

DECLARATION OF JUNE ANN MUNFORD

1. My name is June Ann Munford. I am over the age of 18, have personal knowledge of the facts set forth herein, and am competent to testify to the same.
2. I have been retained on behalf of the Petitioner to provide assistance in the above-illustrated matter in establishing the authenticity and public availability of the documents discussed in this declaration. I am being compensated for my services in this matter at the rate of \$200.00 per hour plus reasonable expenses. My statements are objective, and my compensation does not depend on the outcome of this matter.
3. I declare under penalty of perjury that the foregoing is true and correct. I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code.
4. I earned a Master of Library and Information Science (MLIS) from the University of Wisconsin-Milwaukee in 2009. I have over ten years of

experience in the library/information science field. Beginning in 2004, I have served in various positions in the public library sector including Assistant Librarian, Youth Services Librarian and Library Director. I have attached my Curriculum Vitae as Appendix CV.

5. During my career in the library profession, I have been responsible for materials acquisition for multiple libraries. In that position, I have cataloged, purchased and processed incoming library works. That includes purchasing materials directly from vendors, recording publishing data from the material in question, creating detailed material records for library catalogs and physically preparing that material for circulation. In addition to my experience in acquisitions, I was also responsible for analyzing large collections of library materials, tailoring library records for optimal catalog search performance and creating lending agreements between libraries during my time as a Library Director.
6. I am fully familiar with the catalog record creation process in the library sector. In preparing a material for public availability, a library catalog record describing that material would be created. These records are typically written in Machine Readable Catalog (herein referred to as “MARC”) code and contain information such as a physical description of the material,

metadata from the material's publisher, and date of library acquisition. In particular, the 008 field of the MARC record is reserved for denoting the date of creation of the library record itself. As this typically occurs during the process of preparing materials for public access, it is my experience that an item's MARC record indicates the date of an item's public availability.

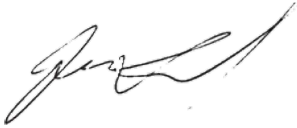
7. Typically, in creating a MARC record, a librarian would gather various bits of metadata such as book title, publisher and subject headings among others and assign each value to a relevant numerical field. For example, a book's physical description is tracked in field 300 while title/attribution is tracked in field 245. The 008 field of the MARC record is reserved for denoting the creation of the library record itself. As this is the only date reflecting the inclusion of said materials within the library's collection, it is my experience that an item's 008 field accurately indicates the date of an item's public availability.

8. I have reviewed Exhibit 1009, "Development of MPEG Camera" by T. Kurashige, et al., as published in *Proceedings of the 1997 IEEE International Symposium on Consumer Electronics*.

9. Attached hereto as Appendix KURASHIGE01 is a true and correct copy of the MARC record for *Proceedings of the 1997 IEEE International Symposium on Consumer Electronics* as held by the library at Carnegie Mellon University. I secured this record myself from the library's public catalog. The MARC record contained within Appendix KURASHIGE01 accurately describes the title, publisher and ISBN number of *Proceedings of the 1997 IEEE International Symposium on Consumer Electronics*.
10. Attached hereto as Appendix KURASHIGE02 is a true and correct copy of "Development of MPEG Camera" as published in *Proceedings of the 1997 IEEE International Symposium on Consumer Electronics* as held by the Carnegie Mellon University. These scans were secured from the library's collection. In comparing Exhibit 1009 to Appendix KURASHIGE02, it is my determination that Exhibit 1009 is a true and correct copy of "Development of MPEG Camera" by T. Kurashige, et al., as published in *Proceedings of the 1997 IEEE International Symposium on Consumer Electronics*.
11. The 008 field of the MARC record in Appendix KURASHIGE01 indicates the date of record creation. The 008 field of Appendix KURASHIGE01 indicates the Carnegie Mellon University first acquired *Proceedings of the*

1997 IEEE International Symposium on Consumer Electronics as of October 2, 1997. Considering this information, I determine that *Proceedings of the 1997 IEEE International Symposium on Consumer Electronics* and therefore "Development of MPEG Camera" were made available to the public shortly after October 2, 1997.

Dated: 12/11/2024

A handwritten signature in black ink, appearing to read 'June Ann Munford', with a stylized, flowing script.

June Ann Munford

Appendix CV

June A. Munford
Curriculum Vitae

Education

University of Wisconsin-Milwaukee - MS, Library & Information Science, 2009
Milwaukee, WI

- Coursework included cataloging, metadata, data analysis, library systems, management strategies and collection development.
- Specialized in library advocacy, cataloging and public administration.

Grand Valley State University - BA, English Language & Literature, 2008
Allendale, MI

- Coursework included linguistics, documentation and literary analysis.
- Minor in political science with a focus in local-level economics and government.

Professional Experience

Researcher / Expert Witness, October 2017 – present
Freelance ● Pittsburgh, Pennsylvania & Grand Rapids, Michigan

- Material authentication and public accessibility determination. Declarations of authenticity and/or public accessibility provided upon research completion. Experienced with appeals and deposition process.
- Research provided on topics of public library operations, material publication history, digital database services and legacy web resources.
- Past clients include Alston & Bird, Arnold & Porter, Baker Botts, Fish & Richardson, Erise IP, Irell & Manella, O'Melveny & Myers, Perkins-Coie, Pillsbury Winthrop Shaw Pittman and Slayden Grubert Beard.

Library Director, February 2013 - March 2015
Dowagiac District Library ● Dowagiac, Michigan

- Executive administrator of the Dowagiac District Library. Located in

Southwest Michigan, this library has a service area of 13,000, an annual operating budget of over \$400,000 and total assets of approximately \$1,300,000.

- Developed careful budgeting guidelines to produce a 15% surplus during the 2013-2014 & 2014-2015 fiscal years while being audited.
- Using this budget surplus, oversaw significant library investments including the purchase of property for a future building site, demolition of existing buildings and building renovation projects on the current facility.
- Led the organization and digitization of the library's archival records.
- Served as the public representative for the library, developing business relationships with local school, museum and tribal government entities.
- Developed an objective-based analysis system for measuring library services - including a full collection analysis of the library's 50,000+ circulating items and their records.

November 2010 - January 2013

Librarian & Branch Manager, Anchorage Public Library ● Anchorage, Alaska

- Headed the 2013 Anchorage Reads community reading campaign including event planning, staging public performances and creating marketing materials for mass distribution.
- Co-led the social media department of the library's marketing team, drafting social media guidelines, creating original content and instituting long-term planning via content calendars.
- Developed business relationships with The Boys & Girls Club, Anchorage School District and the US Army to establish summer reading programs for children.

June 2004 - September 2005, September 2006 - October 2013

Library Assistant, Hart Area Public Library

Hart, MI

- Responsible for verifying imported MARC records and original MARC

cataloging for the local-level collection as well as the Michigan Electronic Library.

- Handled OCLC Worldcat interlibrary loan requests & fulfillment via ongoing communication with lending libraries.

Professional Involvement

Alaska Library Association - Anchorage Chapter

- Treasurer, 2012

Library Of Michigan

- Level VII Certification, 2008
- Level II Certification, 2013

Michigan Library Association Annual Conference 2014

- New Directors Conference Panel Member

Southwest Michigan Library Cooperative

- Represented the Dowagiac District Library, 2013-2015

Professional Development

Library Of Michigan Beginning Workshop, May 2008

Petoskey, MI

- Received training in cataloging, local history, collection management, children's literacy and reference service.

Public Library Association Intensive Library Management Training, October 2011

Nashville, TN

- Attended a five-day workshop focused on strategic planning, staff management, statistical analysis, collections and cataloging theory.

Alaska Library Association Annual Conference 2012 - Fairbanks, February 2012

Fairbanks, AK

- Attended seminars on EBSCO advanced search methods, budgeting, cataloging, database usage and marketing.

Depositions

2019 • Fish & Richardson

Apple v. Qualcomm (IPR2018-001281, 39521-00421IP, IPR2018-01282 and 39521-00421IP2)

2019 • Erise IP

Implicit, LLC v. Netscout Systems, Inc (Civil Action No. 2:18-cv-53-JRG)

2019 • Perkins-Coie

Adobe Inc. v. RAH Color Technologies LLC (Cases IPR2019-00627, IPR2019-00628, IPR2019-00629 and IPR2019-00646)

2020 • O'Melveny & Myers

Maxell, Ltd. v. Apple Inc. (Case No. 5:19-cv-00036-RWS)

2021 • Pillsbury Winthrop Shaw Pittman LLP

Intel v. SRC (IPR2020-1449)

2022 • Perkins-Coie

Realtek v. Future Link (IPR2021-01182)

2023 • Fish & Richardson

Neuroderm Ltd. v. Abbvie, Inc (Case No. PGR2022-00040)

2023 • Fish & Richardson

Nearmap US Inc. v. Pictometry International Corp. (IPR2022-00735)

2023 • Fish & Richardson

Samsung Electronics v. MemoryWeb LLC (Case No. 39843-0136PS1)

2023 ● Pillsbury Winthrop Shaw Whitman LLP

Gravel Rating Systems v. Costco Wholesale Corp. (Civil Action No. 4:21-cv-149-ALM)

2024 ● Willkie-Farr

Netflix, Inc. v. VideoLabs. Inc. (IPR2023-00628)

Limited Case and Clientele History

Alston & Bird

- Ericsson

v. Collision Communications (IPR2022-01233)

- Nokia

v. Neptune Subsea, Xtera (Case No. 1:17-cv-01876)

- Universal Electronics Inc

v. Roku Inc (IPR2022-00818)

Arnold & Porter

- Ivantis

v. Glaukos (Case No. 8:18-cv-00620)

- Samsung

v. Jawbone (Case No. 2:21-cv-00186)

Benesch Friedlander Coplan & Aronoff

- Voyis
 - v. Cathx (Case No. 5:21-cv-00077-RWS)

Deschert LLP

- Smaxtec Animal Care
 - v. ST Reproductive Technologies, LLC (IPR2024-00885)

Erise I.P.

- Apple
 - v. Ericsson Inc. (IPR2022-00715)
 - v. Future Link Systems (IPRs 6317804, 6622108, 6807505, and 7917680)
 - v. INVT (Case No. 20-1881)
 - v. Navblazer LLC (IPR2020-01253)
 - v. Qualcomm (IPR2018-001281, 39521-00421IP, IPR2018-01282, 39521-00421IP2)
 - v. Quest Nettech Corp (Case No. 2:19-cv-00118-JRG)
 - v. Telefonaktiebolaget LM Ericsson (IPR2022-00275)
 - v. Theta IP, LLC (IPR2024-00818)
- Fanduel
 - v. CGT (Case No. 19-1393)
- Garmin
 - v. Phillips North America LLC (Case No. 2:19-cv-6301-AB-KS)

- Netscout
 - v. Longhorn HD LLC (Case No. 2:20-cv-00349)
 - v. Implicit, LLC (Civil Action No. 2:18-cv-53-JRG)
- Sony Interactive Entertainment LLC
 - v. Bot M8 LLC (IPR2020-01288)
 - v. Infernal Technology LLC (Case No. 2:19-CV-00248-JRG)
- Unified Patents
 - v. GE Video Compression (Civil Action No. 2:19-cv-248)

Fish & Richardson

- Apple
 - v. AliveCor (3:21-cv-03958)
 - v. LBS Innovations (Case No. 2:19-cv-00119-JRG-RSP)
 - v. Koss Corporation (IPR2021-00305)
 - v. Masimo (IPR 50095-0012IP1, 50095-0012IP2, 50095-0013IP1, 50095-0013IP2, 50095-0006IP1, 50095-0135IP1)
 - v. Neonode (Case No. 21-cv-08872-EMC)
 - v. Qualcomm (IPR2018-001281, 39521-00421IP, IPR2018-01282, 39521-00421IP2)
- Dell
 - v. Neo Wireless (IPR2022-00616)
- Dish Network
 - v. Entropic Communications, LLC (Case No. 2:2023-CV-01043)

- v. Realtime Adaptive Streaming (Case No. 1:17-CV-02097-RBJ)
 - v. TQ Delta LLC (Case No. 18-1798)
- Evapco Dry Cooling
 - v. SPG Dry Cooling (IPR2021-00688)
- Genetec
 - v. Sensormatic Electronics (Case No. 1:20-CV-00760)
- Huawei
 - v. Bell Northern Research LLC (IPR2019-01174)
- Kianxis
 - v. Blue Yonder (Case No. 3:20-cv-03636)
- LG Electronics
 - v. Bell Northern Research LLC (Case No. 3:18-cv-2864-CAB-BLM)
- Metaswitch
 - v. Sonus Networks (IPR2018-01719)
- Microsoft
 - v. Throughputer Inc (IPR2022-00757)
- Mom Enterprises
 - v. Ddrops Company (Case No. 1:22-cv-00332)
- MLC Intellectual Property

- v. MicronTech (Case No. 3:14-cv-03657-SI)
- Nearmap Inc
 - v. EagleView Technologies (IPR2022-01009)
- Neuroderm Ltd.
 - v. Abbvie, Inc (Case No. PGR2022-00040)
- Realtek Semiconductor
 - v. Future Link (IPR2021-01182)
- Quectel
 - v. Koninklijke Philips (Case No. 1:20-cv-01710)
- Samsung
 - v. Aire Technology (IPR2022-00877)
 - v. Bell Northern Research (Case No. 2:19-cv-00286-JRG)
 - v. Communication Technologies Inc (IPR2022-01221)
 - v. Jawbone Innovations (IPR2022-00865)
 - v. MemoryWeb LLC (IPR2022-00885)
 - v. Dodots Licensing Solutions (IPR2023-00701)
 - v. Telefonaktiebolaget LM Ericsson (IPR2021-00615)
- Texas Instruments
 - v. Vantage Micro LLC (IPR2020-01261)
- Xilinx
 - v. Sentient Sensors LCC (Case No. 1:22-cv-00173)

Groombridge Wu

- Nearmap

v. Eagle View Technologies Inc. and Pictometry International Corp.
(Case No. 2:21-cv-00283-TS-DAO)

Irell & Manella

- Curium

O'Melveny & Myers

- Apple

v. Maxell (Case No. 5:19-cv-00036-RWS)

- Disney Media & Entertainment Distribution LLC

v. Digital Media Technology Holdings, LLC (Case No. 2:22-cv-01642)

- Micron Technology Inc.

v. Besang Inc (IPR2023-00900)

- Samsung

v. Daedalus Prime LLC (1335 Investigation)

Perkins-Coie

- Amazon

v. Nokia (IPR2024-00847 and IPR2024-00848)

- Heru Industries
 - v. The UAB Research Foundation (IPR2022-01148)
- Intel Corporation
 - v. BeSang Inc. (IPR2023-00991)
 - v. BitMICRO (Case No. 5:23-cv-00625)
 - v. Telefonaktiebolaget L M Ericsson (IPR2024-00610)
- Realtek Semiconductor
 - v. Future Link (IPR2021-01182)
- Twitter Inc
 - v. VOIP-Pal.com (Case No. 3:20-cv-02397-JD)
- TCL Industries
 - v. Koninklijke Philips NV (IPR2021-00495, IPR2021-00496 and IPR2021-00497)

Pillsbury Winthrop Shaw Pittman

- Intel
 - v. FG SRC LLC (Case No. 6:20-cv-00315)
- Gravel Rating Systems
 - v. Costco (Case No. 4:21-cv-149)
 - v. Lowe's Home Centers (Case No. 4:21-cv-150)
 - v. T-Mobile USA (Case No. 4:21-cv-152)
 - v. Kohl's Inc. (Case No. 4:21-cv-258)
 - v. Under Armor (Case No. 4:21-cv-356)

Quinn Emanuel

- ServiceNow, Inc.
 - v. InQusient, Inc. (Case No. 22-900-CJB)
- Wolfspeed
 - v. The Trustees of Purdue University (Case No. 1:2021-cv-00840)

Sheppard, Mullin, Richter & Hampton LLP

- Cadence Design Systems Inc.
 - v. Semiconductor Design Technologies (Case No. 3:23-cv-01001)

Stern, Kessler, Goldstein & Fox

- Preliminary Research

Willkie, Farr & Gallagher LLP

- Neurent
 - v. The Foundry, LLC (IPR2024-00669)
- Netflix, Inc.
 - v. VideoLabs, Inc. (IPR2023-00628)

Appendix KURASHIGE01

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050 04\$aTK6680.5 \$b.I34 1997
082 00\$a621.382 \$221
111 2#\$aIEEE International Symposium on Consumer Electronics \$n(1997 : \$cSingapore)
245 10\$aISCE '97 : \$bproceedings of 1997 IEEE International Symposium on Consumer Electronics : December 2-4, 1997, Hilton International, Singapore.
246 18\$a1997 IEEE International Symposium on ConsumerElectronics
246 30\$aConsumer electronics
246 30\$aProceedings of 1997 IEEE International Symposium on Consumer Electronics
260 ##\$aPiscataway, New Jersey : \$bIEEE, \$cc1997.
300 ##\$axxii, 312 p. : \$bill. ; \$c30 cm.
500 ##\$a"IEEE Catalog Number 97TH8348"
504 ##\$aIncludes bibliographical references.
596 ##\$a9
650 #0\$aDigital communications \$vCongresses.
650 #0\$aDigital television \$vCongresses.
650 #0\$aDigital video \$vCongresses.
710 2#\$aInstitute of Electrical and Electronics Engineers.
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Creator	IEEE International Symposium on Consumer Electronics (1997 : Singapore) > Institute of Electrical and Electronics Engineers. >
Subject	Digital communications > Digital television > Digital video >
Genre	Congresses >
Other title	1997 IEEE International Symposium on Consumer Electronics Consumer electronics Proceedings of 1997 IEEE International Symposium on Consumer Electronics
Related titles	Available in other form: Proceedings of 1997 IEEE International Symposium on Consumer Electronics : 2-4 December 1997, Singapore >
Publisher	Piscataway, New Jersey : IEEE
Creation Date	c1997
Format	xxii, 312 p. : ill. ; 30 cm.
Bibliography Note	Includes bibliographical references.
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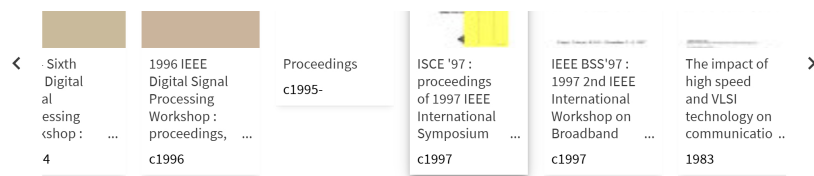
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Appendix KURASHIGE02

Proceedings

ISCE '97



**IEEE INTERNATIONAL SYMPOSIUM
ON CONSUMER ELECTRONICS**

December 2 – 4, 1997



Hilton International, Singapore

Organised by:

*IEEE Consumer Electronics Society
Singapore Chapter*

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1997 IEEE INTERNATIONAL SYMPOSIUM ON CONSUMER ELECTRONICS

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IEEE Catalog Number 97TH8348
ISBN 0-7803-4371-9 Softbound Edition
ISBN 0-7803-4372-7 Microfiche Edition
Library of Congress Number 97-80529

TABLE OF CONTENTS

ISCE '97

Welcome to Singapore, the garden city, for the 1997 IEEE International Symposium on Consumer Electronics (ISCE'97) in Singapore. The symposium is located in the heart of Singapore, the island of the future, where things happen! All of us are looking forward to an exciting and memorable symposium.

The International Symposium on Consumer Electronics (ISCE), 1997, sponsored by the Institute of Electrical & Electronics Engineers, Inc. (IEEE), will be held in Hilton, Singapore from December 2 to 4, 1997. It is a great honour and pleasure for the ISCE'97 committee to welcome you to the ISCE'97. ISCE is the only Consumer Electronics Conference held outside USA, and in particular, to be held in the Asia Pacific Region annually, organized in turn by the different IEEE Consumer Electronics Chapters sponsoring this event. These Chapters include chapters from Beijing, Hong Kong, Seoul, Singapore, Taipei and Tokyo. The last two ISCE conferences were held in Hong Kong and Taipei. In 1997, ISCE will be organized in Singapore for the first time.

Proceedings of 1997 IEEE INTERNATIONAL SYMPOSIUM ON CONSUMER ELECTRONICS

ISCE'97 is a premier technical conference in the field of consumer electronics. It provides a forum for technical professionals from the consumer electronics industry and academics to exchange information and results of research on systems, circuits, technology, processes and products of consumer electronics. The symposium will feature keynote addresses, tutorials, technical sessions, and a technical programme committee. The symposium will be held in Hilton, Singapore, from December 2 to 4, 1997. The symposium will be held in Hilton, Singapore, from December 2 to 4, 1997. The symposium will be held in Hilton, Singapore, from December 2 to 4, 1997.

First of all, we would like to thank IEEE of Hong Kong and CIE of China for giving us the opportunity to organize the ISCE conference in Singapore. In addition, we would also like to thank all the societies sponsoring ISCE'97 for helping us to promote the conference worldwide. The response of consumer electronics industry and academics to ISCE'97 has been overwhelming. We are most grateful to all the participants who have submitted their papers for ISCE'97. The response of consumer electronics industry and academics to ISCE'97 has been overwhelming. We are most grateful to all the participants who have submitted their papers for ISCE'97.

December 2 - 4, 1997

Hilton International, Singapore

ISCE'97 Technical Programme Committee has been formed. The committee has been formed by experts from Hitachi (Japan), JVC (Japan), Microsoft (USA), Philips (Singapore), Pioneer (Japan), Samsung (Korea) and Sanyo (Japan). This international forum with good industrial representation and academic involvement, we received a large number of papers from universities covering China, Hong Kong, Korea, Singapore, Taipei and USA. Technical papers will be presented for all areas of interest in traditional and new consumer electronics products such as Digital Video Disk (DVD), Multimedia Processing and Internet Applications, Personal Communication System (PCS), HDTV and digital video consumer products. The technical programme committee and the dedicated band of technical reviewers have worked long and hard to put together a programme which is rich in quality and substance, highlighting new topics, novel approaches and practical implementations of state-of-the-art technology. We wish to thank all the reviewers for their diligent work.

This year, we are fortunate to have leading experts, Mr. Stuart Lipoff, President of IEEE Consumer Electronics Society and Dr. Hiroshi YASUDA, ISO/IEC JTC1/SC29 (MPEG and JPEG) committee and the President of DAVID (Digital Audio Visual Council) to deliver keynotes entitled, *Exploring Convergence and Multimedia*, *Redefining the Consumer Electronics Industry* and *Recent Advances in Digital Audio*, respectively. Two tutorials have been scheduled on Tuesday, the day before the official opening of ISCE'97 symposium. We believe the tutorial programme will cover important and timely topics in the field of consumer electronics.

We wish that your stay in Singapore will be enjoyable and memorable, and that the technical programme will send you back home motivated, energized, and full of new ideas. We look forward to a most informative and enjoyable ISCE'97.



IEEE

Nicholas C H YUN
General Chairman

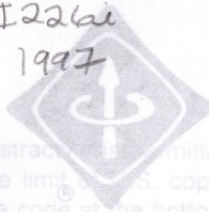
Man-Nang CHONG
Technical Chairman

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TABLE OF CONTENTS

Chairmen's Message	i
ISCE'97 Organising Committee	ii
ISCE'97 International Advisors	iii
Acknowledgements	iv
ISCE'97 Programme Overview	v
General Information on Symposium	vi
Floor Plan Of Conference Venue	vii
Keynote Addresses	viii
Tutorials	x
ISCE'97 Technical Programme	xii
ISCE'97 Technical Programme Session Codes	xviii
Authors' Index	xix
Technical Papers	1 - 312

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IEEE Catalog Number 97TH8348
ISBN 0-7803-4371-9 Softbound Edition
ISBN 0-7803-4372-7 Microfiche Edition
Library of Congress Number 97-80529

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CHAIRMEN'S MESSAGE

Welcome to Singapore, the garden city. We have selected *Hilton International Singapore Hotel* as the venue for the 1997 IEEE International Symposium on Consumer Electronics - ISCE' 97 in Singapore. Hilton is located in the heart of Singapore City - Orchard Road, where things happen ! All of us are looking forward to an exciting and memorable symposium.

The International Symposium on Consumer Electronics (ISCE), 1997, sponsored by the Institute of Electrical & Electronics Engineers, Inc. (IEEE), will be held in Hilton, Singapore from December 2 to 4, 1997. It is a great honour and pleasure for the ISCE'97 committee to welcome you to the ISCE'97. ISCE is the only Consumer Electronics Conference held outside USA, and in particular, to be held in the Asia Pacific region annually, organized in turn by the different IEEE Consumer Electronics Chapters supporting this event. These Chapters include chapters from Beijing, Hong Kong, Seoul, Singapore, Taipei and Tokyo. The last two ISCE events were held in Hong Kong(1994) and Beijing(1996). In 1997, it will be organised in Singapore for the first time. The next ISCE is to be held in Taipei. In addition to the various Consumer Electronics Chapters that are supporting this event, ISCE'97 also has the official support from the IEEE Consumer Electronics Society based in USA, CIE of China and IEE of Hong Kong and Singapore. ISCE aims to be the consumer electronics industry's premier technical conference in the Asia Pacific Region. The conference hopes to bring together top technical professionals from the consumer electronics industry and academics to exchange information and results of recent work on systems, circuits, technology, processes and applications in all areas of consumer electronics.

First of all, we would like to thank IEE of Hong Kong and CIE of China for giving us the opportunity to organise the ISCE conference in Singapore. In addition, we would also like to thank all the societies supporting ISCE'97 for helping us to promote the conference actively in their respective country and region. The response of consumer electronics community to the Call for Papers for ISCE'97 has been overwhelming. We are most grateful to all the contributors; without their interest and effort we would not have been able to achieve the high quality reflected in the Technical Programme. The international industrial participation is evident from the fact that the papers were received from Hitachi (Japan), JVC (Japan), Microsoft (USA), NEC (Japan), NHK (Japan), Panasonic (Singapore), Philips (Singapore), Pioneer (Japan), Samsung (Korea) and Sanyo (Japan). This international forum with good industrial participation is complemented with academic involvement; we received a good number of papers from Universities covering China, Hong Kong, Korea, Singapore, Taipei and USA. Technical papers will be presented for all areas of interest in traditional and new consumer electronics products such as Digital Video Disk (DVD), Multimedia Processing and Internet Applications, Personal Communication System (PCS), HDTV and digital video consumer products. The technical programme committee and the dedicated band of technical reviewers have worked long and hard to put together a programme which is rich in quality and substance, highlighting new topics, novel approaches and practical implementations of state-of-the-art technology. We wish to thank all the reviewers for their diligent work.

This year, we are fortunate to have leading experts, Mr. Stuart Lipoff, President of IEEE Consumer Electronics Society and Dr. Hiroshi YASUDA, Chairman of ISO/IEC JTC1/SC29 (MPEG and JPEG) committee and the President of DAVIC (Digital Audio Visual Council) to deliver keynotes entitled, *Exploring Convergence and Multimedia as Powerful Forces Redefining the Consumer Electronics Industry* and *Recent Advances in Digital Audio and Image Standardisation Activities*, respectively. Two tutorials have been scheduled on Tuesday, Dec 2, the day before the official opening of ISCE'97 symposium. We believe the tutorial programme will cover important and timely topics in the field of consumer electronics.

We wish that your stay in Singapore will be enriching and memorable, and that the technical programme will send you back home motivated, enthusiastic, and full of new ideas. We look forward to a most informative and enjoyable ISCE'97.

Nicholas C H VUN
General Chairman

Man-Nang CHONG
Technical Chairman

ISCE' 97 TECHNICAL PROGRAMME

DB: Digital TV Broadcasting
Wednesday, 3 December,
11:00am - 12:30pm
Singapore Room

Session Chair : Taiichiro Kurita,
NHK, Japan

Services And Navigation In Satellite ISDB
 Kenjiro Kai, Kazuya Usui, Mikihiro Ueno,
 Tadashi Isobe
 NHK, Japan 1

The Implementation Of TSSC
(Transmitter Station System Controller)
For KOREASAT DBS
 Tae Kyoon Kim, Sang Eel Nam, Won Sohn,
 Hyun Sook Cho
 ETRI, Korea 5

The Monitoring Of MPEG Program
Signals In Digital DBS System
 Jeong-Hyun Park
 ETRI, Korea 9

D-VHS VCR For The Digital Broadcasting
System
 Manabu Sasamoto, Nobutaka Amada,
 Shigeru Yamazaki, Hiroo Okamoto,
 Takaharu Noguchi, Hiroyuki Torii
 Hitachi Ltd, Japan 15

Key Distribution For Secure VSAT
Satellite Communication
 Jeong-Hyun Park, Sun-Bae Lim
 ETRI, Korea 19

DAP: Digital Audio Processing
Wednesday, 3 December,
11:00am - 12:30pm
Thailand Room

Session Chair : Neo Sua Hong,
Panasonic Singapore Laboratories P/L,
Singapore

Efficient Architecture For Spatial Hearing
Expansion
 Dong-Ook Chung, Young-Beom Jang, Han-
 Mook Choi, Hyung-Lae Roh
 Samsung Electronics Co., Ltd., Korea 23

Speaker Verification For Home Security
System
 Kwok K Ang, Alex C Kot
 NTU, Singapore 27

Cost Effective Implementation Of ITU-T
G.723.1 On A DSP Chip
 Sang-Min Lee, Sangil Park, Youngbeom
 Jang
 Samsung Electronics Co., Ltd., Korea 31

A 3V Micropower Programmable g_m -C
Filter Set For Hearing Aids
 L.J. Luo, J S Chang, Y C Tong
 Tri-Tech Pte. Ltd., Singapore 35

A Digital Hearing Aid With 8-Band
Curvilinear Loudness Fitting
 Young-Cheol Park, Dong-Wook Kim, Won-
 Ky Kim, Sang-Il Park
 Samsung Biomedical Research Institute,
 Korea 39

A Hierarchical Bounding Box Method For
Searching The Speech Database For
Speech Recognition
 Wai Tong Fung, Shiu Yin Yuen, Chi Hang
 Tse
 City University Of Hong Kong,
 Hong Kong 43

HDTV: High Definition TV
Wednesday, 3 December,
1:30pm - 3:00pm
Singapore Room

Session Chair : Hideo Ohshima,
Japanese Broadcasting Corporation,
Japan

Improved Performance Of Video Decoder Using Down Scaler And Adaptive Comb Filter

Bongsoon Kang, Sunwoo Jun, Byung-Hwan Chun, John Gerard
 Samsung Electronics, Korea 47

Parallel Implementation Of Motion-Compensation For HDTV Video Decoder

Chang L. Lee
 ITRI, Taiwan 51

A 42-Inch-Diagonal HDTV Plasma Display

T. Kurita, M. Seki, J. Koike, Y. Takano, T. Yamamoto, H. Kokubun, K. Kobayashi, H. Murakami, Y. Sasaoka, K. Takahashi
 NHK, Japan 55

A Comparison On VSB And COFDM Used In HDTV Terrestrial Broadcasting

Qingdong Yao, Kuang Wang, Gang Yang, Peiliang Qiu
 Zhejiang University, China 59

Pragmatically Coded 2 Dimensional AM For HDTV Transmission

S K Hong, H G Jeon, W C Song, C E Kang
 Yonsei University, Korea 63

Implementation Scheme Of VSB Modulation For HDTV Terrestrial Broadcasting

Zhaoyang Zhang, Peiliang Qiu, Kuang Wang, Qingdong Yao
 Zhejiang University, China 67

HA: Home Automation & User Interface Design
Wednesday, 3 December,
1:30pm - 3:00pm
Thailand Room

Session Chair : Po-Ching Yang,
National Taiwan University of Science & Technology, Taiwan

The ModuleC Network Architecture: A Novel Paradigm Of Computing Through Information Appliances

Sandeep Chatterjee
 MIT, USA 71

DooRae Distance Home Study System On DooRae Framework For Integrated Home Information Service

Seok Soo Kim, Dae Joon Hwang
 Sung Kyun Kwan University, Korea 75

A Service Of Home Security System On Intelligent Network

Sin-Min Tsai, Po-Ching Yang, Shyi-Shiou Wu, Shya-Shiou Sun
 National Taiwan University Of Science And Technology, Taiwan 79

An Application Of Infrared Technique To Control A Computer Keyboard For Handicap

Yu-Luen Chen, Walter H Chang, May-Kuen Wong, Tan-Fuk Tang, Te-Son Kuo
 National Taiwan University, Taiwan 83

Consumer Products User Interface Using Face And Eye Orientation

Hitoshi Hongo, Akira Murata, Kazuhiko Yamamoto
 Sanyo Electric Co. Ltd, Japan 87

A Digital Satellite Receiver With An Advanced User Friendly Interface

Kenji Katsumata, Satoshi Iimuro, Takanori Eda, Shigeru Yoneda, Takehito Kishi, Hiroshi Yoshikawa, Yasuhisa Ichifuji
 Hitachi, Ltd., Japan 91

DVD: DVD Technology
Wednesday, 3 December,
3:30pm - 5:30pm
Singapore Room

Session Chair : Yamashita Kei
Hitachi Ltd, Japan

DVD Players Using A Viterbi Decoding Circuit

H. Hayashi, H. Kobayashi, M. Umezawa,
 S. Hosaka, H. Hirano
 Pioneer Electronic Corp., Japan 95

Low-Complexity And Low-Delay Video Transcoding For Compressed MPEG-2 Bitstream

Kou-Sou Kan, Kuo-Chin Fan, Yin-Hwa Huang
 National Central University, Taiwan 99

Sub-Picture Decoder Architecture For DVD

Jui-Yuan Lin
 ITRI, Taiwan 103

2x Speed For DVD-ROM Playback System

T Takeuchi, K Hirose, J Nakajima, M Hirabayashi, Y Nagai, Y Ueki, J. Azuma, H Endoh, A Fukushima
 Hitachi, Ltd., Japan 107

Analysis For Error Code Performance Of MPEG-2 Transport System

J P Mei, S Cheng
 Beijing University Of Posts And Telecommunication, China 111

Servo System Control In Digital Video Disc(DVD)

S M Zhu, F H Choo, K S Low, C W Chan, P H Kong, M Suraj
 Nanyang Technological Univ., Singapore 114

Scene Change Based Output Rate Control Strategy For Constant Bit Rate Video Coding

Jun Sun, Xiangzhong Fang, Wenjun Zhang, Songyu Yu
 Shanghai Jiao Tong University, China 118

CSE: Circuits & Systems Engineering
Wednesday, 3 December,
3:30pm - 5:30pm
Thailand Room

Session Chair : Lau Chiew Tong
Nanyang Technological Uni., Singapore

Robust Single Chip On Screen Display For Home VCRS

Sung-II Cho, Kyoung-Hwan Kim, Bongsoon Kang
 Samsung Electronics, Korea 122

1 Ghz CMOS Down-Conversion Mixer

Seungwook Lee, Changsik Yoo, Wonchan Kim, Hyun-Kyu Ryu, Wonchul Song
 Seoul National University, Korea 125

An Adaptive Low Power DC-DC Converter Concept For PLL Controlled Tuning Of RF Circuit

Alan Yeo, Hans Brekelmans
 Philips Singapore Pte. Ltd., Singapore 128

Voltage Doubler Protection Circuit Results In Large Cost Savings

Stefan Mozar
 Singapore Polytechnic, Singapore 133

Assembly Language Software Development System

Ronnie Kum Yuen Yang, William Choong Yew Wong, Chin Hon Ng, Satoshi Endo
 Panasonic Singapore Laboratories Pte. Ltd, Singapore 138

Development Of DCS(Digital Cordless-Phone System)

Satoru Toguchi
 JVC, Japan 142

PIM-ASCII100 Digital Data Encoding Scheme For Short Distance Wireless Infrared Transmission

N Sriskanthan, S C Lim, K R Subramanian
 NTU, Singapore 145

Wireless Pointing Device Using Capacitive Coupling

Abdul Wahab, Eng Chong Tan, Kay Min Low
 NTU, Singapore 149

VC: Video Compression
Thursday, 4 December,
11:00am - 12:30pm
Singapore Room

Session Chair : Hsueh-Ming Hang,
National Chiao-Tung University, Taiwan

Performance Analysis Of H.261 And H.263 Video Coding Algorithms
Golam Ashraf, M. N. Chong
Nanyang Technological Univ., Singapore 153

An Improvement Of Bottom-Up Variable-Block Matching Technique For Video Compression
Chin-Chen Chang, Lin-Li Chen, Tung-Shou Chen
National Chung Cheng University, Taiwan 157

Low Bit-Rate Video Coding Using Image Triangulation And Warping
Chichyang Chen, Te-Lung Lin
Feng Chia University, Taiwan 161

Error Control For Low Bit Rate Coding Transmission
Hsiang-Cheh Huang, Hsueh-Ming Hang,
National Chiao Tung University, Taiwan 165

Parallel Implementation Of Fractal Image Compression
Guan Nge Toh, Kin Keong Wong
NTU, Singapore 169

1 Chip Low Power MPEG1 CODEC With Compact Motion Estimation
H Ohtsubo, T Fujihira, K Asada, T Imaide
Hitachi, Ltd., Japan 173

An Advanced Scan Format Converter With Flexible And High Quality Signal Processing
Masato Sugiyama, Mitsuo Nakajima,
Yasutaka Tsuru, Taihei Nakama, Shoji Kimura, Haruki Takata, Kazuo Ishikura,
Yasuhiro Hirano
Hitachi, Ltd., Japan 276

PCS: Personal Communication System
Thursday, 4 December,
11:00am - 12:30pm
Thailand Room

Session Chair : Jeong-Hyun Park,
ETRI, Korea

Managing Flash Memory In Personal Communication Devices
Mei-Liang Chiang, Paul C. H. Lee, Ruei-Chuan Chang,
National Chiao Tung University, Taiwan 177

Efficient Energy Utilization With A Time Constraint And Time Varying Channels
John J Metzner, Joon-Moon Chung
The Pennsylvania State University, USA 183

Reliable PN Chip Clock Generation For CDMA Code Acquisition & Tracking
Hyun-Seo Oh, Hyun-Chul Kim, Chang-Eon Kang, Jung-Young Son
ETRI, Korea 187

Performance Evaluation Of PN Acquisition Algorithm In CDMA Cellular System
Gweon-Do Jo
ETRI, Korea 190

A Novel Adaptive Two-Stage Detector For Synchronous DS-CDMA Communication Systems
Wanshi Chen, Manh Anh Do
NTU, Singapore 194

Effects Of Spreading Chip Waveform Pulse-Shaping On The Performance Of DS-CDMA Indoor Radio Personal Communication Systems In A Frequency-Selective Rician Fading Channel
Boon Kiong Kok, M. A. Do
NTU, Singapore 198

Differentially Coherent Code Phase Synchronization Technique In A DS-SS Mobile Packet Radio
Kyung-Ho Kim, Chang-Eon Kang
Yonsei University, Korea 202

VP1: Video Processing 1
Thursday, 4 December,
1:30pm - 3:00pm
Singapore Room

Session Chair : Ting-Ting Lin,
University of California, USA

Digital TV Video Format Conversion By
Extendible Inverse DCT
 Yuh-Feng Hsu, Yung-Chang Chen
 National Tsing Hua University,
 Taiwan 206

A Multiprocessor System For Video
Coding Applications
 Deepak S Iyer, M.N.Chong, Wentong Cai
 NTU, Singapore 210

Stereo Image Coding With Disparity
Compensation Using Dynamic
Programming
 Hyun-Ho Jeon, Jae-Han Kim Deock-Gil Oh
 ETRI, Korea 214

Development Of MPEG Camera
 T Kurashige, J Shiohawa, H Chiba, N
 Yamamoto, T Kitade, H Tarumizu, H Kami,
 T Imai
 Hitachi, Ltd., Japan 218

LPF-Based Motion Estimation
 Z Q Cai
 Singapore Polytechnic, Singapore 222

Is MPEG Encryption By Using Random
List Instead Of Zigzag Order Secure?
 Lintian Qiao, Klara Nahrstedt, Ming-Chit
 Tam
 University Of Illinois, USA 226

Differentially Coherent Code
Modulation Technique For DS-SS
 Songyu Yu
 Mobile Packet Radio
 Kyung-Ho Kim, Chang-Eon Kang
 Yonsei University, Korea 202

DC: Digital Communications
Thursday, 4 December,
1:30pm - 3:00pm
Thailand Room

Session Chair : Ong Jin Teong,
Nanyang Technological Uni., Singapore

Minimizing Memory Requirement For A
Multi-Rate Continuous Media Server
 Jen-Wen Ding, Shiao-Li Tsao, Yueh-Min
 Huang, Chih-Wen Cheng, Jun-Lin Liu
 National Cheng-Kung University,
 Taiwan 230

Multicarrier Techniques For Wideband
CDMA
 Jiang Yue, M.A. Do
 NTU, Singapore 234

Highly Integrated Ultra Compact RF
Transceiver Module For Wireless Data &
Telephone Applications
 M Guruprasad, David Chow
 Philips Singapore Pte. Ltd., Singapore 238

GPS Decoder
 E C Tan, A Wahab, S E Ong
 NTU, Singapore 242

An Intelligent Chinese Pen-Based Secure
Screen Phone For New PSTN Services
 Char-Shin Miou, Nai-Jen Cheng, Yeou-Fuh
 Kuan, Horns-Ren Chang, Heh-Deng Sheu,
 Chao-Hao Lee, Ming-Shin Chang, Bor-Shenn
 Jeng
 National Central University, Taiwan 246

About A Method For Distribution Keys Of
A Computer Network Using Elliptic
Curves
 Eugen Petac
 "Ovidius" University Of Constantza,
 Romania 309

Infrared Transmission
 N Srisanthan, S C Lim, K R Subramanian
 NTU, Singapore 145

Wireless Pointing Device Using
Capacitive Coupling
 Abdul Wahab, Eng Chong Tan, Kay Min
 Low
 NTU, Singapore 148

VP2: Video Processing 2
Thursday, 4 December,
3:30pm - 5:30pm
Singapore Room

MP: Multimedia Processing & Internet Applications
Thursday, 4 December,
3:30pm - 5:30pm
Thailand Room

Session Chair : Jan-Ming Ho,
Academia Sinica, Taiwan

Session Chair : Bob Frankston,
Microsoft Corporation, USA

Television Home Server For Integrated Services -- Toward The Realization Of ISDB "Anytime" Services

Tatsuya Kurioka, Hiroki Minami, Haruo Okuda, Junji Numazawa, Akio Yanagimachi, Hideo Ohshima
 NHK, Japan 250

A Video CD Player Design

Chin Hon Ng, Han Song Low, Jek Thoon Tan, Chay Chin Lee, Siew Lee Cheong, Panasonic Singapore Lab Pte Ltd, Singapore 254

Storage Rebuild For Automatic Failure Recovery In Video-On-Demand Servers

Y B Lee, P C Wong
 The Chinese University Of Hong Kong, Hong Kong 258

Experiences In Designing A TCP/IP Based VOD System Over A Dedicated Network

Der-Jen Lu, Yu-Chung Wang, Jan-Ming Ho, Ming-Tat Ko, Meng-Chang Chen
 Academia Sinica, Taiwan 262

A Study On A Video Editing System That Uses The Broadband Computer Network

S Nakano, Y Yang, K Kawashima
 Toyama Prefectural University, Japan 267

CCD Noise Filtering Based On Surface Diffusion Model Combined With Min/Max Curvature

Suk Ho Lee, Moon Gi Kang, Kyu Tae Park
 Yonsei University, Korea 272

An Advanced Scan Format Converter With Flexible And High Quality Signal Processing

Masato Sugiyama, Mitsuo Nakajima, Yasutaka Tsuru, Taihei Nakama, Shoji Kimura, Haruki Takata, Kazuo Ishikura, Yasuhiro Hirano
 Hitachi, Ltd., Japan 276

Optical Fiber Digital Transmission Of Multiplexed Video And Audio Signals Suitable For Multimedia Applications

Hideyuki Asada, Takashi Yamada, Nabil Abd Rabou, Hiroaki Ikeda, Yoshifumi Shimodaira, Hirofumi Yoshida
 NEC Shizuoka Co Ltd, Japan 280

On The Inter-Dependency Of Interactive Multimedia Protocol And Network Architecture

Shing Hung Chang, Meng Huang Lee
 Academia Sinica, Taiwan 284

The Internet And Consumer Electronics

Bob Frankston
 Microsoft Corporation, USA 288

An Internet Speech Gateway Server

S Foo, C K Yeo, S C Hui
 NTU, Singapore 292

Distance Education System On A Distributed Object Multimedia Environment And Applying Intelligent Classroom Monitoring System Using ISDN

Hee Choon Kwon, Seok Soo Kim, Dae Joon Hwang
 Sung Kyun Kwan University, Korea 296

New Type Of Electronic Encyclopedia For Boys And Girls - An Application Of Multimedia Videos To Consumer Electronics

Kayo Suzuki, Mitsuru Nagao, Akira Muraki, Hiroaki Ikeda
 Telecommunication Advancement Organisation of Japan, Japan 300

A Multimedia Authoring Tool For The Internet

S Y Sung, W M Soon, W L Loh, V Shaw
 National University of Singapore, Singapore 304

Development of MPEG Camera

T. Kurashige*, J. Shiokawa**, H. Chiba**, N. Yamamoto**,
T. Kitade**, H. Tarumizu*, H. Kami*, T. Imai**

*Hitachi Video & Information System Co.Ltd. Kanagawa, Japan

**Multimedia Systems Research & Development, Hitachi, Ltd. Kanagawa, Japan

ABSTRACT

We have developed a handy digital camera to record MPEG-1 video and JPEG still photo. The newly developed camera signal processing LSI and real-time MPEG-1 CODEC LSI compress and decompress image, and a RISC MPU, SH-3, does MPEG-1 audio compression and decompression. We adopt PC card type HDD to record compressed image and audio instead of tape media for easy file handling and high adaptability with PC. Users are able to arrange, retrieve and playback files on the camera easily using the 1.8" TFT-LCD and "Media Navigation System," the built-in file handling function.

1. INTRODUCTION

With a rapid growth of multimedia technology, we have more opportunities to handle pictures on a PC or the network. Many types of digital still cameras have already been realized. Most of them compress pictures with JPEG format and play back them on a PC or a TV set. It also become easier to distribute photos through network.

However, there has never been a camera that records digital full-motion picture easily and simply. We have developed a real-time encoding and decoding (CODEC) LSI with MPEG1 format. We have realized the new handy digital camera which can treat MPEG1 image easily with that CODEC LSI.

We also developed a picture improvement system to reduce block distortion and mosquito noise easily appeared in the high-contrast edge outskirts or the scene change.

This paper describes the developed camera structure and picture improvement system.

Picture1: Outlook of MPEG camera

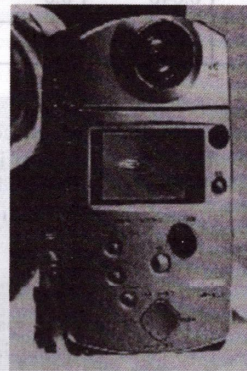


Table1:Major Specification

size	83(W) x 143.5(H) x 56(D) mm
weight	385g 540g (Buttery &HDD include)
motion picture	MPEG1(352*240), IBP / 30fps
still picture	JPEG(704*480)
Audio	MPEG-1 layer II
Interface	NTSC analog video PC-CARD (ATA HDD) HI-Speed Serial (original protocol)
File Format	MS-DOS compatible
Recording capacity	20minute(MPEG system)
(260MB HDD)	3000 photo 4hours digital audio
LCD	1.8" TFT (279*220)
PC Adapters	ISA, ECP, SCSI (option)

(home page: <http://www.mpegcam.net>)

2. CONSTRUCTION of MPEG CAMERA

Figure1 shows the block diagram of MPEG CAMERA.

2.1 CAMERA HEAD BLOCK

1/4" size 720*480 Inter Line CCD

3-times optical zoom lens and 2-times electrical zoom

2.2 CAMERA PROCESSOR BLOCK

Camera digital signal processing (DSP) LSI has changeable filters, Up/Down sampling circuits and CCD scanning circuits for coexistence of still picture (JPEG) mode and moving picture (MPEG) mode. The CCD is driven in the line-mixed readout and DSP outputs 352*240(4.2.0) pixels picture at the MPEG mode. At the JPEG mode, CCD is driven in the frame(non line-mixed) readout and DSP outputs 704*480(4.2.2) pixels picture.

And this LSI has detectors for image brightness, color information, and integral value of the edge signal. Most of parameters of these filters and detectors are set by camera-micro-processor(H8-3042) and are able to be updated even in the middle of the recording.

2.3 CODEC BLOCK

CODEC LSI carries out realtime MPEG1 picture compression, including such as DCT, motion estimation, and quantization. 8Mbit SD-RAM is used for working-RAM and a VBV(Video Bufferling Verify) buffer .

Bit rate Control for every macro block is done by built-in processor, and for every picture frame by System MPU(SH3, RISK processor, 54mips).

2.4 MPU BLOCK

System MPU is in charge of CODEC Control, MPEG audio (Layer II) compression, MPEG system stream generation (MUX), and File management. The MPU also controls "Media Navigation System," the file handling system. It displays thumbnail images for a user to manage files easily. Figure2 shows the signal flow at the MPEG system encoding.

2.5 LCD BLOCK

1.8" TFT LCD is used to monitor recording image, and playback image.

2.6 HDD

HDD interface is PCMCIA-ATA standard compliant. File Format is FAT compatible and improved. Proprietary emergency method is because the camera is easy to receive a physical shock and sudden power off.

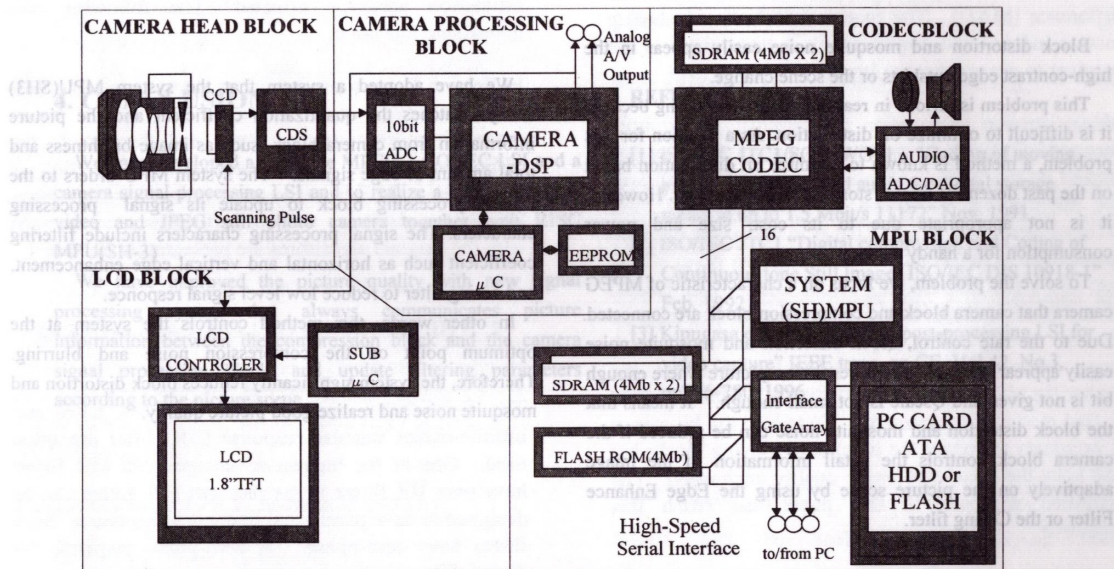


Figure1 Block Diagram of MPEG Camera

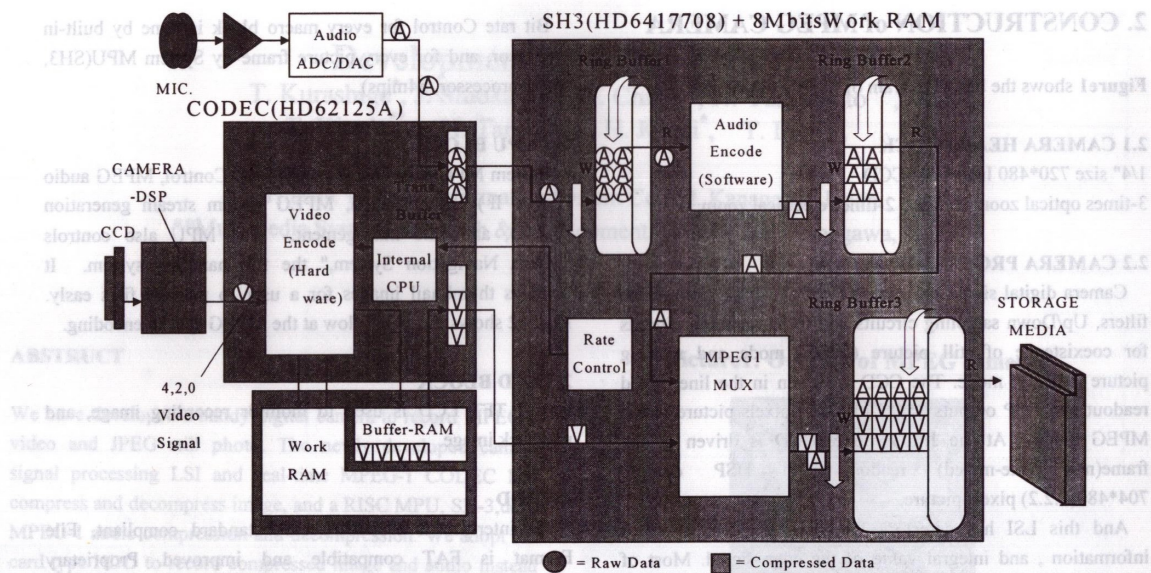


Figure2 : MPEG system encoding signal flow

3. PICTURE IMPROVEMENT

Block distortion and mosquito noise easily appear in the high-contrast edge outskirts or the scene change.

This problem is serious in realtime MPEG encoding because it is difficult to optimize bit distribution. As a solution for this problem, a method is known to optimize bit distribution based on the past dozens of frames stored in frame memory. However, it is not appropriate due to its cost, size and power consumption for a handy camera.

To solve the problem, we focus on a characteristic of MPEG camera that camera block and compression block are connected. Due to the rate control, block distortion and mosquito noise easily appear at edges in high resolution picture where enough bit is not given and Qscale is not small enough. It means that the block distortion and mosquito noise can be reduced if the camera block controls the detail information of the image adaptively on the picture scene by using the Edge Enhance Filter or the Coring filter.

We have adopted a system that the system MPU(SH3) always watches the quantization coefficient and the picture information from camera block, such as image brightness and total amount of edge signals. The system MPU orders to the camera processing block to update its signal processing characters. The signal processing characters include filtering coefficient such as horizontal and vertical edge enhancement, and coring filter to reduce low level signal response.

In other words, this method controls the system at the optimum point on the compression noise and blurring. Therefore, the system significantly reduces block distortion and mosquito noise and realize good picture quality.

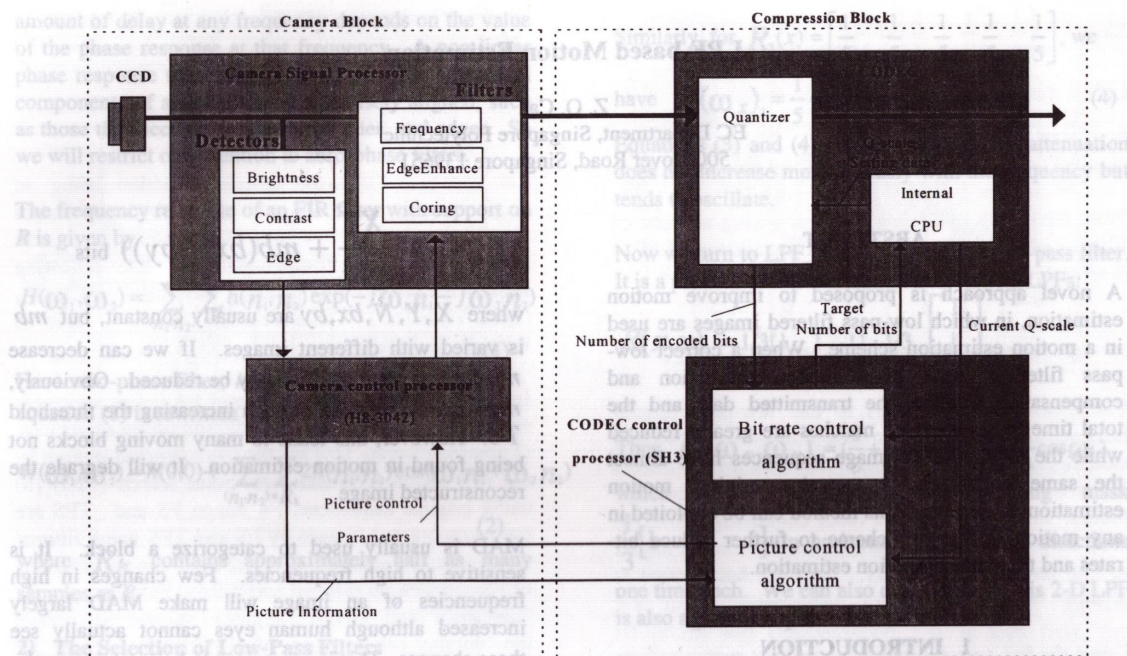


Figure3: Internal communication system for Picture Controlling

4. CONCLUSION

We have developed a real-time MPEG-1 CODEC LSI and a camera signal processing LSI and to realize a handy MPEG-1 video and JPEG still photo camera together with RISC MPU(SH-3).

We have improved the picture quality with new signal processing system that always communicates picture information between the compression block and the camera signal processing block, and update filtering parameters according to the picture scene.

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