bitstream, wherein parameters are defined in a parameter set and each picture comprises information of one or more slices, the software program product comprising:

- defining parameters in a sequence parameter set for a sequence of pictures;

- defining parameters in a picture parameter set for a picture; and
- defining at least one picture parameter in a slice header, the picture parameter remaining unchanged at least in all slice headers of one picture.

21. (currently amended) A software program product comprising machine executable steps stored on a computer readable medium for execution on a processor, the machine executable steps for decoding sequences of pictures from a bitstream, wherein parameters are defined in a parameter set and each picture comprises information of one or more slices, the software program comprising:

- recognizing a sequence parameter set for a sequence of pictures and forming at least one sequence parameter pertaining to a sequence using the parameter set;
- recognizing a picture parameter set for a picture and forming at least one first picture parameter pertaining to a picture using the parameter set;
- forming at least one second picture parameter using information of a slice header, the at least one second picture parameter remaining unchanged at least in all slice headers of one picture; and
- using the at least one second picture parameter in decoding.

22. (currently amended) A computer readable storage medium including a software program comprising machine executable steps for encoding sequences of pictures into a bitstream, wherein parameters are defined in a parameter set and each picture comprises information of one or more slices, the software program comprising machine executable instructions for:

- defining parameters in a sequence parameter set for a sequence of pictures;
- defining parameters in a picture parameter set for a picture; and
- defining at least one picture parameter in a slice header, the picture parameter remaining unchanged at least in all slice headers of one picture.

23. (currently amended) A computer readable storage medium including a software program comprising machine executable steps for decoding sequences of pictures from a bitstream, wherein parameters are defined in a parameter set and each picture comprises information of one or more slices, the software program comprising machine executable instructions for:

- recognizing a sequence parameter set and forming at least one sequence parameter pertaining to a sequence using the parameter set for a sequence of pictures;
- recognizing a picture parameter set and forming at least one first picture parameter pertaining to a picture using the parameter set for a picture;
- forming at least one second picture parameter using information of a slice header, the at least one second picture parameter remaining unchanged at least in all slice headers of one picture; and
- using the at least one second picture parameter in decoding.

24. (previously presented) An encoder for encoding sequences of pictures into a bitstream, wherein parameters are defined in a parameter set and each picture comprises information of one or more slices, the encoder comprising:

- means for defining parameters in a sequence parameter set for a sequence of pictures;
- means for defining parameters in a picture parameter set for a picture; and
- means for defining at least one picture parameter in a slice header, the picture parameter remaining unchanged at least in all slice headers of one picture.

25. (previously presented) A decoder for decoding sequences of pictures from a bitstream, wherein parameters are defined in a parameter set and each picture comprises information of one or more slices, the decoder comprising:

- means for recognizing a sequence parameter set for a sequence of pictures and forming at least one sequence parameter pertaining to a sequence using the parameter set for a picture;
- means for recognizing a picture parameter set and forming at least one first picture parameter pertaining to a picture using the parameter set;
- means for forming at least one second picture parameter using information of a slice header, the at least one second picture parameter remaining unchanged at least in all slice headers of one picture; and
- means for using the at least one second picture parameter in decoding.

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 379 of 431

REMARKS

Claims 1-25 were examined by the Office, and in the Office Action of October 8, 2008 all claims are rejected. With this response claims 20-23 are amended to recite "computer readable medium." All amendments are fully supported by the specification as originally filed. Support for these amendments can be found at least from page 19, lines 14-16 and page 20, lines 7-8. Applicant respectfully requests reconsideration and withdrawal of the rejections in view of the following discussion.

Specification

In section 2, on page 2 of the Office Action, the specification is objected to as failing to provide proper antecedent basis for the claimed subject matter. The Office asserts that there is no support for the phrases "readable medium for execution on a processor," or "storage medium including software program." Page 19, lines 14-16 and page 20, lines 7-8 discuss an encoder and a decoder respectively, which both include a memory. Therefore, it would be apparent to one of skill in the art that the software can be stored into a memory, which is known to be a computer readable medium. Accordingly, applicant respectfully submits that the specification provides proper antecedent basis for the claimed subject matter.

Claim Rejections Under § 101

In section 4, on page 3 of the Office Action, claims 20-23 are rejected under 35 U.S.C. § 101 as being directed to non-statutory subject matter. Claims 20-23 are amended as suggested by the Office to recite "computer readable medium," and "computer readable storage medium." Therefore, applicant respectfully requests withdrawal of the rejection to claims 20-23.

Claim Rejections Under § 103

In section 6, on page 4 of the Office Action, claims 1-25 are rejected under 35 U.S.C. § 103(a) as unpatentable over Visharam et al. (U.S. Appl. Publ. No.

2004/0010802) in view of Joch et al. (U.S. Patent No. 7,227,901). Applicant respectfully submits that claim 1 is not disclosed or suggested by the cited references, because the cited references fail to disclose or suggest all of the limitations recited in claim 1. The cited references at least fail to disclose or suggest defining at least one picture parameter in a slice header, the picture parameter remaining unchanged at least in all slice headers of one picture, as recited in claim 1.

On page 5 the Office acknowledges that Visharam fails to disclose that the picture parameter remains unchanged at least in all slice headers of one picture, and relies upon Joch for this teaching. However, Joch also fails to disclose or suggest this limitation recited in claim 1. Joch instead states that a picture parameter set in the second level includes values of parameters that will remain unchanged with a coded representation of a picture frame or field. See Joch column 9, lines 6-33. In Joch, the sequence level (17) is the first level, the picture level (19) is the second level, and the slice level (21) is the third level. Joch further states that the picture parameter set on the second level includes values of parameters that will remain unchanged within the coded representation of a picture.

However, claim 1 recites that at least one picture parameter in a slice header remains unchanged at least in all slice headers of one picture. Therefore, if the teachings of Joch were applied, it would mean that the picture parameter set would contain such picture parameters which remain unchanged throughout one picture. However, the pic_parameter_set_id depicted in the slice header of Figure 1 of Joch is not a picture parameter. Instead, it is only a reference to a picture parameter set which should be the same in all slice headers of one picture. Therefore, Joch cannot disclose or suggest that the slice header includes at least one picture parameter, and that picture parameter remains unchanged at least in all slice headers of one picture, as recited in claim 1.

Independent claims 6, 10, 11-12, 14-16 and 20-25 contain limitations similar to those recited in claim 1. Therefore, for at least the reasons discussed above with

respect to claim 1, these independent claims are not disclosed or suggested by the cited references.

The claims rejected above, and depending from the above referenced independent claims are not disclosed or suggested at least in view of their dependencies.

In view of the foregoing, it is respectfully submitted that the present application as amended is in condition for allowance and such action is earnestly solicited. The undersigned hereby authorizes the Commissioner to charge Deposit Account No. 23-0442 for any fee deficiency required to submit this response.

Respectfully submitted,

Dated: 9 Febru 2009

Keith R. Obert
Attorney for Applicant
Reg. No. 58,051

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RYPE W#21
FEB 12 2009
PATENT & TRADEMARK OFFICE

Practitioner's Docket No. 915-005.053

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of: Miska HANNUKSELA et al.

Application No.: 10/426,928 Group No.: 2621

Filed: April 30, 2003 Examiner: Gims S. PHILIPPE

For: **METHOD FOR CODING SEQUENCES OF PICTURES**

Mail Stop: AMENDMENT
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

AMENDMENT TRANSMITTAL

1. Transmitted herewith is an amendment for this application.

STATUS

2. Applicant is

☐ a small entity. A statement:

☐ is attached.

☐ was already filed.

☑ other than a small entity.

CERTIFICATE OF MAILING/TRANSMISSION UNDER 37 C.F.R. §1.8(a)

I hereby certify that this correspondence is, on the date shown below, being:

MAILING

☒ deposited with the United States Postal Service with sufficient postage as first-class mail, in an envelope addressed to the Commissioner of Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

Date: February 9, 2009

FACSIMILE

☐ transmitted by facsimile to the U.S. Patent and Trademark Office.

Kathleen Sipos
Signature

Kathleen Sipos
(type or print name of person certifying)

02/12/2009 CCHAU1 00000024 10426928
01 FC:1251 130.00 OP

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 383 of 431

EXTENSION OF TERM

NOTE: "Extension of Time in Patent Cases (Supplement Amendments) - If a timely and complete response has been filed after a Non-Final Office Action, an extension of time is not required to permit filing and/or entry of an additional amendment after expiration of the shortened statutory period.

If a timely response has been filed after a Final Office Action, an extension of time is required to permit filing and/or entry of a Notice of Appeal or filing and/or entry of an additional amendment after expiration of the shortened statutory period unless the timely-filed response placed the application in condition for allowance. Of course, if a Notice of Appeal has been filed within the shortened statutory period, the period has ceased to run." Notice of December 10, 1985 (1061 O.G. 34-35).

NOTE: See 37 C.F.R. §1.645 for extensions of time in interference proceedings, and 37 C.F.R. §1.550(c) for extensions of time in reexamination proceedings.

3. The proceedings herein are for a patent application and the provisions of 37 C.F.R. §1.136 apply.

(complete (a) or (b), as applicable)

(a) ☑ Applicant petitions for an extension of time under 37 C.F.R. §1.136 (fees: 37 C.F.R. §1.17(a)(1)-(4)) for the total number of months checked below:

Extension (months)	Fee for other than small entity	Fee for small entity
☑ one month	$ 130.00	$ 65.00
☐ two months	$ 490.00	$245.00
☐ three months	$1,110.00	$555.00
☐ four months	$1,730.00	$865.00

Fee: $ 130.00

If an additional extension of time is required, please consider this a petition therefor.

(check and complete the next item, if applicable)

☐ An extension for ____ months has already been secured. The fee paid therefor of $_____ is deducted from the total fee due for the total months of extension now requested.

Extension fee due with this request $

OR

(b) ☐ Applicant believes that no extension of term is required. However, this conditional petition is being made to provide for the possibility that applicant has inadvertently overlooked the need for a petition for extension of time.

FEE FOR CLAIMS

4. The fee for claims (37 C.F.R. §1.16(b)-(d)) has been calculated as shown below:

(Col. 1)	(Col. 2)	(Col. 3)	SMALL ENTITY			OTHER THAN A SMALL ENTITY	
CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NO. PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE	ADDIT. FEE	*OR*	RATE	ADDIT. FEE
TOTAL: 25	MINUS 25	= 0	x $ 26 = $			x $ 52 = $	
INDEP: 14	MINUS 14	= 0	x $110 = $			x $220 = $	
☐ FIRST PRESENTATION OF MULTIPLE DEP. CLAIM			+$195 = $			+$390 = $	
			TOTAL ADDL. FEE $			TOTAL ADDL. FEE $	

WARNING: "After final rejection or action (§1.113) amendments may be made cancelling claims or complying with any requirement of form which has been made." 37 C.F.R. §1.116(a) (emphasis added).

(complete (c) or (d), as applicable)

(c) ☑ No additional fee for claims is required.

OR

(d) ☐ Total additional fee for claims required is $_____.

FEE PAYMENT

5. ☑ Attached is a check in the sum of $ 130.00 .
☐ Authorization is hereby made to charge the amount of $_____.
  ☐ to Deposit Account No. _____.
  ☐ to Credit card as shown on the attached credit card information authorization form PTO-2038

FEE DEFICIENCY

NOTE: If there is a fee deficiency and there is no authorization to charge an account, additional fees are necessary to cover the additional time consumed in making up the original deficiency. If the maximum six-month period has expired before the deficiency is noted and corrected, the application is held abandoned. In those instances where authorization to charge is included, processing delays are encountered in returning the papers to the PTO Finance Branch in order to apply these charges prior to action on the cases. Authorization to charge the deposit account for any fee deficiency should be checked. See the Notice of April 7, 1986 (1065 O.G. 31-33).

6. ☑ If any additional extension and/or fee is required, charge Account No. 23-0442.

AND/OR

☑ If any additional fee for claims is required, charge Account No. 23-0442 .

Signature of Practitioner

Reg. No.: **58,051**

Telephone No.: **(203) 261-1234**

Customer No.: **004955**

Keith R. Obert

Ware, Fressola, Van Der Sluys & Adolphson LLP

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PTO/SB/06 (07-06)
Approved for use through 1/31/2007. OMB 0651-0032
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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 10/426,928	Filing Date 04/30/2003	☐ To be Mailed

APPLICATION AS FILED – PART I

	(Column 1)	(Column 2)	SMALL ENTITY ☐		OR	OTHER THAN SMALL ENTITY	
FOR	NUMBER FILED	NUMBER EXTRA	RATE ($)	FEE ($)		RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	X $ =		OR	X $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X $ =			X $ =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $250 ($125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).						
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL			TOTAL	

APPLICATION AS AMENDED – PART II

		(Column 1)		(Column 2)	(Column 3)	SMALL ENTITY		OR	OTHER THAN SMALL ENTITY	
	02/12/2009	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)		RATE ($)	ADDITIONAL FEE ($)
AMENDMENT	Total (37 CFR 1.16(i))	* 25	Minus	** 25	= 0	X $ =		OR	X $52=	0
	Independent (37 CFR 1.16(h))	* 14	Minus	***14	= 0	X $ =		OR	X $220=	0
	☐ Application Size Fee (37 CFR 1.16(s))									
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	**0**

		(Column 1)		(Column 2)	(Column 3)					
		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)		RATE ($)	ADDITIONAL FEE ($)
AMENDMENT	Total (37 CFR 1.16(i))	*	Minus	**	=	X $ =		OR	X $ =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	X $ =		OR	X $ =	
	☐ Application Size Fee (37 CFR 1.16(s))									
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

Legal Instrument Examiner:
/phyllis canty/

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

UNITED STATES PATENT AND TRADEMARK OFFICE

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/426,928	04/30/2003	Miska Hannuksela	915-005.053	6259

7590 06/05/2009

Ware, Fressola, Van Der Sluys & Adolphson, LLP
Building Five, Bradford Green
755 Main Street
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Monroe, CT 06468

EXAMINER	
PHILIPPE, GIMS S	
ART UNIT	PAPER NUMBER
2621	

MAIL DATE	DELIVERY MODE
06/05/2009	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

PTOL-90A (Rev. 04/07)

Office Action Summary	Application No.	Applicant(s)	
	10/426,928	HANNUKSELA ET AL.	
	Examiner	Art Unit	
	Gims S. Philippe	2621	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *12 February 2009*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-25* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-25* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 389 of 431

Response to Amendment

1. Applicant's response received on February 12, 2009 in which claims 20-23 were amended has been fully considered and entered, but the arguments are moot in view of the new ground(s) of rejection.

Claim Rejections - 35 USC § 101

2. 35 U.S.C. 101 reads as follows:

> Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

3. Claims 1-5 and 6-9 are rejected under 35 U.S.C. 101 as not falling within one of the four categories of inventions.

With respect to claims 1 and 6, Supreme Court precedent and recent Federal Circuit decision indicate that a statutory "process" under 35 U.S.C. 101 must (1) be tied to another statutory category (such as a particular apparatus), or (2) transform underlying subject matter (such as an article or material) to a different state or thing. While the instant claim recites a series of steps or acts to be performed, the claim neither transform underlying subject matter nor is positively tied to another statutory category that accomplishes the claimed method steps, and therefore does not qualify as a statutory process.

For example in claim 1, the method for encoding sequences of pictures into a bitstream including steps of defining parameter in a sequence parameter, defining parameters in a picture parameter, and defining one picture parameter in a slice header is of sufficient breadth that it would be reasonably interpreted as a series of steps completely performed mentally, verbally or without a machine.

The applicant has provided no explicit and deliberate definition of defining parameter in a sequence parameter, defining parameters in a picture parameter, and defining one picture parameter in a slice header to limit the steps for detecting the still pixels in the video steam.

For example in claim 6, the method for decoding sequences of pictures from a bitstream including steps of recognizing a sequence parameter set, recognizing a picture parameter set, forming one picture parameter and using a second parameter set is of sufficient breadth that it would be reasonably interpreted as a series of steps completely performed mentally, verbally or without a machine.

The applicant has provided no explicit and deliberate definition of recognizing a sequence parameter set, recognizing a picture parameter set, forming one picture parameter and using a second parameter set to limit the steps for decoding sequences of picture from the bistream.

Claims 2-5 and 7-9 are rejected by dependency to claims 1 and 6 respectively.

Response to Arguments

4. Regarding claims 1-25, the applicant notes that claims 20-23 were amended to recite “computer readable medium”. The applicant further noted that support for the amendments are found on page 19, lines 14-16 and page 20, lines 7-8.
The examiner reviewed 19, lines 14-16 and page 20, lines 7-8 for the noted support. However, the cited pages and lines do not contain any support for the amended claims 20-23 with “computer readable medium”.

The applicant argues with respect to the rejection under 35 U.S.C 103 made with respect to claims 1-25. The applicant argues that Joch fails to disclose or suggest limitation recited in claim 1. The applicant notes that Joch, in col. 9, lines 6-33, discloses that a picture parameter set in the second level will remain unchanged with a coded representation of a picture frame or field.
To the examiner the pic_parameter_set_id in the slice header is a picture parameter set comprising picture parameter.

It is the examiner’s belief that the arguments are not deemed to be persuasive. The rejection will be repeated below for the sake of completeness.

Specification

5. The specification is objected to as failing to provide proper antecedent basis for the claimed subject matter. See 37 CFR 1.75(d)(1) and MPEP § 608.01(o). Correction

of the following is required: There is no support in the Specification for "readable medium for execution on a processor". There is no support for “storage medium including software program”.

Claim Rejections - 35 USC § 101

6. 35 U.S.C. 101 reads as follows:

> Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

The USPTO “Interim Guidelines for Examination of Patent Applications for Patent Subject Matter Eligibility” (Official Gazette notice of 22 November 2005 <http://www.uspto.gov/web/offices/com/sol/og/2005/week47/og200547.htm>), Annex IV, reads as follows:

> Descriptive material can be characterized as either "functional descriptive material" or "nonfunctional descriptive material." In this context, "functional descriptive material" consists of data structures and computer programs which impart functionality when employed as a computer component. (The definition of "data structure" is "a physical or logical relationship among data elements, designed to support specific data manipulation functions." The New IEEE Standard Dictionary of Electrical and Electronics Terms 308 (5th ed. 1993).) "Nonfunctional descriptive material" includes but is not limited to music, literary works and a compilation or mere arrangement of data.
>
> When functional descriptive material is recorded on some computer-readable medium it becomes structurally and functionally interrelated to the medium and will be statutory in most cases since use of technology permits the function of the descriptive material to be realized. Compare In re Lowry, 32 F.3d 1579, 1583-84, 32 USPQ2d 1031, 1035 (Fed. Cir. 1994) (claim to data structure stored on a computer readable medium that increases computer efficiency held statutory) and Warmerdam, 33 F.3d at 1360-61, 31 USPQ2d at 1759 (claim to computer having a specific data structure stored in memory held statutory product-by-process claim) with Warmerdam, 33 F.3d at 1361, 31 USPQ2d at 1760 (claim to a data structure per se held nonstatutory).
>
> In contrast, a claimed computer-readable medium encoded with a computer

> program is a computer element which defines structural and functional interrelationships between the computer program and the rest of the computer which permit the computer program's functionality to be realized, and is thus statutory. See Lowry, 32 F.3d at 1583-84, 32 USPQ2d at 1035.

7. Claims 20-23 are rejected under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject matter as follows.

Claim 20-23 define a software program product comprising machine executable steps stored on a readable medium embodying functional descriptive material. However, the claim does not define a computer-readable medium or memory and is thus non-statutory for that reason (i.e., "When functional descriptive material is recorded on some computer-readable medium it becomes structurally and functionally interrelated to the medium and will be statutory in most cases since use of technology permits the function of the descriptive material to be realized" - Guidelines Annex IV). That is, the scope of the presently claimed [a computer program, an algorithm, a medium, a program providing medium, a memory, etc - whatever is claimed] can range from paper on which the program is written, to a program simply contemplated and memorized by a person. The examiner suggests amending the claim to embody the program on "computer-readable medium" or equivalent in order to make the claim statutory. Any amendment to the claim should be commensurate with its corresponding disclosure.

Claim Rejections - 35 USC § 103

8. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

9. Claims 1-25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Visharam et al. (US Patent Application no. 2004/0010802 A1) in view of Joch et al. (US Patent no. 7227901).

Regarding claims 1, 6, 10-12, 14, 15-16, and 20-25, Visharam discloses the same encoder/decoder, software programs with machine executable steps and method for encoding sequences of pictures into a bitstream wherein parameters are defined in a parameter set and each picture comprises information on one or more slices (See figs. 5, 9, 10A, 10B, and [0033 to 0037]), and comprising defining parameters in a sequence parameter set for a sequence of pictures (See [0042], lines 2-7), defining parameters in a picture parameter set for a picture (See [0042], lines 11-14), and defining at least one picture parameter in a slice header (See [0042], lines 7-11). The applicant should note that the step of identifying the picture parameter in the slice header will help in decoding as noted in [0022]. Also the step of defining the picture parameter in the slice header is met in [0067-0068].

It is noted that although Visharam provides a slice header with parameter (See [0039-0040]) is silent about the picture parameter remaining unchanged at least in all slice headers of one picture.

However, Joch et al. discloses a method for encoding sequences of pictures comprising the steps of defining at least one picture parameter in a slice header, the picture parameter remaining unchanged at least in all slice headers of one picture (See Joch fig. 2, items 27, 31, 29, and col. 9, lines 34-52).

Therefore, it is considered obvious that one skilled in the art at the time of the invention would recognize the advantage of modifying Visharam's slice header by incorporating Joch' step of defining at least one picture parameter in a slice header, the picture parameter remaining unchanged at least in all slice headers of one picture. The motivation for performing such a modification in Visharam is to facilitate the decoding of the picture based on the setting of the picture parameter in the slice in order to facilitate the reconstruction of a macroblock of a slice (See Joch col. 9, lines 60-64 and col. 10, lines 13-21).

As per claims 2, 7, and 17, Visharam further discloses a slice header included with a reference to a picture parameter set (See [0040, 0041]).

As per claims 3, 8, and 18, Visharam further discloses the picture parameter set included with reference to a sequence parameter set (See [0042]).

As per claims 4, 9, and 19, Visharam further discloses the picture parameter selected from a group of information of a picture order count, a frame number and an identifier of an independently decodable picture (See fig. 5, items 500 and 502, fig. 11, and [0037]).

As per claim 5, Visharam further discloses the sequence parameter set and picture parameter set are transmitted less often than once per each picture (See [0046-0048]).

As per claim 13, Visharam further discloses storing the parameter set in both the encoder and the decoder (See [0022] and [0070]).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Gims S. Philippe whose telephone number is (571) 272-7336. The examiner can normally be reached on M-F (10:30-7:00).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mehrdad Dastouri can be reached on (571) 272-7418. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Gims S Philippe
Primary Examiner
Art Unit 2621

/G. S. P./
/Gims S Philippe/
Primary Examiner, Art Unit 2621

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	10426928	HANNUKSELA ET AL.
	Examiner	Art Unit
	Gims S Philippe	2621

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	09/29/2008	06/02/2009							
	1	✓	✓							
	2	✓	✓							
	3	✓	✓							
	4	✓	✓							
	5	✓	✓							
	6	✓	✓							
	7	✓	✓							
	8	✓	✓							
	9	✓	✓							
	10	✓	✓							
	11	✓	✓							
	12	✓	✓							
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	14	✓	✓							
	15	✓	✓							
	16	✓	✓							
	17	✓	✓							
	18	✓	✓							
	19	✓	✓							
	20	✓	✓							
	21	✓	✓							
	22	✓	✓							
	23	✓	✓							
	24	✓	✓							
	25	✓	✓							

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 399 of 431

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	10426928	HANNUKSELA ET AL.
	Examiner	Art Unit
	Gims S Philippe	2621

SEARCHED			
Class	Subclass	Date	Examiner
375	240.29, 240.10	9/29/08	GP

SEARCH NOTES		
Search Notes	Date	Examiner
Updated previously searched areas	9/29/08	GP
Updated previously searched areas	6/2/09	GP

INTERFERENCE SEARCH			
Class	Subclass	Date	Examiner

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 400 of 431

OIPE
OCT 07 2009
PATENT & TRADEMARK OFFICE

PATENT
Attorney Docket No. 915-005.053

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In Re Application Of:

Miska HANNUKSELA et al.	:	Confirmation No.: **6259**
Application Serial No.: **10/426,928**	:	Group/Art Unit: **2621**
Filing Date: **April 30, 2003**	:	Examiner: **Gims S. PHILIPPE**

Title: ***Method for Coding Sequences of Pictures***

Commissioner of Patents
Mail Stop: **AMENDMENT**
P.O. Box 1450
Alexandria, VA 22313-1450

AMENDMENT

Sir:

In response to the non-final Office Action of June 5, 2009, please amend the above-captioned patent application as follows:

CERTIFICATE OF MAILING

I hereby certify that this communication is being deposited with the United States Postal Service today, 10.5.09, in an envelope with sufficient postage as first-class mail addressed to the Commissioner of Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

Cathy Sturmer

IN THE CLAIMS:

Please amend the claims as follows:

1. (currently amended) A method for encoding sequences of pictures into a bitstream, wherein parameters are defined in a parameter set and each picture comprises information of one or more slices, the method comprising:

- defining, in an encoder, ~~parameters~~ parameter values in a sequence parameter set for a sequence of pictures;
- defining, in the encoder, ~~parameters~~ parameter values in a picture parameter set for a picture; and
- defining, in the encoder, at least one picture parameter value in a slice header, the picture parameter value remaining unchanged at least in all slice headers of one picture.

2. (original) The method according to claim 1, wherein the slice header is included with a reference to a picture parameter set.

3. (original) The method according to claim 1, wherein the picture parameter set is included with a reference to a sequence parameter set.

4. (currently amended) The method according to claim 1, wherein the picture parameter value is selected from a group of information of a picture order count and a frame number.

5. (original) The method according to claim 1, wherein the sequence parameter set and picture parameter set are transmitted less often than once per each picture.

6. (currently amended) A method for decoding sequences of pictures from a bitstream, wherein parameters are defined in a parameter set and each picture comprises information of one or more slices, the method comprising:

- recognizing, in a decoder, a sequence parameter set and forming at least one sequence parameter pertaining to a sequence using the parameter set;
- recognizing, in the decoder, a picture parameter set and forming at least one first picture parameter value pertaining to a picture using the parameter set;
- forming, in the decoder, at least one second picture parameter value using information of a slice header, the at least one second picture parameter value remaining unchanged at least in all slice headers of one picture; and
- using, in the decoder, the at least one second picture parameter value in decoding.

7. (original) The method according to claim 6, wherein the slice header is included with a reference to a picture parameter set.

8. (original) The method according to claim 6, wherein the picture parameter set is included with a reference to a sequence parameter set.

9. (currently amended) The method according to claim 6, wherein the second picture parameter value is selected from a group of information of a picture order count and a frame number.

10. (currently amended) An encoder for encoding sequences of pictures into a bitstream, wherein parameters are defined in a parameter set and each picture comprises information of one or more slices, the encoder comprising:

- a processor configured for:
- defining ~~parameters~~parameter values in a sequence parameter set for a sequence of pictures;

- defining ~~parameters~~parameter values in a picture parameter set for a picture; and
- defining at least one picture parameter value in a slice header, the picture parameter value remaining unchanged at least in all slice headers of one picture.

11. (currently amended) A decoder for decoding sequences of pictures from a bitstream, wherein parameters are defined in a parameter set and each picture comprises information of one or more slices, the decoder comprising:

- a processor configured for:
- recognizing a sequence parameter set for a sequence of pictures and forming at least one sequence parameter pertaining to a sequence using the parameter set for a picture;
- recognizing a picture parameter set and forming at least one first picture parameter value pertaining to a picture using the parameter set;
- forming at least one second picture parameter value using information of a slice header, the at least one second picture parameter value remaining unchanged at least in all slice headers of one picture; and
- using the at least one second picture parameter value in decoding.

12. (currently amended) A system comprising an encoder for encoding sequences of pictures into a bitstream, a decoder for decoding sequences of pictures from the bitstream, wherein parameters are defined in a parameter set and each picture comprises information of one or more slices, the encoder comprising:

- a processor configured for:
- defining ~~parameters~~parameter values in a sequence parameter set for a sequence of pictures;
- defining ~~parameters~~parameter values in a picture parameter set for a picture; and

- defining at least one picture parameter value in a slice header, the picture parameter value remaining unchanged at least in all slice headers of one picture;

and the decoder comprising:

- a processor configured for:
- recognizing a sequence parameter set for a sequence of pictures and forming at least one sequence parameter pertaining to a sequence using the parameter set;
- recognizing a picture parameter set for a picture and forming at least one first picture parameter value pertaining to a picture using the parameter set;
- forming at least one second picture parameter value using information of a slice header, the at least one second picture parameter value remaining unchanged at least in all slice headers of one picture; and
- using the at least one second picture parameter value in decoding.

13. (original) The system according to claim 12, wherein a parameter set is stored in both the encoder and the decoder.

14. (currently amended) A transmitting device comprising an encoder for encoding sequences of pictures into a bitstream, wherein parameters are defined in a parameter set and each picture comprises information of one or more slices, the encoder comprising:

- a processor configured for:
- defining ~~parameters~~parameter values in a sequence parameter set for a sequence of pictures;
- defining ~~parameters~~parameter values in a picture parameter set for a picture; and
- defining at least one picture parameter value in a slice header, the picture parameter value remaining unchanged at least in all slice headers of one picture.

15. (currently amended) A receiving device comprising a decoder for decoding sequences of pictures from a bitstream, wherein parameters are defined in a parameter set and each picture comprises information of one or more slices, the decoder comprising:

- a processor configured for:
- recognizing a sequence parameter set for a sequence of pictures and forming at least one sequence parameter pertaining to a sequence using the parameter set;
- recognizing a picture parameter set for a picture and forming at least one first picture parameter value pertaining to a picture using the parameter set;
- forming at least one second picture parameter value using information of a slice header, the at least one second picture parameter value remaining unchanged at least in all slice headers of one picture; and
- using the at least one second picture parameter value in decoding.

16. (currently amended) A bitstream comprising:

- encoded pictures;
- sequence parameters in a sequence parameter set for a sequence of pictures;
- picture ~~parameters~~parameter values in a picture parameter set for a picture;
- information of a slice comprising a slice header; and
- at least one picture parameter value in the slice header, the picture parameter value remaining unchanged at least in all slice headers of one encoded picture.

17. (original) The bitstream according to claim 16, wherein the slice header is included with a reference to a picture parameter set.

18. (original) The bitstream according to claim 16, wherein the picture parameter set is included with a reference to a sequence parameter set.

19. (currently amended) The bitstream according to claim 16, wherein the picture parameter value is selected from a group of information of a picture order count and a frame number.

20. (currently amended) A ~~software program product comprising machine executable steps stored on a~~ computer readable storage medium embedded with a computer program comprising programming code for execution on a processor, the ~~machine executable steps~~programming code for encoding sequences of pictures into a bitstream, wherein parameters are defined in a parameter set and each picture comprises information of one or more slices, ~~the software program product comprising~~and the programming code for:

- defining ~~parameters~~parameter values in a sequence parameter set for a sequence of pictures;
- defining ~~parameters~~parameter values in a picture parameter set for a picture; and
- defining at least one picture parameter value in a slice header, the picture parameter value remaining unchanged at least in all slice headers of one picture.

21. (currently amended) A ~~software program product comprising machine executable steps stored on a~~ computer readable storage medium embedded with a computer program comprising programming code for execution on a processor, the ~~machine executable steps~~programming code for decoding sequences of pictures from a bitstream, wherein parameters are defined in a parameter set and each picture comprises information of one or more slices, ~~the software program comprising~~and the programming code for:

- recognizing a sequence parameter set for a sequence of pictures and forming at least one sequence parameter pertaining to a sequence using the parameter set;
- recognizing a picture parameter set for a picture and forming at least one first picture parameter value pertaining to a picture using the parameter set;

- forming at least one second picture parameter value using information of a slice header, the at least one second picture parameter value remaining unchanged at least in all slice headers of one picture; and
- using the at least one second picture parameter value in decoding.

22. (CANCELED)

23. (CANCELED)

24. (currently amended) An encoder for encoding sequences of pictures into a bitstream, wherein parameters are defined in a parameter set and each picture comprises information of one or more slices, the encoder comprising:

- means for defining ~~parameters~~parameter values in a sequence parameter set for a sequence of pictures;
- means for defining ~~parameters~~parameter values in a picture parameter set for a picture; and
- means for defining at least one picture parameter value in a slice header, the picture parameter value remaining unchanged at least in all slice headers of one picture.

25. (currently amended) A decoder for decoding sequences of pictures from a bitstream, wherein parameters are defined in a parameter set and each picture comprises information of one or more slices, the decoder comprising:

- means for recognizing a sequence parameter set for a sequence of pictures and forming at least one sequence parameter pertaining to a sequence using the parameter set for a picture;
- means for recognizing a picture parameter set and forming at least one first picture parameter value pertaining to a picture using the parameter set;

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 408 of 431

- means for forming at least one second picture parameter value using information of a slice header, the at least one second picture parameter value remaining unchanged at least in all slice headers of one picture; and
- means for using the at least one second picture parameter value in decoding.

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 409 of 431

REMARKS

Claims 1-25 were examined by the Office, and in the Office Action of June 5, 2009 all claims are rejected. With this response, claims 1, 4, 6, 9-12, 14-16, 19-21 and 24-25 are amended, and claims 22-23 are cancelled. All amendments are fully supported by the specification as originally filed. Support for these amendments can be found at least from page 4, lines 16-18, page 19, lines 14-16 and page 20, lines 7-8. Applicant respectfully requests reconsideration and withdrawal of the rejections in view of the following discussion.

Claim Rejections Under § 101

In section 3, on page 2 of the Office Action, claims 1-9 are rejected under 35 U.S.C. § 101 as not falling within one of the four categories of inventions. With this response, claim 1 is amended to recite "in an encoder," and claim 6 is amended to recite "in a decoder." Therefore, claims 1-9 are tied to a particular apparatus, i.e. an encoder or a decoder, and therefore are statutory. Accordingly, applicant respectfully requests withdrawal of the rejection to claims 1-9.

Specification

In section 5, on page 4 of the Office Action, the specification is objected to as failing to provide proper antecedent basis for the claimed subject matter. Page 19, lines 14-16 and page 20, lines 7-8 discuss an encoder and a decoder respectively, which both include a memory. Therefore, it would be apparent to one of skill in the art that the software can be stored into a memory, which is known to be a computer readable storage medium, as recited in claims 20 and 21. Accordingly, applicant respectfully submits that the specification provides proper antecedent basis for the claimed subject matter.

Claim Rejections Under § 101

In section 7, on page 6 of the Office Action, claims 20-23 are rejected under 35 U.S.C. § 101 as being directed to non-statutory subject matter. Claims 20-21 are amended as suggested by the Office to recite "computer readable storage medium," and claims 22-23 are cancelled. As discussed above, the computer readable storage medium corresponds to the memory discussed on page 19, lines 14-16 and page 20, lines 7-8. Therefore, applicant respectfully requests withdrawal of the rejection to claims 20-23.

Claim Rejections Under § 103

In section 9, on page 7 of the Office Action, claims 1-25 are rejected under 35 U.S.C. § 103(a) as unpatentable over Visharam et al. (U.S. Appl. Publ. No. 2004/0010802) in view of Joch et al. (U.S. Patent No. 7,227,901). Applicant respectfully submits that claim 1 is not disclosed or suggested by the cited references, because the cited references fail to disclose or suggest all of the limitations recited in claim 1. The cited references at least fail to disclose or suggest defining at least one picture parameter value in a slice header, the picture parameter value remaining unchanged at least in all slice headers of one picture, as recited in claim 1.

The Office asserts that the pic_parameter_set_id of Joch in the slice header is a picture parameter set comprising a picture parameter. However, applicant respectfully disagrees. Visharam only discloses that a parameter set defines a group of parameter values that control the decoding of the VCL data. See Visharam paragraph [0022]. Therefore, a parameter set is not a parameter that controls the decoding of the VCL data but the parameter inside the parameter set can be. By using this analogy the index of the parameter set, i.e. pic_parameter_set_id of Joch is not a picture parameter value that controls the decoding of the VCL data. Accordingly, the cited references fail to disclose or suggest defining at least one picture parameter value in a slice header, the picture parameter value remaining unchanged at least in all slice headers of one picture, as recited in claim 1.

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 411 of 431

Independent claims 6, 10, 11-12, 14-16 and 20-25 contain limitations similar to those recited in claim 1. Therefore, for at least the reasons discussed above with respect to claim 1, these independent claims are not disclosed or suggested by the cited references.

The claims rejected above, and depending from the above referenced independent claims are not disclosed or suggested at least in view of their dependencies.

In view of the foregoing, it is respectfully submitted that the present application as amended is in condition for allowance and such action is earnestly solicited. The undersigned hereby authorizes the Commissioner to charge Deposit Account No. 23-0442 for any fee deficiency required to submit this response.

Respectfully submitted,

Dated: 5 October 2009

Keith R. Obert
Attorney for Applicant
Registration No. 58,051

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Snap v. Nokia - IPR2025-01338
Page 412 of 431

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PTO/SB/22 (07-09)
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PETITION FOR EXTENSION OF TIME UNDER 37 CFR 1.136(a) FY 2009 (Fees pursuant to the Consolidated Appropriations Act, 2005 (H.R. 4818).)	Docket Number (Optional) 915-005.053
Application Number 10/426,928	Filed April 30, 2003
For METHOD FOR CODING SEQUENCES OF PICTURES	
Art Unit 2621	Examiner Gims S. PHILIPPE

This is a request under the provisions of 37 CFR 1.136(a) to extend the period for filing a reply in the above identified application.

The requested extension and fee are as follows (check time period desired and enter the appropriate fee below):

	Fee	Small Entity Fee	
☑ One month (37 CFR 1.17(a)(1))	$130	$65	$ 130.00
☐ Two months (37 CFR 1.17(a)(2))	$490	$245	$
☐ Three months (37 CFR 1.17(a)(3))	$1110	$555	$
☐ Four months (37 CFR 1.17(a)(4))	$1730	$865	$
☐ Five months (37 CFR 1.17(a)(5))	$2350	$1175	$

☐ Applicant claims small entity status. See 37 CFR 1.27.

☑ A check in the amount of the fee is enclosed.

10/07/2009 CCHAU1 00000048 10426928
01 FC:1251 130.00 OP

☐ Payment by credit card. Form PTO-2038 is attached.

☐ The Director has already been authorized to charge fees in this application to a Deposit Account.

☑ The Director is hereby authorized to charge any fees which may be required, or credit any overpayment, to Deposit Account Number 23-0442.

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I am the

☐ applicant/inventor.

☐ assignee of record of the entire interest. See 37 CFR 3.71.
Statement under 37 CFR 3.73(b) is enclosed (Form PTO/SB/96).

☑ attorney or agent of record. Registration Number 58,051

☐ attorney or agent under 37 CFR 1.34.
Registration number if acting under 37 CFR 1.34 _____

Signature	October 5, 2009 (Date)
Keith R. Obert (Typed or printed name)	203-261-1234 (Telephone Number)

NOTE: Signatures of all the inventors or assignees of record of the entire interest or their representative(s) are required. Submit multiple forms if more than one signature is required, see below.

☐ Total of _____ forms are submitted.

This collection of information is required by 37 CFR 1.136(a). The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 6 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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Doc Code: TRAN.LET

Document Description: Transmittal Letter

OCT 07 2009
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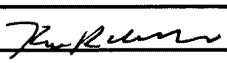
Application Number	10/426,928
Filing Date	April 30, 2003
First Named Inventor	Miska HANNUKSELA
Art Unit	2621
Examiner Name	Gims S. PHILIPPE
Attorney Docket Number	915-005.053

ENCLOSURES *(Check all that apply)*

- ☑ Fee Transmittal Form
- ☑ Fee Attached
- ☑ Amendment/Reply
- ☐ After Final
- ☐ Affidavits/declaration(s)
- ☑ Extension of Time Request
- ☐ Express Abandonment Request
- ☐ Information Disclosure Statement
- ☐ Certified Copy of Priority Document(s)
- ☐ Reply to Missing Parts/ Incomplete Application
- ☐ Reply to Missing Parts under 37 CFR 1.52 or 1.53
- ☐ Drawing(s)
- ☐ Licensing-related Papers
- ☐ Petition
- ☐ Petition to Convert to a Provisional Application
- ☐ Power of Attorney, Revocation Change of Correspondence Address
- ☐ Terminal Disclaimer
- ☐ Request for Refund
- ☐ CD, Number of CD(s) _____
- ☐ Landscape Table on CD
- ☐ After Allowance Communication to TC
- ☐ Appeal Communication to Board of Appeals and Interferences
- ☐ Appeal Communication to TC **(Appeal Notice, Brief, Reply Brief)**
- ☐ Proprietary Information
- ☐ Status Letter
- ☐ Other Enclosure(s) (please Identify below):

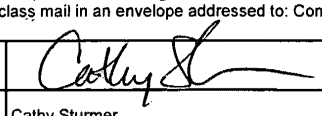
Remarks

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT

Firm Name	Ware, Fressola, Van Der SLuys & Adolphson LLP		
Signature			
Printed name	Keith R. Obert		
Date	October 5, 2009	Reg. No.	58,051

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I hereby certify that this correspondence is being facsimile transmitted to the USPTO or deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on the date shown below:

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Typed or printed name	Cathy Sturmer	Date	October 5, 2009

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Fees pursuant to the Consolidated Appropriations Act, 2005 (H.R. 4818).

FEE TRANSMITTAL
For FY 2009

☐ Applicant claims small entity status. See 37 CFR 1.27

TOTAL AMOUNT OF PAYMENT	($)	130.00

Complete if Known	
Application Number	10/426,928
Filing Date	April 30, 2003
First Named Inventor	Miska HANNUKSELA
Examiner Name	Gims S. PHILIPPE
Art Unit	2621
Attorney Docket No.	915-005.053

METHOD OF PAYMENT (check all that apply)

☑ Check ☐ Credit Card ☐ Money Order ☐ None ☐ Other (please identify): _____

☑ Deposit Account Deposit Account Number: 23-0442 Deposit Account Name: Ware, Fressola et al.

For the above-identified deposit account, the Director is hereby authorized to: (check all that apply)

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FEE CALCULATION

1. BASIC FILING, SEARCH, AND EXAMINATION FEES

Application Type	FILING FEES Fee ($)	FILING FEES Small Entity Fee ($)	SEARCH FEES Fee ($)	SEARCH FEES Small Entity Fee ($)	EXAMINATION FEES Fee ($)	EXAMINATION FEES Small Entity Fee ($)	Fees Paid ($)
Utility	330	165	540	270	220	110	
Design	220	110	100	50	140	70	
Plant	220	110	330	165	170	85	
Reissue	330	165	540	270	650	325	
Provisional	220	110	0	0	0	0	

2. EXCESS CLAIM FEES

Fee Description	Fee ($)	Small Entity Fee ($)
Each claim over 20 (including Reissues)	52	26
Each independent claim over 3 (including Reissues)	220	110
Multiple dependent claims	390	195

Total Claims _____ - 20 or HP = _____ Extra Claims _____ x Fee ($) _____ = Fee Paid ($) _____

HP = highest number of total claims paid for, if greater than 20.

Indep. Claims _____ - 3 or HP = _____ Extra Claims _____ x Fee ($) _____ = Fee Paid ($) _____

HP = highest number of independent claims paid for, if greater than 3.

Multiple Dependent Claims: Fee ($) _____ Fee Paid ($) _____

3. APPLICATION SIZE FEE

If the specification and drawings exceed 100 sheets of paper (excluding electronically filed sequence or computer listings under 37 CFR 1.52(e)), the application size fee due is $270 ($135 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).

Total Sheets _____ - 100 = _____ Extra Sheets _____ / 50 = _____ Number of each additional 50 or fraction thereof (round up to a whole number) x Fee ($) _____ = Fee Paid ($) _____

4. OTHER FEE(S)

Fees Paid ($)

Non-English Specification, $130 fee (no small entity discount) _____

Other (e.g., late filing surcharge): 1-month extension of time 130.00

SUBMITTED BY

Signature		Registration No. (Attorney/Agent) 58,051	Telephone 203-261-1234
Name (Print/Type)	Keith R. Obert		Date October 5, 2009

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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 10/426,928	Filing Date 04/30/2003	☐ To be Mailed

APPLICATION AS FILED – PART I

	(Column 1)	(Column 2)	SMALL ENTITY ☐ RATE ($)	SMALL ENTITY ☐ FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	OTHER THAN SMALL ENTITY FEE ($)
FOR	NUMBER FILED	NUMBER EXTRA					
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	X $ =		OR	X $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X $ =			X $ =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $250 ($125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).						
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL			TOTAL	

APPLICATION AS AMENDED – PART II

AMENDMENT 10/07/2009	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE ($)	SMALL ENTITY ADDITIONAL FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	* 23	Minus	** 25	= 0	X $ =		OR	X $52=	0
Independent (37 CFR 1.16(h))	* 12	Minus	***14	= 0	X $ =		OR	X $220=	0
☐ Application Size Fee (37 CFR 1.16(s))									
☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
					TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	0

AMENDMENT	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)	OR	RATE ($)	ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	*	Minus	**	=	X $ =		OR	X $ =	
Independent (37 CFR 1.16(h))	*	Minus	***	=	X $ =		OR	X $ =	
☐ Application Size Fee (37 CFR 1.16(s))									
☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
					TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

Legal Instrument Examiner:
/KIMBERLY WILLIAMS/

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7590 01/26/2010

Ware, Fressola, Van Der Sluys & Adolphson, LLP
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P.O. Box 224
Monroe, CT 06468

EXAMINER	
PHILIPPE, GIMS S	
ART UNIT	PAPER NUMBER
2621	

DATE MAILED: 01/26/2010

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/426,928	04/30/2003	Miska Hannuksela	915-005.053	6259

TITLE OF INVENTION: METHOD FOR CODING SEQUENCES OF PICTURES

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	NO	$1510	$300	$0	$1810	04/26/2010

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.

HOW TO REPLY TO THIS NOTICE:

I. Review the SMALL ENTITY status shown above.

If the SMALL ENTITY is shown as YES, verify your current SMALL ENTITY status:

A. If the status is the same, pay the TOTAL FEE(S) DUE shown above.

B. If the status above is to be removed, check box 5b on Part B - Fee(s) Transmittal and pay the PUBLICATION FEE (if required) and twice the amount of the ISSUE FEE shown above, or

If the SMALL ENTITY is shown as NO:

A. Pay TOTAL FEE(S) DUE shown above, or

B. If applicant claimed SMALL ENTITY status before, or is now claiming SMALL ENTITY status, check box 5a on Part B - Fee(s) Transmittal and pay the PUBLICATION FEE (if required) and 1/2 the ISSUE FEE shown above.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Utility patents issuing on applications filed on or after Dec. 12, 1980 may require payment of maintenance fees. It is patentee's responsibility to ensure timely payment of maintenance fees when due.

PTOL-85 (Rev. 08/07) Approved for use through 08/31/2010.

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 417 of 431

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: Mail **Mail Stop ISSUE FEE**
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450
or Fax (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

7590 01/26/2010

Ware, Fressola, Van Der Sluys & Adolphson, LLP
Building Five, Bradford Green
755 Main Street
P.O. Box 224
Monroe, CT 06468

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission
I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

(Depositor's name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/426,928	04/30/2003	Miska Hannuksela	915-005.053	6259

TITLE OF INVENTION: METHOD FOR CODING SEQUENCES OF PICTURES

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	NO	$1510	$300	$0	$1810	04/26/2010

EXAMINER	ART UNIT	CLASS-SUBCLASS
PHILIPPE, GIMS S	2621	375-240010

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).
❑ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.
❑ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list
(1) the names of up to 3 registered patent attorneys or agents OR, alternatively,
(2) the name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.
1 _____
2 _____
3 _____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE (B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent) : ❑ Individual ❑ Corporation or other private group entity ❑ Government

4a. The following fee(s) are submitted:
❑ Issue Fee
❑ Publication Fee (No small entity discount permitted)
❑ Advance Order - # of Copies _____

4b. Payment of Fee(s): **(Please first reapply any previously paid issue fee shown above)**
❑ A check is enclosed.
❑ Payment by credit card. Form PTO-2038 is attached.
❑ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment, to Deposit Account Number _____ (enclose an extra copy of this form).

5. **Change in Entity Status** (from status indicated above)
❑ a. Applicant claims SMALL ENTITY status. See 37 CFR 1.27.
❑ b. Applicant is no longer claiming SMALL ENTITY status. See 37 CFR 1.27(g)(2).

NOTE: The Issue Fee and Publication Fee (if required) will not be accepted from anyone other than the applicant; a registered attorney or agent; or the assignee or other party in interest as shown by the records of the United States Patent and Trademark Office.

Authorized Signature _____ Date _____

Typed or printed name _____ Registration No. _____

This collection of information is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450.

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 418 of 431

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/426,928	04/30/2003	Miska Hannuksela	915-005.053	6259

7590 01/26/2010

Ware, Fressola, Van Der Sluys & Adolphson, LLP
Building Five, Bradford Green
755 Main Street
P.O. Box 224
Monroe, CT 06468

EXAMINER	
PHILIPPE, GIMS S	
ART UNIT	PAPER NUMBER
2621	

DATE MAILED: 01/26/2010

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(application filed on or after May 29, 2000)

The Patent Term Adjustment to date is 798 day(s). If the issue fee is paid on the date that is three months after the mailing date of this notice and the patent issues on the Tuesday before the date that is 28 weeks (six and a half months) after the mailing date of this notice, the Patent Term Adjustment will be 798 day(s).

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (http://pair.uspto.gov).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

PTOL-85 (Rev. 08/07) Approved for use through 08/31/2010.

Notice of Allowability	Application No.	Applicant(s)	
	10/426,928	HANNUKSELA ET AL.	
	Examiner	Art Unit	
	Gims S. Philippe	2621	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to *amendment received on October 7th 2009*.

2. ☒ The allowed claim(s) is/are *1-21, 24-25*.

3. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
   a) ☐ All b) ☐ Some* c) ☐ None of the:
      1. ☐ Certified copies of the priority documents have been received.
      2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
      3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

4. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
      1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
   (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

   Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892)
2. ☐ Notice of Draftperson's Patent Drawing Review (PTO-948)
3. ☐ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date _____
4. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
5. ☐ Notice of Informal Patent Application
6. ☐ Interview Summary (PTO-413), Paper No./Mail Date _____ .
7. ☐ Examiner's Amendment/Comment
8. ☐ Examiner's Statement of Reasons for Allowance
9. ☐ Other _____.

/Gims S Philippe/
Primary Examiner, Art Unit 2621

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 420 of 431

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	10426928	HANNUKSELA ET AL.
	Examiner	**Art Unit**
	Gims S Philippe	2621

ORIGINAL		INTERNATIONAL CLASSIFICATION						
CLASS	SUBCLASS	CLAIMED					NON-CLAIMED	
375	240.01	H	0	4	N	7 / 12 (2006.01.01)		

CROSS REFERENCE(S)					
CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)				
375	240.29				

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
1	1	17	17												
2	2	18	18												
3	3	19	19												
4	4	20	20												
5	5	21	21												
6	6	-	22												
7	7	-	23												
8	8	22	24												
9	9	23	25												
10	10														
11	11														
12	12														
13	13														
14	14														
15	15														
16	16														

NONE		Total Claims Allowed:	
(Assistant Examiner)	(Date)	23	
/Gims S Philippe/ Primary Examiner.Art Unit 2621	01/16/2010	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	1

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 421 of 431

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	10426928	HANNUKSELA ET AL.
	Examiner	Art Unit
	Gims S Philippe	2621

SEARCHED			
Class	Subclass	Date	Examiner
375	240.29, 240.10	9/29/08	GP

SEARCH NOTES		
Search Notes	Date	Examiner
Updated previously searched areas	9/29/08	GP
Updated previously searched areas	6/2/09	GP
Updated previously searched areas	1/16/10	GP

INTERFERENCE SEARCH			
Class	Subclass	Date	Examiner
375	240.01, 240.29	1/16/10	GP

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	526	((sequence with (picture or image or frame or video)) same (slice near3 header))	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2010/01/16 15:21
L2	208815	(parameter$1 same (encod$3 or cod$3 or compress$3))	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2010/01/16 15:22
L3	377	l1 and l2	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2010/01/16 15:22
L4	377	(slice near3 header) and l3	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2010/01/16 15:23
L5	287	((picture or image or frame or video) near3 parameter) and l4	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2010/01/16 15:30
L6	204	(information with slice) and l5	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2010/01/16 15:31
L7	69	(slice with header with identif$) and l6	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2010/01/16 15:32
L8	64	(chang$3 or unchang$3) and l7	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2010/01/16 15:34
S36	1	scalab$ and "7032236".pn.	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2010/01/15 19:34
S37	0	FGS and "7032236".pn.	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2010/01/15 19:37
S38	1	(rate or ratio) and "7032236".pn.	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2010/01/15 19:39

S39	0	(bitrate or bit-rate) and "7032236".pn.	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2010/01/15 19:42
S40	0	bitstream and "7032236".pn.	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2010/01/15 19:53
S41	0	bitst and "7032236".pn.	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2010/01/15 19:53
S42	2	(rate or bitrate or bitstream) and "7072971".pn.	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2010/01/15 19:55
S43	1	((rate or bitrate or bitstream) with (coding or encoding)) and "7072971".pn.	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2010/01/15 20:12
S44	1	layer and "7032236".pn.	US-PGPUB; USPAT; EPO; JPO; DERWENT	AND	ON	2010/01/15 22:16

1/16/10 3:48:32 PM

Snap - Exhibit 1002
Snap v. Nokia - IPR2025-01338
Page 424 of 431

PRINTER RUSH

(PTO ASSISTANCE)

Application:	10426928	**Examiner:**	Philippe	**GAU:**	2621
From:	Kevin Danemark	**Location:**	IDC	**Date:**	02/26/2010

Tracking #: Week Date: 02/01/2010

DOC CODE	DOC DATE	MISCELLANEOUS
☐ 1449		☐ Continuing Data
☒ IDS	04/13/2007	☐ Foreign Priority
☐ CLM		☐ Document Legibility
☐ IIFW/FWCLM		☐ Fees
☐ SRFW		☐ Other
☐ DRW		
☐ OATH		Attn:
☐ 312		
☐ SPEC		

[RUSH] Message:

Please initial/line through citations.

thank you

[XRUSH] Response:

Initials: _____

Examiner: PUBS contacts - for DESIGNS: Don Fairchild. 703-756-1566; for ALL OTHER files: Bernadette Queen. 703-756-1565.
NOTE: This form will be included as part of the official USPTO record with the response document coded as XRUSH.

REV: May 09

PRINTER RUSH

(PTO ASSISTANCE)

Application:	10426928	**Examiner:**	Philippe	**GAU:**	2621
From:	Kevin Danemark	**Location:**	IDC	**Date:**	02/26/2010

Tracking #: Week Date: 02/01/2010

DOC CODE	DOC DATE	MISCELLANEOUS
☐ 1449		☐ Continuing Data
☒ IDS	04/13/2007	☐ Foreign Priority
☐ CLM		☐ Document Legibility
☐ IIFW/FWCLM		☐ Fees
☐ SRFW		☐ Other
☐ DRW		
☐ OATH		Attn:
☐ 312		
☐ SPEC		

[RUSH] Message:

Please initial/line through citations.

thank you

[XRUSH] Response:

IDS has been initialed by the Examiner.

Initials: /G.P./

Examiner: PUBS contacts - for DESIGNS: Don Fairchild. 703-756-1566; for ALL OTHER files: Bernadette Queen. 703-756-1565.
NOTE: This form will be included as part of the official USPTO record with the response document coded as XRUSH.

REV: May 09

OIPE IAP70
APR 13 2007
PATENT & TRADEMARK OFFICE

FORM PTO-1449 INFORMATION DISCLOSURE STATEMENT	ATTY DOCKET NO. 915-005.053	SERIAL NO. 10/426,928
	APPLICANT: **M. HANNUKSELA, et al.**	
	FILING DATE: April 30, 2003	ART UNIT: 2621

UNITED STATES PATENT DOCUMENTS

EXAM. INITIAL		DOCUMENT NUMBER	DATE	INVENTOR/ASSIGNEE	CLASS	SUBCLASS	FILING DATE IF APPROPRIATE

FOREIGN PATENT DOCUMENTS

		DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES/NO

OTHER DOCUMENTS (INCLUDING AUTHOR, TITLE, DATE, PERTINENT PAGES, ETC.)

/GP/		"H.26L over IP and H.324 Framework"; ITU-Telecommunications Standardization Sector, Study Group 16 Question 6, Video Coding Experts Group (VCEG); Fourteenth Meeting, Santa Barbara, CA; September, 2001.

Examiner (To be assigned) /Gims Philippe/	Date: 03/13/2010

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: Mail Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450
or Fax (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

7590 01/26/2010

Ware, Fressola, Van Der Sluys & Adolphson, LLP
Building Five, Bradford Green
755 Main Street
P.O. Box 224
Monroe, CT 06468



Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission
I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

Cathy Sturmer	(Depositor's name)
	(Signature)
April 7, 2010	(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/426,928	04/30/2003	Miska Hannuksela	915-005.053	6259

TITLE OF INVENTION: METHOD FOR CODING SEQUENCES OF PICTURES

04/07/2010 SDENBOB4 00000092 10426928
01 FC:1501 1510.00 OP
02 FC:1504 300.00 OP

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	NO	$1510	$300	$0	$1810	04/26/2010

EXAMINER	ART UNIT	CLASS-SUBCLASS
PHILIPPE, GIMS S	2621	375-240010

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).
☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.
☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list
(1) the names of up to 3 registered patent attorneys or agents OR, alternatively,
(2) the name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1 Ware, Fressola, Van Der
2 Sluys & Adolphson LLP
3

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE: Nokia Corporation

(B) RESIDENCE: (CITY and STATE OR COUNTRY): Espoo, FINLAND

Please check the appropriate assignee category or categories (will not be printed on the patent): ☐ Individual ☒ Corporation or other private group entity ☐ Government

4a. The following fee(s) are submitted:
☒ Issue Fee
☒ Publication Fee (No small entity discount permitted)
☐ Advance Order - # of Copies _____

4b. Payment of Fee(s): **(Please first reapply any previously paid issue fee shown above)**
☒ A check is enclosed.
☐ Payment by credit card. Form PTO-2038 is attached.
☒ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment, to Deposit Account Number 23-0442 (enclose an extra copy of this form).

5. **Change in Entity Status** (from status indicated above)
☐ a. Applicant claims SMALL ENTITY status. See 37 CFR 1.27.
☐ b. Applicant is no longer claiming SMALL ENTITY status. See 37 CFR 1.27(g)(2).

NOTE: The Issue Fee and Publication Fee (if required) will not be accepted from anyone other than the applicant; a registered attorney or agent; or the assignee or other party in interest as shown by the records of the United States Patent and Trademark Office.

Authorized Signature _____ Date April 7, 2010

Typed or printed name Keith R. Obert Registration No. 58,051

This collection of information is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450.

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United States Patent and Trademark Office
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Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/426,928	05/25/2010	7724818	915-005.053	6259

7590 05/05/2010

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ISSUE NOTIFICATION

The projected patent number and issue date are specified above.

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(application filed on or after May 29, 2000)

The Patent Term Adjustment is 1099 day(s). Any patent to issue from the above-identified application will include an indication of the adjustment on the front page.

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (http://pair.uspto.gov).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Application Assistance Unit (AAU) of the Office of Data Management (ODM) at (571)-272-4200.

APPLICANT(s) (Please see PAIR WEB site http://pair.uspto.gov for additional applicants):

Miska Hannuksela, Tampere, FINLAND;
Ye-Kui Wang, Tampere, FINLAND;

IR103 (Rev. 10/09)

AO 120 (Rev. 08/10)

TO:	Mail Stop 8 Director of the U.S. Patent and Trademark Office P.O. Box 1450 Alexandria, VA 22313-1450	REPORT ON THE FILING OR DETERMINATION OF AN ACTION REGARDING A PATENT OR TRADEMARK

In Compliance with 35 U.S.C. § 290 and/or 15 U.S.C. § 1116 you are hereby advised that a court action has been filed in the U.S. District Court Eastern District of North Carolina on the following

☐ Trademarks or ☑ Patents. (☐ the patent action involves 35 U.S.C. § 292.):

DOCKET NO.	DATE FILED	U.S. DISTRICT COURT
5:19-CV-427-BO	9/25/2019	Eastern District of North Carolina

PLAINTIFF	DEFENDANT
Nokia Technologies Oy	Lenovo (Shanghai) Electronics Technology Co., Ltd. et al

	PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1	6,856,701		
2	6,950,469		
3	6,968,005		
4	7,263,125		
5	7,280,599		

In the above—entitled case, the following patent(s)/ trademark(s) have been included:

DATE INCLUDED	INCLUDED BY ☐ Amendment ☐ Answer ☐ Cross Bill ☐ Other Pleading	
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1 7,532,808		
2 7,724,818		
3 8,036,273		
4 8,144,764		
5 9,800,891		

In the above—entitled case, the following decision has been rendered or judgement issued:

DECISION/JUDGEMENT

CLERK	(BY) DEPUTY CLERK	DATE
PETER A. MOORE, JR.	Susan Rudd, Deputy	9/26/2019

Copy 1—Upon initiation of action, mail this copy to Director **Copy 3—Upon termination of action, mail this copy to Director**
Copy 2—Upon filing document adding patent(s), mail this copy to Director **Copy 4—Case file copy**

AO 120 (Rev. 08/10)

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