AO 120 (Rev. 08/10)

TO:	REPORT ON THE FILING OR DETERMINATION OF AN ACTION REGARDING A PATENT OR TRADEMARK
Mail Stop 8 Director of the U.S. Patent and Trademark Office P.O. Box 1450 Alexandria, VA 22313-1450	

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 for the Western District of Texas, Waco Division on the following

☐ Trademarks or ☑ Patents. (☐ the patent action involves 35 U.S.C. § 292.):

DOCKET NO.	DATE FILED	U.S. DISTRICT COURT
6:22-cv-421	4/27/2022	for the Western District of Texas, Waco Division

PLAINTIFF	DEFENDANT
BUFFALO PATENTS, LLC	ONEPLUS TECHNOLOGY (SHENZHEN) CO., LTD.

	PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1	6,856,086	2/15/2005	BUFFALO PATENTS, LLC
2	6,904,405	6/7/2005	BUFFALO PATENTS, LLC
3	8,204,737	6/19/2012	BUFFALO PATENTS, LLC
4			
5			

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
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In the above—entitled case, the following decision has been rendered or judgement issued:

DECISION/JUDGEMENT
10/17/2022 Doc #9 ORDER GRANTING 8 Motion to Dismiss.

CLERK	(BY) DEPUTY CLERK	DATE
PHILIP J. DEVLIN		10/17/2022

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

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AO 120 (Rev. 08/10)

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Mail Stop 8 **Director of the U.S. Patent and Trademark Office** **P.O. Box 1450** **Alexandria, VA 22313-1450**	

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☐ Trademarks or ☑ Patents. (☐ the patent action involves 35 U.S.C. § 292.):

DOCKET NO.	DATE FILED	U.S. DISTRICT COURT
6:22-cv-422	4/27/2022	for the Western District of Texas, Waco Division

PLAINTIFF	DEFENDANT
BUFFALO PATENTS, LLC	TCL Technology Group Corporation, TCL Electronics Holdings Limited, TCL Communication Technology Holdings Limited, and TCL Communication Limited

	PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1	6,856,086	2/15/2005	BUFFALO PATENTS, LLC
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DOCKET NO.	DATE FILED	U.S. DISTRICT COURT
6:22-cv-423	4/27/2022	for the Western District of Texas, Waco Division

PLAINTIFF	DEFENDANT
BUFFALO PATENTS, LLC	ZTE CORPORATION

	PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1	6,856,086	2/15/2005	BUFFALO PATENTS, LLC
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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 NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
10/061,052	01/28/2002	Edwin A. Suominen	**OR-0004

CONFIRMATION NO. 5352

35690
MEYERTONS, HOOD, KIVLIN, KOWERT & GOETZEL, P.C.
P.O. BOX 398
AUSTIN, TX 78767-0398

POA ACCEPTANCE LETTER

OC000000044024735

Date Mailed: 10/18/2010

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 10/08/2010.

The Power of Attorney in this application is accepted. Correspondence in this application will be mailed to the above address as provided by 37 CFR 1.33.

/sleutchit/

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

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 NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
10/061,052	01/28/2002	Edwin A. Suominen	**OR-0004

CONFIRMATION NO. 5352

23377
WOODCOCK WASHBURN LLP
CIRA CENTRE, 12TH FLOOR
2929 ARCH STREET
PHILADELPHIA, PA 19104-2891

POWER OF ATTORNEY NOTICE

OC000000044024715

Date Mailed: 10/18/2010

NOTICE REGARDING CHANGE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 10/08/2010.

- The Power of Attorney to you in this application has been revoked by the assignee who has intervened as provided by 37 CFR 3.71. Future correspondence will be mailed to the new address of record(37 CFR 1.33).

/sleutchit/

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

PTO/SB/80 (01-06)
Approved for use through 12/31/2006. OMB 0651-0035
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 displays a valid OMB control number.

POWER OF ATTORNEY TO PROSECUTE APPLICATIONS BEFORE THE USPTO

I hereby revoke all previous powers of attorney given in the application identified in the attached statement under 37 CFR 3.73(b).

I hereby appoint:

☑ Practitioners associated with the Customer Number: 35690

OR

☐ Practitioner(s) named below (if more than ten patent practitioners are to be named, then a customer number must be used):

Name	Registration Number	Name	Registration Number

as attorney(s) or agent(s) to represent the undersigned before the United States Patent and Trademark Office (USPTO) in connection with any and all patent applications assigned only to the undersigned according to the USPTO assignment records or assignment documents attached to this form in accordance with 37 CFR 3.73(b).

Please change the correspondence address for the application identified in the attached statement under 37 CFR 3.73(b) to:

☑ The address associated with Customer Number: 35690

OR

☐ Firm or Individual Name			
Address			
City		State	Zip
Country			
Telephone		Email	

Assignee Name and Address:

Optical Research Partners LLC
2215-B Renaissance Drive, Suite 5
Las Vegas, NV 89119

A copy of this form, together with a statement under 37 CFR 3.73(b) (Form PTO/SB/96 or equivalent) is required to be filed in each application in which this form is used. The statement under 37 CFR 3.73(b) may be completed by one of the practitioners appointed in this form if the appointed practitioner is authorized to act on behalf of the assignee, and must identify the application in which this Power of Attorney is to be filed.

SIGNATURE of Assignee of Record

The individual whose signature and title is supplied below is authorized to act on behalf of the assignee

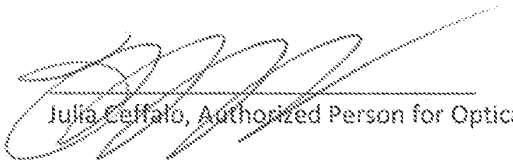
Signature		Date	27 SEP 2006
Name	Julia Ceffalo	Telephone	
Title	Authorized Person for Optical Research Partners LLC		

This collection of information is required by 37 CFR 1.31, 1.32 and 1.33. 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 3 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.

DECLARATION REGARDING AUTHORITY TO SIGN ON BEHALF OF A LEGAL ENTITY
37 C.F.R. 3.73(b)(2)(i)

I, Julia Ceffalo (whose title is supplied below), hereby declare that I am authorized to sign on behalf of Optical Research Partners LLC.



Julia Ceffalo, Authorized Person for Optical Research Partners LLC

27 SEP 2010

[date]

PTO/SB/96 (08-08)
Approved for use through 08/31/2008. 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 displays a valid OMB control number.

STATEMENT UNDER 37 CFR 3.73(b)

Applicant/Patent Owner: Optical Research Partners LLC

Application No./Patent No.: 6904405 Filed/Issue Date: 6/7/2005

Entitled: MESSAGE RECOGNITION USING SHARED LANGUAGE MODEL

Optical Research Partners LLC, a Limited Liability Company
(Name of Assignee) (Type of Assignee, e.g., corporation, partnership, university, government agency, etc.)

states that it is:

1. ☑ the assignee of the entire right, title, and interest; or

2. ☐ an assignee of less than the entire right, title and interest
(The extent (by percentage) of its ownership interest is _____%)

in the patent application/patent identified above by virtue of either:

A. ☐ An assignment from the inventor(s) of the patent application/patent identified above. The assignment was recorded in the United States Patent and Trademark Office at Reel _____, Frame _____, or for which a copy thereof is attached.

OR

B. ☑ A chain of title from the inventor(s), of the patent application/patent identified above, to the current assignee as follows:

1. From: Edwin A. Suominen To: MOUNT HAMILTON PARTNERS, LLC
The document was recorded in the United States Patent and Trademark Office at
Reel 016010, Frame 0010, or for which a copy thereof is attached.

2. From: MOUNT HAMILTON PARTNERS, LLC To: OPTICAL RESEARCH PARTNERS LLC
The document was recorded in the United States Patent and Trademark Office at
Reel 016202, Frame 0961, or for which a copy thereof is attached.

3. From: _____ To: _____
The document was recorded in the United States Patent and Trademark Office at
Reel _____, Frame _____, or for which a copy thereof is attached.

☐ Additional documents in the chain of title are listed on a supplemental sheet.

☑ As required by 37 CFR 3.73(b)(1)(i), the documentary evidence of the chain of title from the original owner to the assignee was, or concurrently is being, submitted for recordation pursuant to 37 CFR 3.11.

[NOTE: A separate copy (*i.e.*, a true copy of the original assignment document(s)) must be submitted to Assignment Division in accordance with 37 CFR Part 3, to record the assignment in the records of the USPTO. See MPEP 302.08]

The undersigned (whose title is supplied below) is authorized to act on behalf of the assignee.

Signature	10/8/2010 (6257-33702) Date
Dean M. Munyon	512-853-8800
Printed or Typed Name	Telephone Number
Attorney (Reg. No.: 42,914)	
Title	

This collection of information is required by 37 CFR 3.73(b). 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: **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.

PTO/SB/47 (03-09)
Approved for use through 03/31/2012. OMB 0651-0016
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 displays a valid OMB control number.

"FEE ADDRESS" INDICATION FORM

Address to:
Mail Stop M Correspondence
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

- OR -

Fax to:
571-273-6500

INSTRUCTIONS: The issue fee must have been paid for application(s) listed on this form. In addition, only an address represented by a Customer Number can be established as the fee address for maintenance fee purposes (hereafter, fee address). A fee address should be established when correspondence related to maintenance fees should be mailed to a different address than the correspondence address for the application. **When to check the first box below**: If you have a Customer Number to represent the fee address. **When to check the second box below**: If you have no Customer Number representing the desired fee address, in which case a completed Request for Customer Number (PTO/SB/125) must be attached to this form. For more information on Customer Numbers, see the Manual of Patent Examining Procedure (MPEP) § 403.

For the following listed application(s), please recognize as the "Fee Address" under the provisions of 37 CFR 1.363 the address associated with:

☑ Customer Number: 35690

OR

☐ The attached Request for Customer Number (PTO/SB/125) form.

PATENT NUMBER (if known)	APPLICATION NUMBER
6904405	10/061052

Completed by (check one):

☐ Applicant/Inventor

☑ Attorney or Agent of record 42,914 (Reg. No.)

☐ 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)

☐ Assignee recorded at Reel _____ Frame_____

Signature

Dean M. Munyon, Reg. No. 42,914
Typed or printed name

512-853-8800
Requester's telephone number

10/8/2010 (6257-33702)
Date

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 that one signature is required, see below*.

☐ * Total of _____ forms are submitted.

This collection of information is required by 37 CFR 1.363. 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 5 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 COMPLETED FORMS TO THIS ADDRESS.
SEND TO: Mail Stop M Correspondence, 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.

Electronic Acknowledgement Receipt	
EFS ID:	8594149
Application Number:	10061052
International Application Number:	
Confirmation Number:	5352
Title of Invention:	MESSAGE RECOGNITION USING SHARED LANGUAGE MODEL
First Named Inventor/Applicant Name:	Edwin A. Suominen
Customer Number:	23377
Filer:	Dean M. Munyon/Christine Acker
Filer Authorized By:	Dean M. Munyon
Attorney Docket Number:	**OR-0004
Receipt Date:	08-OCT-2010
Filing Date:	28-JAN-2002
Time Stamp:	18:16:12
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Power of Attorney	Tablet_PC_PoA_DRATS.pdf	1018788 08355b36a43821d9e4679336db4d79b205e7a3c1	no	2

Warnings:
Information:

2	Assignee showing of ownership per 37 CFR 3.73(b).	statement.pdf	62478 ea53ea3f7e9bba72a5d7637b005b537b8e479958	no	1
Warnings:					
Information:					
3	Change of Address	fee.pdf	62270 01745729882ae81f0b8d9d74666a9c99ec5e1b84	no	1
Warnings:					
Information:					
		Total Files Size (in bytes):	1143536		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

PTO/SB/80 (01-06)
Approved for use through 12/31/2006. OMB 0651-0035
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 displays a valid OMB control number.

POWER OF ATTORNEY TO PROSECUTE APPLICATIONS BEFORE THE USPTO

I hereby revoke all previous powers of attorney given in the application identified in the attached statement under 37 CFR 3.73(b).

I hereby appoint:

☑ Practitioners associated with the Customer Number: 35690

OR

☐ Practitioner(s) named below (if more than ten patent practitioners are to be named, then a customer number must be used):

Name	Registration Number	Name	Registration Number

as attorney(s) or agent(s) to represent the undersigned before the United States Patent and Trademark Office (USPTO) in connection with any and all patent applications assigned only to the undersigned according to the USPTO assignment records or assignment documents attached to this form in accordance with 37 CFR 3.73(b).

Please change the correspondence address for the application identified in the attached statement under 37 CFR 3.73(b) to:

☑ The address associated with Customer Number: 35690

OR

☐ Firm or Individual Name			
Address			
City		State	Zip
Country			
Telephone		Email	

Assignee Name and Address:

Optical Research Partners LLC
2215-B Renaissance Drive, Suite 5
Las Vegas, NV 89119

A copy of this form, together with a statement under 37 CFR 3.73(b) (Form PTO/SB/96 or equivalent) is required to be filed in each application in which this form is used. The statement under 37 CFR 3.73(b) may be completed by one of the practitioners appointed in this form if the appointed practitioner is authorized to act on behalf of the assignee, and must identify the application in which this Power of Attorney is to be filed.

SIGNATURE of Assignee of Record

The individual whose signature and title is supplied below is authorized to act on behalf of the assignee

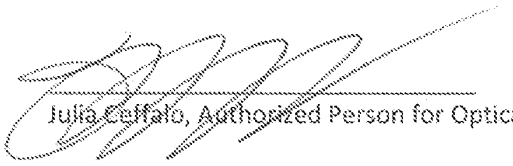
Signature		Date	27 SEP 2006
Name	Julia Ceffalo	Telephone	
Title	Authorized Person for Optical Research Partners LLC		

This collection of information is required by 37 CFR 1.31, 1.32 and 1.33. 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 3 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.

DECLARATION REGARDING AUTHORITY TO SIGN ON BEHALF OF A LEGAL ENTITY
37 C.F.R. 3.73(b)(2)(i)

I, Julia Ceffalo (whose title is supplied below), hereby declare that I am authorized to sign on behalf of Optical Research Partners LLC.



Julia Ceffalo, Authorized Person for Optical Research Partners LLC

27 SEP 2010

[date]

PTO/SB/96 (08-08)
Approved for use through 08/31/2008. 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 displays a valid OMB control number.

STATEMENT UNDER 37 CFR 3.73(b)

Applicant/Patent Owner: Optical Research Partners LLC

Application No./Patent No.: 10/061052 Filed/Issue Date: 1/28/2002

Entitled: MESSAGE RECOGNITION USING SHARED LANGUAGE MODEL

Optical Research Partners LLC, a Limited Liability Company
(Name of Assignee) (Type of Assignee, e.g., corporation, partnership, university, government agency, etc.)

states that it is:

1. ☑ the assignee of the entire right, title, and interest; or

2. ☐ an assignee of less than the entire right, title and interest
(The extent (by percentage) of its ownership interest is _____%)

in the patent application/patent identified above by virtue of either:

A. ☐ An assignment from the inventor(s) of the patent application/patent identified above. The assignment was recorded in the United States Patent and Trademark Office at Reel _____, Frame _____, or for which a copy thereof is attached.

OR

B. ☑ A chain of title from the inventor(s), of the patent application/patent identified above, to the current assignee as follows:

1. From: Edwin A. Suominen To: MOUNT HAMILTON PARTNERS, LLC
The document was recorded in the United States Patent and Trademark Office at
Reel 016010, Frame 0010, or for which a copy thereof is attached.

2. From: MOUNT HAMILTON PARTNERS, LLC To: OPTICAL RESEARCH PARTNERS LLC
The document was recorded in the United States Patent and Trademark Office at
Reel 016202, Frame 0961, or for which a copy thereof is attached.

3. From: _____ To: _____
The document was recorded in the United States Patent and Trademark Office at
Reel _____, Frame _____, or for which a copy thereof is attached.

☐ Additional documents in the chain of title are listed on a supplemental sheet.

☑ As required by 37 CFR 3.73(b)(1)(i), the documentary evidence of the chain of title from the original owner to the assignee was, or concurrently is being, submitted for recordation pursuant to 37 CFR 3.11.

[NOTE: A separate copy (*i.e.*, a true copy of the original assignment document(s)) must be submitted to Assignment Division in accordance with 37 CFR Part 3, to record the assignment in the records of the USPTO. See MPEP 302.08]

The undersigned (whose title is supplied below) is authorized to act on behalf of the assignee.

Signature	10/8/2010 (6257-33703) Date
Dean M. Munyon	512-853-8800
Printed or Typed Name	Telephone Number
Attorney (Reg. No.: 42,914)	
Title	

This collection of information is required by 37 CFR 3.73(b). 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: 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.

Electronic Acknowledgement Receipt	
EFS ID:	8594184
Application Number:	10061052
International Application Number:	
Confirmation Number:	5352
Title of Invention:	MESSAGE RECOGNITION USING SHARED LANGUAGE MODEL
First Named Inventor/Applicant Name:	Edwin A. Suominen
Customer Number:	23377
Filer:	Dean M. Munyon/Christine Acker
Filer Authorized By:	Dean M. Munyon
Attorney Docket Number:	**OR-0004
Receipt Date:	08-OCT-2010
Filing Date:	28-JAN-2002
Time Stamp:	18:19:21
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Power of Attorney	Tablet_PC_PoA_DRATS.pdf	1018788 08355b36a43821d9e4679336db4d79b205e7a3c1	no	2
Warnings:					
Information:					

2	Assignee showing of ownership per 37 CFR 3.73(b).	statement.pdf	62398 19e1b0848eee124b5cf5304bb50ab1f2fd6a2c55	no	1
Warnings:					
Information:					
			Total Files Size (in bytes):	1081186	

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New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
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DOCKET NO.: **OR-0004 **PATENT**

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In Re Application of:	
Edwin A. Suominen	**Confirmation No.: 5352**
Application No.: 10/061,052	**Group Art Unit: 2654**
Filing Date: January 28, 2002	**Examiner: Angela A. Armstrong**
Patent No.: 6,904,405	**Issue Date: June 7, 2005**

For: MESSAGE RECOGNITION USING SHARED LANGUAGE MODEL

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

NOTIFICATION OF LOSS OF ENTITLEMENT TO SMALL ENTITY STATUS
(37 CFR 1.28(b))

Applicant hereby notifies the Patent and Trademark Office that it is no longer entitled to status as a Small Entity, and that the claim for Small Entity status is hereby withdrawn.

Date: 6/24/08

Michael D. Stein
Registration No. 34,734

Woodcock Washburn LLP
Cira Centre
2929 Arch Street, 12th Floor
Philadelphia, PA 19104-2891
Telephone: (215) 568-3100
Facsimile: (215) 568-3439

Electronic Acknowledgement Receipt	
EFS ID:	3522766
Application Number:	10061052
International Application Number:	
Confirmation Number:	5352
Title of Invention:	MESSAGE RECOGNITION USING SHARED LANGUAGE MODEL
First Named Inventor/Applicant Name:	Edwin A. Suominen
Customer Number:	23377
Filer:	Michael David Stein/Chelsey McKnight
Filer Authorized By:	Michael David Stein
Attorney Docket Number:	**OR-0004
Receipt Date:	26-JUN-2008
Filing Date:	28-JAN-2002
Time Stamp:	13:10:02
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes) /Message Digest	Multi Part /.zip	Pages (if appl.)
1	Miscellaneous Incoming Letter	OR-0004.pdf	16399 5a1b761d8ebc943ffef403aafcd8e054f6af535d	no	1

Warnings:
Information:

Total Files Size (in bytes):	16399

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

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 NUMBER	FILING OR 371 (c) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
10/061,052	01/28/2002	Edwin A. Suominen	

CONFIRMATION NO. 5352

OC000000017674456

23377
WOODCOCK WASHBURN LLP
ONE LIBERTY PLACE, 46TH FLOOR
1650 MARKET STREET
PHILADELPHIA, PA 19103

Date Mailed: 12/16/2005

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 07/15/2005.

The Power of Attorney in this application is accepted. Correspondence in this application will be mailed to the above address as provided by 37 CFR 1.33.

DAVID O LIPSCOMB
OIPE (703) 308-9010

OFFICE COPY

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
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Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371 (c) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
10/061,052	01/28/2002	Edwin A. Suominen	

CONFIRMATION NO. 5352

Edwin A. Suominen
Suite 300
14614 North Kierland Boulevard
Scottsdale, AZ 85254

OC000000017674454

Date Mailed: 12/16/2005

NOTICE REGARDING CHANGE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 07/15/2005.

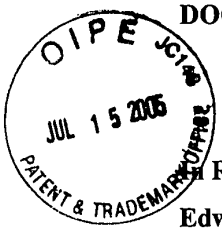
- The Power of Attorney to you in this application has been revoked by the assignee who has intervened as provided by 37 CFR 3.71. Future correspondence will be mailed to the new address of record(37 CFR 1.33).

DAVID O LIPSCOMB
OIPE (703) 308-9010

OFFICE COPY

COMPLETED

1FW DS:D



DOCKET NO.: IVOR-0004 **PATENT**

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In Re Application of:
Edwin A. Suominen

Confirmation No.: 5352

Patent No.: 6,904,405

Group Art Unit: 2654

Filing Date: January 28, 2002

Examiner: Angela A. Armstrong

For: MESSAGE RECOGNITION USING SHARED LANGUAGE MODEL

DATE OF DEPOSIT: 7-13-05

I HEREBY CERTIFY THAT THIS PAPER IS BEING DEPOSITED WITH THE UNITED STATES POSTAL SERVICE AS FIRST CLASS MAIL, POSTAGE PREPAID, ON THE DATE INDICATED ABOVE AND IS ADDRESSED TO THE COMMISSIONER FOR PATENTS, P.O. BOX 1450, ALEXANDRIA, VA 22313-1450.

TYPED NAME: **Michael D. Stein**
REGISTRATION NO.: **34,734**

Mail Stop Post Issue
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

ASSIGNEE POWER OF ATTORNEY

The undersigned, assignee of the entire interest in the above-identified application, hereby appoints the attorneys associated with the following customer number of the firm of WOODCOCK WASHBURN LLP, One Liberty Place - 46th Floor, Philadelphia, Pennsylvania, 19103, as attorneys for applicant(s), with full power of substitution and revocation, to prosecute this application, to make alterations and amendments therein, to receive the patent, and to transact all business in the Patent and Trademark Office connected therewith.

23377

Send all future correspondence and address all telephone calls to:

Michael D. Stein
WOODCOCK WASHBURN LLP
One Liberty Place - 46th Floor
Philadelphia PA 19103
Telephone: (215) 568-3100

2005 WW

STATEMENT UNDER 37 CFR § 3.73(b)

Optical Research Partners LLC, a Nevada Limited Liability Company,

states that it is:

☒ the assignee of the entire right, title, and interest; or

☐ an assignee of an undivided part interest

in the patent application/patent identified above by virtue of either:

1. ☐ An assignment from the inventor of the patent application/patent identified above.

   ☐ 1. The assignment was recorded in the Patent and Trademark Office at Reel , Frame(s) .

OR

2. ☒ A chain of title from the inventor(s), of the patent application/patent identified above, to the current assignee as shown below:

   From: **Edwin A. Suominen** To: **Mount Hamilton Partners, LLC**
   The document was recorded in the Patent and Trademark Office at Reel **016010**, Frame(s) **0010-0012**, or for which a copy thereof is attached.

   From: **Mount Hamilton Partners, LLC** To: **Optical Research Partners LLC**. The document was recorded in the Patent and Trademark Office at Reel **016202**, Frames **0961-0964**, or for which a copy thereof is attached.

   ☐ Additional documents in the chain of title are listed on a supplemental sheet.

   ☐ Copies of assignments or other documents in the chain of title are attached.

The undersigned (whose title is supplied below) is empowered to act on behalf of the assignee.

Signature
Name: **Julia Ceffalo**
Title: AUTHORIZED PERSON

Date: 30 JUN 2005

2005WW

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. 5352

SERIAL NUMBER	FILING OR 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
10/061,052	01/28/2002 RULE	704	2654	

APPLICANTS

Edwin A. Suominen, Valley, WA;

**** CONTINUING DATA ***************************

This application is a CON of 09/616,157 07/14/2000 ABN which claims benefit of 60/144,481 07/17/1999

**** FOREIGN APPLICATIONS *********************

IF REQUIRED, FOREIGN FILING LICENSE GRANTED ** SMALL ENTITY **
** 04/01/2002

Foreign Priority claimed	STATE OR COUNTRY	SHEETS DRAWING	TOTAL CLAIMS	INDEPENDENT CLAIMS
☐ yes ☐ no 35 USC 119 (a-d) conditions met ☐ yes ☐ no ☐ Met after Allowance Verified and Acknowledged Examiner's Signature Initials	WA	17	7	4

ADDRESS

Edwin A. Suominen
Suite 300
14614 North Kierland Boulevard
Scottsdale ,AZ 85254

TITLE

MESSAGE RECOGNITION USING SHARED LANGUAGE MODEL

FILING FEE RECEIVED	FEES: Authority has been given in Paper	
670	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

OIPE JC16 JAN 2 1 2005 PATENT & TRADEMARK

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 (703) 746-4000

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 01/13/2005

Edwin A. Suominen
Suite 300
14614 North Kierland Boulevard
Scottsdale, ~~AR~~ AZ 85254

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 (703) 746-4000, on the date indicated below.

Edwin A. Suominen (Depositor's name)
(Signature)
1/21/05 (Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/061,052	01/28/2002	Edwin A. Suominen		5352

TITLE OF INVENTION: MESSAGE RECOGNITION USING SHARED LANGUAGE MODEL

APPLN. TYPE	SMALL ENTITY	ISSUE FEE	PUBLICATION FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	YES	$700	$300	$1000	04/13/2005

EXAMINER	ART UNIT	CLASS-SUBCLASS
ARMSTRONG, ANGELA A	2654	704-235000

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. Edwin A. Suominen
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 enclosed:
☒ Issue Fee
☒ Publication Fee (No small entity discount permitted)
☐ Advance Order - # of Copies _____

4b. Payment of Fee(s):
☐ A check in the amount of the fee(s) is enclosed.
☒ Payment by credit card. Form PTO-2038 is attached.
☐ The Director is hereby authorized by charge the required fee(s), 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).

The Director of the USPTO is requested to apply the Issue Fee and Publication Fee (if any) or to re-apply any previously paid issue fee to the application identified above.
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.

700.00 OP
300.00 OP

Authorized Signature _____ Date 1/21/05

Typed or printed name Edwin A Suominen Registration No. 43,174

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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PTOL-85 (Rev. 12/04) Approved for use through 04/30/2007. OMB 0651-0033 U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

01/24/2005 LWONDIM2 00000152 10061052
01 FC:2801
02 FC:1804
1/2 * RCVD AT 1/21/2005 10:35:56 PM [Eastern Standard Time] * SVR:USPTO-EFXRF-2/0 * DNIS:7464000 * CSID:5099372760 * DURATION (mm-ss):01-48

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

NOTICE OF ALLOWANCE AND FEE(S) DUE

7590 01/13/2005

Edwin A. Suominen
Suite 300
14614 North Kierland Boulevard
Scottsdale, AR 85254

EXAMINER	
ARMSTRONG, ANGELA A	
ART UNIT	PAPER NUMBER
2654	

DATE MAILED: 01/13/2005

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/061,052	01/28/2002	Edwin A. Suominen		5352

TITLE OF INVENTION: MESSAGE RECOGNITION USING SHARED LANGUAGE MODEL

APPLN. TYPE	SMALL ENTITY	ISSUE FEE	PUBLICATION FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	YES	$700	$300	$1000	04/13/2005

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 REFLECTS A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE APPLIED IN THIS APPLICATION. THE PTOL-85B (OR AN EQUIVALENT) MUST BE RETURNED WITHIN THIS PERIOD EVEN IF NO FEE IS DUE OR THE APPLICATION WILL BE REGARDED AS ABANDONED.

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 should be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). Even if the fee(s) have already been paid, Part B - Fee(s) Transmittal should be completed and returned. 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.

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. 12/04) Approved for use through 04/30/2007.

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 (703) 746-4000

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 01/13/2005

Edwin A. Suominen
Suite 300
14614 North Kierland Boulevard
Scottsdale, AR 85254

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 (703) 746-4000, on the date indicated below.

(Depositor's name)

(Signature)

(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/061,052	01/28/2002	Edwin A. Suominen		5352

TITLE OF INVENTION: MESSAGE RECOGNITION USING SHARED LANGUAGE MODEL

APPLN. TYPE	SMALL ENTITY	ISSUE FEE	PUBLICATION FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	YES	$700	$300	$1000	04/13/2005

EXAMINER	ART UNIT	CLASS-SUBCLASS
ARMSTRONG, ANGELA A	2654	704-235000

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 enclosed:

☐ Issue Fee

☐ Publication Fee (No small entity discount permitted)

☐ Advance Order - # of Copies _____

4b. Payment of Fee(s):

☐ A check in the amount of the fee(s) is enclosed.

☐ Payment by credit card. Form PTO-2038 is attached.

☐ The Director is hereby authorized by charge the required fee(s), 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).

The Director of the USPTO is requested to apply the Issue Fee and Publication Fee (if any) or to re-apply any previously paid issue fee to the application identified above.
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.

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.
10/061,052	01/28/2002	Edwin A. Suominen		5352

7590 01/13/2005

Edwin A. Suominen
Suite 300
14614 North Kierland Boulevard
Scottsdale, AR 85254

EXAMINER	
ARMSTRONG, ANGELA A	

ART UNIT	PAPER NUMBER
2654	

DATE MAILED: 01/13/2005

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 443 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 443 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 (703) 305-8283.

PTOL-85 (Rev. 12/04) Approved for use through 04/30/2007.

Notice of Allowability	Application No.	Applicant(s)	
	10/061,052	SUOMINEN, EDWIN A.	
	Examiner	Art Unit	
	Angela A. Armstrong	2654	

-- 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 *the response filed 09/10/2004*.

2. ☒ The allowed claim(s) is/are *62 and 81-96*.

3. ☒ The drawings filed on *01/28/2002* are accepted by the Examiner.

4. ☐ 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.

5. ☐ 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.

6. ☐ 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).

7. ☐ 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-1449 or PTO/SB/08), Paper No./Mail Date 9/10/04
4. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
5. ☐ Notice of Informal Patent Application (PTO-152)
6. ☐ Interview Summary (PTO-413), Paper No./Mail Date _____ .
7. ☐ Examiner's Amendment/Comment
8. ☐ Examiner's Statement of Reasons for Allowance
9. ☐ Other _____.

RICHEMOND DORVIL
SUPERVISORY PATENT EXAMINER

OIPE JC61
SEP 10 2004
PATENT & TRADEMARK OFFICE

RECEIVED
SEP 16 2004
Technology Center 2600

Form PTO-1449 (Modified)

List of Patents and Publications for Applicant's Information Disclosure Statement

Serial No.: 10/061,052
Applicant(s): Edwin A. Suominen
Group: 2654
Filed: January 28, 2002

U.S. PATENT DOCUMENTS

Examiner Initials		Document Number	Date	Name	Class	Subclass	Filing Date*
AAA	A	6,340,967	01/02	Maxted	345	179	04/99
AAA	B	6,393,395	05/02	Guha *et al.*	704	232	
AAA	C	6,363,348	03/02	Besling *et al.*	704	270.1	

** Provided only for patents issued less than one year before applicant's earliest claimed filing date. May not be actual §102(e) date.*

U.S. PUBLISHED PATENT APPLICATIONS

Examiner Initials		Document Number	Pub. Date	Name	Class	Subclass	Filing Date**
AAA	D	US 2003/0216913	11/03	Keely *et al.*	704	235	05/02
AAA	E	US 2003/0212961	11/03	Soin *et al.*	715	530	05/02
AAA	F	US 2003/0189603	10/03	Goyal *et al.*	345	863	04/02
AAA	G	US 2002/0075300	06/02	Tang *et al.*	345	744	06/01

***Provided only for applications published less than one year before applicant's earliest claimed filing date. Only effective upon issuance of the cited application as a U.S. Patent. May not be actual §102(e) date.*

OTHER ART

Examiner Initials		Author, Title, Publication Name, Pertinent Pages, Date, *etc.*
AAA	H	Bellegarda, J. *et al.* Research Report RC 17312, "Automatic Recognititon of Integrated Speech and Handwriting Information," IBM Research Division, dated August 1991.
AAA	I	Falcigno, K. IBM T.J. Watson Research Center Library. Email of June 29, 2004 regarding Research Report RC 17312.
AAA	J	Feng, W. "Using Handwriting and Gesture Recogititon to Correct Speech Recognition Errors," from Proc. Of the 10th Int'l Conf. On Adv. Sci. & Tech., pp. 105-112, dated March 1994. (Some images blank in available copy.)
AAA	K	Meyer, A. "Pen Computing: A Technology Overview and a Vision", SIGCHI Bulletin, Vol. 27, No. 3, dated July 1995.
AAA	L	Starner, T. *et al.* "On-Line Cursive Handwriting Recognition Using Speech Recognition Methods," in International Conference on Acoustics, Speech and Signal Processing, Vol. 5, pp. 125-128, 1994.

Examiner: A Armstrong Date Considered: 01/06/05

EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance *and* not considered. Include copy of this form with next communication to applicants.

Form PTO-1449 (Modified)

List of Patents and Publications for Applicant's Information Disclosure Statement

Serial No.: 10/061,052
Applicant(s): Edwin A. Suominen
Group: 2654
Filed: January 28, 2002

OTHER ART

Examiner Initials		Author, Title, Publication Name, Pertinent Pages, Date, *etc.*
AAA	M	Suhm, B. *et al.* "Model-based and Empirical Evaluation of multimodal Interactive Error Correction," CHI '99 Conference Proceedings, pp. 584-591, dated May 1999.

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SEP 16 2004
Technology Center 2600

Examiner: A. Armstrong Date Considered: 01/06/05

EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance *and* not considered. Include copy of this form with next communication to applicants.

Issue Classification	Application No.	Applicant(s)	
	10/061,052	SUOMINEN, EDWIN A.	
	Examiner	Art Unit	
	Angela A. Armstrong	2654	

ISSUE CLASSIFICATION

ORIGINAL					CROSS REFERENCE(S)						
CLASS				SUBCLASS	CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)					
704				235	704	270					
INTERNATIONAL CLASSIFICATION											
G	1	0	L	15/26							
G	1	0	L	21/00							
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Angela Armstrong 1/7/05
(Assistant Examiner) (Date)

AVB 1/11/05
(Legal Instruments Examiner) (Date)

RICHEMOND DORVIL
SUPERVISORY PATENT EXAMINER

(Primary Examiner) (Date) 1/10/05

Total Claims Allowed: 17

O.G. Print Claim(s)	O.G. Print Fig.
1	2

☐ 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
	1		31		61	3	91		121		151		181
	2		32	1	62	4	92		122		152		182
	3		33		63	5	93		123		153		183
	4		34		64	9	94		124		154		184
	5		35		65	10	95		125		155		185
	6		36		66	11	96		126		156		186
	7		37		67		97		127		157		187
	8		38		68		98		128		158		188
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	25		55	12	85		115		145		175		205
	26		56	13	86		116		146		176		206
	27		57	14	87		117		147		177		207
	28		58	15	88		118		148		178		208
	29		59	19	89		119		149		179		209
	30		60	17	90		120		150		180		210

Index of Claims

Application No.	Applicant(s)	
10/061,052	SUOMINEN, EDWIN A.	
Examiner	**Art Unit**	
Angela A. Armstrong	2654	

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

Claim		Date									
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Hatley Group

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BIBDATASHEET

Bib Data Sheet

CONFIRMATION NO. 5352

SERIAL NUMBER	FILING OR 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
10/061,052	01/28/2002 RULE	704	2654	

APPLICANTS

Edwin A. Suominen, Valley, WA;

**** CONTINUING DATA **********

This application is a CON of 09/616,157 07/14/2000 ABN Yes AAA
which claims benefit of 60/144,481 07/17/1999 Yes AAA

**** FOREIGN APPLICATIONS **********

IF REQUIRED, FOREIGN FILING LICENSE GRANTED ** SMALL ENTITY **
** 04/01/2002

Foreign Priority claimed	STATE OR COUNTRY	SHEETS DRAWING	TOTAL CLAIMS	INDEPENDENT CLAIMS
☐ yes ☒ no	WA	17	17	3
35 USC 119 (a-d) conditions met ☐ yes ☒ no ☐ Met after Allowance				
Verified and Acknowledged Examiner's Signature Angela Suominen Initials				

ADDRESS

Edwin A. Suominen
Suite 300
14614 North Kierland Boulevard
Scottsdale ,AR 85254

TITLE

MESSAGE RECOGNITION USING SHARED LANGUAGE MODEL

FILING FEE RECEIVED		
370	FEES: Authority has been given in Paper 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

Search Notes	Application No.	Applicant(s)	
	10/061,052	SUOMINEN, EDWIN A.	
	Examiner	Art Unit	
	Angela A. Armstrong	2654	

SEARCHED			
Class	Subclass	Date	Examiner
704	231,235, 254,257, 260,270	1/6/2005	AAA

INTERFERENCE SEARCHED			
Class	Subclass	Date	Examiner
704	**235**	1/7/2005	**AAA**
704	270	1/7/2005	AAA

SEARCH NOTES (INCLUDING SEARCH STRATEGY)		
	DATE	EXMR
PLUS SEARCH	12/21/2004	AAA
EAST TEXT SEARCH	1/6/2005	AAA

PLUS Search Results for S/N 10061052, Searched December 21, 2004

The Patent Linguistics Utility System (PLUS) is a USPTO automated search system for U.S. Patents from 1971 to the present. PLUS is a query-by-example search system which produces a list of patents that are most closely related linguistically to the application searched. This search was prepared by the staff of the Scientific and Technical Information Center, SIRA.

6092043	5822727	5867597	5579431
6101468	5732187	6101472	5617508
5625748	6233553	6125376	5680506
5890123	5231670	6385586	4567606
6185535	5870705	6457024	4624008
6563911	5970448	6496799	4905286
6813341	6477500	6601029	5361324
5454063	6151576	5956681	5826230
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6073097	6185530	5710866	5566248
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6725199	5475792	6397179	5778404
6240391	5778342	6526380	5765130
5956683	6208959	5712957	6061651
6012030	5434777	5855000	6061651
6018711	5608624	6122613	6067517
6728348	5625814	5794196	4532648
6073101	5632002	5970449	5440662
6219638	6023697	6088669	5483579
6219638	6732078	6205426	5519809
5212821	6088428	5895447	5751260
5765131	5809464	6118888	5774628
6175819	5444768	6345111	5774841
5615296	5179627	5384701	5893059
5960394	6671354	6100882	5895448
6216104	5983179	5918222	5960393
6216104	5377303	6167376	6014624
6249761	5909666	6415256	6076054
6618702	5915236	6711543	6119086
4348550	5920837	5899973	6137863
4454586	5920836	6055498	6195636
RE32012	6615172	6226611	6208971
6519479	6633846	6226611	6223158
5475791	6665640	5664058	6223158
4864623	5995918	5828999	6243680
5502774	6249765	6505155	6253184
5621809	6064963	5540589	6266398
4424415	5937385	4587670	6694294
5479488	6323846	RE33597	6785365
6058366	5911129	5857173	5839109
5806031	5752227	5708704	4488005
6594628	6175820	5572570	4507750
5495553	6219641	6195417	6385585
5842162	6219641	5386494	5802314
5991712	5220595	5850436	5651055
6374221	5748841	6208713	5742736
6085160	5754978	6311182	5271088
6163767	6246981	6535850	6523008
6115482	5852801	4811399	6766299

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant	:	Edwin A. Suominen	Art Unit:	:	2654
Serial No.	:	10/061,052	Examiner:	:	Nolan, D.
Filing Date	:	January 28, 2002			
Title	:	Message Recognition using Shared Language Model			

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

CERTIFICATE OF MAILING UNDER 37 CFR 1.10: I hereby certify that I am depositing this correspondence, including all papers referred to as being enclosed, today in an EXPRESS MAIL package having the label number written below.

September 10, 2004 Edwin A. Suominen
Date *Name* *Signature*

ED 324849894
Express Mail Label No.

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SEP 16 2004
Technology Center 2600

RESPONSE TO OFFICE ACTION

Dear Sir:

Responsive to the *Ex Parte Quayle* Office Action mailed June 10, 2004, applicant submits the following:

- **Amendments to the Specification** begin on page 2 of this paper.
- **Amendments to the Claims** are reflected in the listing of claims that begins on page 5 of this paper.
- **Remarks**, which include a section entitled "Comments on Statement of Reasons for Allowance," begin on page 11 of this paper.

An Information Disclosure Statement (IDS) is enclosed with Form PTO-1449 and required copies of references. Also enclosed is a Form PTO-2038 authorizing credit card payment of **$235** for a requested one-month extension of time ($55) and submission of the IDS after an action that closes prosecution in the application ($180), pursuant to 37 C.F.R. § 1.97(d). The statement required by 37 C.F.R. § 1.97(e) is in the remarks below.

Also enclosed is a corrected drawing sheet for FIG. 1A. Upon receipt of the June 10 Office Action and subsequent review of the application file, applicant noticed that the sheet (which was included in the application as filed) had been inadvertently omitted from applicant's Response to Notice filed July 30, 2002 and did not appear in the publication of the application.

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AMENDMENTS TO THE SPECIFICATION

Please replace the title with the following:

~~Text Processing System~~ Message Recognition using Shared Language Model

Please replace the paragraph from page 9, line 24 through page 10, line 7 with the following:

A transmitter according to various aspects of the present invention includes any suitable hardware and/or software for transmitting voice input via a communications link 115. When a simple wired connection is utilized for a communications link, no transmitter may be needed. When a wireless connection is utilized, a transmitter may include appropriate conversion, modulation, and/or transmission circuitry. For example, transmitter 122 in stylus 110 includes a conventional analog-to-digital converter for converting voice input into digital samples, and a conventional modulator/transmitter for converting the digital samples into an analog signal having a desired modulation format (*e.g.*, FSK, QPSK). A transmitter may be coupled to a radiating device for converting the analog signal into a desired form of field radiation (*e.g.*, an RF signal in the 1-5 GHz range). For example, transmitter 122 couples an RF signal to a conventional dipole antenna having elements 660, which are oriented parallel to a longitudinal axis of stylus 110. As a further example, infrared transmitter 760 in stylus 710 couples digital modulation to a conventional solid state infrared emitter 770. Emitter 770 produces modulated infrared radiation, which passes out of stylus 710 through transparent aperture 775.

Please replace the paragraph at page 10, lines 8-16, with the following:

A receiver according to various aspects of the present invention includes any suitable hardware and/or software for receiving information from a transmitter via a communications link. When a simple wired connection is utilized for a communications link, a receiver may consist of a circuit for amplifying and/or filtering the signal from a

microphone. When a wireless connection is utilized, a receiver may include appropriate receiving, demodulation, and conversion circuitry, generally complementary to circuitry in a cooperating transmitter. For example, receiver 160 of tablet 150 includes a conventional receiver/demodulator for converting an analog signal transmitted by transmitter 122 and picked up by a suitable sensing device (*e.g.*, an antenna, not shown).

Please replace the paragraph at page 21, lines 16-22, with the following:

Preferably, a conventional flat-panel display is integrated into the tablet surface. Such an integrated configuration is advantageous because, *inter alia*, visible "ink" may be displayed to show freehand input as if the stylus pointer were the actual tip of a pen. A display according to various aspects of the present invention may employ any conventional technology such as LCD. It is contemplated that newer display technologies such as IBM's ~~"Roentgen"~~ ROENTGEN display technologies, using aluminum and copper display materials, and "reversible paper" (*e.g.*, Xerox's ~~"Gyricon"~~ GYRICON display technologies) may also be integrated into a tablet surface in accordance with the invention.

Please replace the paragraph at page 30, lines 8-13, with the following:

A message recognizer according to various aspects of the present invention includes any suitable hardware and/or software for recognizing a message of at least one type to provide text data. A message includes any communication in writing, in speech, or by signals. As may be better understood with reference to TABLE III below, examples of types of messages to be recognized include voice input (for speech recognition), freehand input (for handwriting recognition), and visual input (for optical character recognition).

Please replace the paragraph from page 31, line 25 through page 32, line 2 with the following:

A message model according to various aspects of the present invention includes any model (*e.g.*, algorithm, mathematical expression, set of rules, etc.) for defining operation of a message recognizer to provide text data responsive to message input. Conventionally, a message model includes a language model and a model specific to one type of message recognition. For example, a conventional speech recognizer operates in accordance with a type-specific message model consisting of a language model and an acoustic model. As a further example, a conventional handwriting recognizer operates in accordance with its own type-specific message model that consists of a language model and a handwriting model.

Please replace the paragraph at page 38, lines 13-19, with the following:

The semantic model may be part of a shared language model of the invention. In message recognizer 310, for example, semantic model 354 is part of shared language model 350. A message recognizer may include two or more subordinate message recognizers, each of which may operate in accordance with the semantic model in the shared language model. Advantageously, the accuracy of each subordinate message recognizer sharing a language model that includes a semantic model ~~model~~ according to various aspects of the present invention may be improved by user identification of context.

AMENDMENTS TO THE CLAIMS

Claims 1-61 (cancelled).

Claim 62 (previously presented) A system for generating text responsive to message input of a first type and a second type, the system comprising:

(a) a unified message model including:

(1) a shared language model;

(2) a first model specific to a first type of message recognition; and

(3) a second model specific to a second type of message recognition;

(b) a first message recognizer, responsive to the first type of message input to provide text data in accordance with both the shared language model and the first model; and

(c) a second message recognizer, responsive to the second type of message input to provide text data in accordance with both the shared language model and the second model;

wherein

(d) the shared language model is trainable responsive to user correction of misrecognition by either of the first and second message recognizers, thereby improving accuracy of each of the first and second message recognizers.

Claims 63-80 (cancelled).

Claim 81 (previously presented) The system of claim 62 wherein:

(a) the first type of message recognition is speech recognition, the first type of message input is voice input, and the first model is an acoustic model; and

(b) the second type of message recognition is handwriting recognition, the second type of message input is freehand input, and the second model is a handwriting model.

Claim 82 (previously presented) The system of claim 62 wherein the shared language model comprises a syntactic model and a semantic model.

Claim 83 (currently amended) A method for performing message recognition with a shared language model, the method comprising:

(a) performing message recognition of a first type, responsive to a first type of message input, to provide text data in accordance with both ~~a~~ the shared language model and a first model specific to the first type of message recognition;

(b) performing message recognition of a second type, responsive to a second type of message input, to provide text data in accordance with both the shared language model and a second model specific to the second type of message recognition; and

(c) training the shared language model responsive to user correction of error in message recognition of either of the first and second types, thereby improving accuracy of each of the first and second types of message recognition.

Claim 84 (previously presented) The method of claim 83 wherein:

(a) performing the first type of message recognition comprises performing speech recognition responsive to voice input in accordance with the shared language model and a first model that is an acoustic model; and

(b) performing the second type of message recognition comprises performing handwriting recognition responsive to freehand input in accordance with the shared language model and a second model that is a handwriting model.

Claim 85 (previously presented) The method of claim 83 wherein performing message recognition in accordance with the shared language model comprises performing message recognition in accordance with a syntactic model and a semantic model.

Claim 86 (currently amended) A system for performing message recognition with a trainable shared language model, the system comprising:

(a) means for performing message recognition of a first type, responsive to a first type of message input, to provide text data in accordance with both ~~a~~ the shared language model and a first model specific to the first type of message recognition; and

(b) means for performing message recognition of a second type, responsive to a second type of message input, to provide text data in accordance with both the shared language model and a second model specific to the second type of message recognition.

Claim 87 (previously presented) The system of claim 86 wherein:

(a) the first type of message recognition is speech recognition, the first type of message input is voice input, and the first model is an acoustic model; and

(b) the second type of message recognition is handwriting recognition, the second type of message input is freehand input, and the second model is a handwriting model.

Claim 88 (previously presented) The system of claim 86 wherein the shared language model comprises a syntactic model and a semantic model.

Claim 89 (previously presented) The system of claim 86 further comprising means for training the shared language model responsive to user correction of error in message recognition of either of the first and second types, thereby improving accuracy of each of the first and second types of message recognition.

Claim 90 (previously presented) The system of claim 89 wherein the means for training the shared language model includes means for (a) specifying a selection from visual indicia of dictated text that has been erroneously generated, and (b) correcting the selection.

Claim 91 (previously presented) The system of claim 81 further comprising a stylus, wherein the shared language model is trainable responsive to user correction of misrecognition by the first message recognizer by (a) movement of the stylus across visual indicia of dictated text that has been erroneously generated to specify a selection from the text, and (b) correction of the selection.

Claim 92 (previously presented) The system of claim 91 wherein:

(a) the stylus includes a pointing interface and a microphone;

(b) the system further comprises a tablet responsive to the pointing interface;

(c) the voice input is from the microphone; and

(d) the freehand input is from the pointing interface being manually manipulated on the tablet.

Claim 93 (previously presented) The system of claim 92 wherein the visual indicia of dictated text appears on the tablet.

Claim 94 (previously presented) The method of claim 84 wherein training the shared language model includes (a) moving a stylus across visual indicia of dictated text that has been erroneously generated to specify a selection from the text, and (b) correcting the selection.

Claim 95 (previously presented) The method of claim 94 wherein:

(a) performing speech recognition responsive to voice input includes responding to voice input from a microphone in the stylus; and

(b) performing handwriting recognition responsive to freehand input includes responding to manual manipulation of the stylus on a tablet.

Claim 96 (previously presented) The method of claim 95 wherein the visual indicia of dictated text appears on the tablet.

REMARKS

Assignee thanks the Examiner for the indication that all claims are allowable except for various matters of form.

INFORMATION DISCLOSURE STATEMENTS

In an effort to ensure that the most pertinent references are brought before the Examiner during prosecution of this application, applicant performed additional patent and non-patent literature searching after receiving the Office Action mailed June 10, 2004. Various references from those searches are being cited in a concurrently filed IDS.

With one possible exception[1], the undersigned (who is also the applicant) first learned of all of the newly cited references as a result of the searches. Thus, pursuant to 37 C.F.R. § 1.97(e), the undersigned states that

> no item of information contained in the IDS was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the undersigned after making reasonable inquiry, no item of information contained in the IDS was known to any individual designated in § 1.56(c) more than three months prior to the filing of the IDS.

Applicant sincerely appreciates the thoroughness with which this application and its parent have been examined, and hopes that the Examiner will not be greatly inconvenienced in fulfilling the obligation to consider these few additional references before passing the application to issue.

Numerous non-patent references were not considered in the IDS identified as filed August 5, 2002 because copies of the references were not provided with it.[2] However, applicant respectfully submits that the omission was permissible under Rule 97(d)

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[1]The possible exception is Research Report RC 17312, which was cited in a footnote in IBM Technical Disclosure Bulletin Vol 36, No. 02 (cited as item "CCC" of applicant's original PTO-1449 filed with the application). While it is likely that applicant at least scanned the footnote citing the Report more than three months ago, applicant did not obtain a copy of Research Report RC 17312 until after receiving the June 10 Office Action, and it is submitted that such did not make the Report "known to" the applicant contrary to the Rule 97(e) statement.

[2]Notwithstanding the Rule 97(d) issue, applicant appreciates the Examiner's consideration of the patent and published application references despite the omission of copies.

because the IDS properly identified as "the parent to this application" an earlier application that is relied on for an earlier affective filing date under 35 U.S.C. § 120, and copies of the references were provided in the parent application. See, *e.g.*, applicant's Application Transmittal and Declaration, both of which were of record when the IDS was filed and make clear exactly what "the parent to this application" was. Accordingly, applicant encourages the Examiner to consider the references cited in that IDS along with the references now being cited under Rule 97(e).

CLAIM AMENDMENTS

Responsive to the Examiner's concerns about possible misunderstanding of the terms "a shared" and "the shared" in claims 83 and 86, applicant has amended those claims to recite "the shared language model" for all instances of the term after its introduction in the claim preamble. Those amendments do not change the scope of the claims in any way.

Claim 86 is further amended to clarify that the shared language model is trainable.

SPECIFICATION AMENDMENTS

The specification is amended to correct the typographical error noted by the Examiner and others identified by applicant, and to address the Examiner's concerns about usage of possible trademarks.[3] No new matter is added by way of these amendments.

The title of the application is amended to read "Message Recognition using Shared Language Model," which is more descriptive of the claimed inventions than the former "Text Processing System" title.

COMMENTS ON STATEMENT OF REASONS FOR ALLOWANCE

The Examiner points out that the "invention is directed to recognition of speech, writing, *etc.* using both device-specific and shared models." Except for the fact that

[3]The amendment to the paragraph at page 38, lines 13-19 was included in the Preliminary Amendment filed with the application, but apparently not entered.

type-specific rather than "device-specific" models are claimed, applicant basically agrees. Applicant notes, however, that the claimed inventions do not require the use of "a different input mode for correcting." A system in accordance with claim 62, for example, can have its shared language model "trainable responsive to user correction in misrecognition by either of the first and second message recognizers" regardless of whatever input "mode" the user employs to make that correction.

Applicant appreciates the Examiner's observation that even just the portions of the claims that are underlined in the Office Action are not disclosed in what the Examiner considers the "closest prior art," **U.S. PATENT 6,513,005** to Qin *et al.* A continuation application is forthcoming that will likely include claims more generally directed to the underlined limitations.

Applicant agrees that Qin *et al.* fails to anticipate or render the underlined limitations obvious. In addition, the U.S. filing date[4] (July 25, 2000) of that patent is well after the filing date (July 17, 1999) of provisional application Serial No. 60/144,481, whose benefit the parent (Serial No. 09/616,157) to the present application claims under 35 U.S.C. 119(e). Thus, absent some deficiency in continuity of co-pendency or disclosure from provisional application Serial No. 60/144,481 to parent application Serial No. 09/616,157 to the present application, Qin *et al.* is not prior art to the pending claims. Applicant requests timely explanation if the Examiner believes any such deficiency exists.

ALLOWABILITY OVER PARTICULAR REFERENCES OF INTEREST

The following comments regarding several other references of record are provided for the Examiner's consideration before passing the application to allowance.

The Examiner has already noted **U.S. PATENT 5,855,000** to Waibel *et al.*, pointing out that it discloses speech recognition engine output correction with a "repair hypothesis produced from a secondary input signal," see C3/L18-27. The reference's preferred embodiment, "[i]n addition to repair by substituting or deleting located

[4]The foreign priority date (July 25, 1999) of Qin *et al.* doesn't count under 35 U.S.C. 102 (e), see MPEP 2136.03, but even that is after applicant's provisional filing date.

errors, . . . also allows repair by inserting words" (C9/L48-50). Applicant does not believe that Waibel teaches or suggests any type of language model that is shared between the recognizers for the primary and secondary input signals where words could be inserted, substituted, or deleted. Moreover, applicant submits that Waibel's disclosure (see Figure 3, C6/L28-35) is ambiguous with respect to what is meant by "context memory." It is not clear whether Waibel's "correction and repair" language model based on the primary recognition's results and control of another recognition by the model could be considered "sharing." Regardless, applicant submits that Waibel's primary recognition cannot be considered responsive to message input in accordance with the language model, as variously claimed by applicant, because the primary recognition's results are what generated the "correction and repair" language model.[5]

U.S. PATENT 6,285,785 to Bellegarda *et al.* ("the '785 patent") was cited with the original IDS accompanying the application and noted in the supplemental IDS filed April 28, 2004. The Examiner is referred initially to the text at C12/L39 to C13/L29.

The '785 patent purports to disclose two embodiments. The first, illustrated in the reference's FIG. 1, shows separate language models **38a**, **36a**, one for speech and the other for handwriting recognition. The reference states that "the same language model could also be used for AHR [as for ASR]" (C7/L66-67), and "the LM for speech may be different than the LM for handwriting" (C8/L31-32). The second embodiment shown in connection with FIG. 2 depicts a single language model, but operates with a feature vector that is stated to be a combination of "speech and handwriting feature vectors [that] are each generated in response to simultaneously provided acoustic and handwriting input" (C10/L57-60). Applicant does not believe the '785 patent teaches or suggests any combination of its two embodiments.

In comparison, applicant's independent claims call for training of the shared language model (claim 83), or for the shared language model to be trainable (claim 62, claim 86 as amended). Training performed responsive to user correction of

[5]Even where the reference alludes to "rescoring . . . as a result of the repair hypothesis with information stored in the context memory about the recognition hypothesis and possibly previous repair hypothesis," it refers to rescoring that takes place in "correlation step 114," after "continuous recognition 102."

misrecognition by either of the first and second types of message recognition advantageously can improve accuracy of each, as recited in claims 62 and 83. Applicant believes that the '785 patent fails to teach or suggest any training of a shared language model.

RESEARCH REPORT **RC 17312** entitled "Automatic Recognition of Integrated Speech and Handwriting Information" by Bellegarda *et al.* is being cited in the concurrently filed IDS. Applicant calls that reference to the Examiner's attention because its co-authors are the named co-inventors of the '785 patent, and it similarly discusses "the integrated use of speech and handwriting information to improve the overall accuracy of an automatic recognizer," see abstract. However, applicant submits that the report teaches or suggests neither any training of a shared language model, nor any separate types of message recognition with separate, type-specific models and a shared language model.

U.S. PATENT 6,340,967 to Maxted ("the '967 patent") is also being cited in the concurrently filed IDS. The reference's FIG. 13 shows a "Correction Box **66**" (see C12/L4-C13/L46 for an accompanying description) that includes an "Alternative Word List **94**," which displays an "alternative list of words (ie: generated by either handwriting or dictation) that is associated with the presently selected word" (C12/L63-65). Box **66** further includes a "Handwriting Bitmap Icon **74**" that indicates "the word was generated by handwriting" (C12/L19-21), a "Speech Icon **76**" that indicates "the word was generated by dictation" (C12/L22-23), and a "Keyboard Icon **78**" that indicates "the word was generated by method other than handwriting or dictation, such as keyboarding, OCR . . . etc."

"Correction Box **66**" further includes a "Dictionary Icon **80**" that is used "to indicate the dictionary status of a handwritten word" (C12/L29-38, emphasis added). In different states, the "Dictionary Icon" indicates "the word belongs to the Default Dictionary Word List," "the word belongs to the Default Dictionary Word List," or "the word does not belong to the present Default User-Defined Dictionary." Box **66** further includes a "User-Defined Word List Box Command Button **110**" that opens up a "User-

Defined Word List Box **112**," which "allows a user to add, delete, or modify existing words in the Default User-Defined Dictionary" (C13/L42-46). The reference equates the "Default User-Defined Dictionary" to a "presently loaded" "User-Defined Dictionary," see C13/L56-57.

Applicant submits, however, that the '967 patent does not teach or suggest that its "User-Defined Dictionary" is in any way shared between different types of message recognition. Applicant further submits that the '967 patent teaches away from a mode in which speech and handwriting recognizers could perhaps most effectively share a language model – with both recognizers active (and thus accessing the shared model) simultaneously:

> Note that only one method of input (eg: speech or handwriting) is possible at one time. Therefore, dictation mode if activated, is temporarily de-activated, while the user switches to any of the other available modes (eg: Correction, Punctuation, Selection, Edit, and Handwriting Input mode). [C11/L19-23]

CLARIFICATION REGARDING PREVIOUS REMARKS

In the Preliminary Amendment filed July 30, 2002, applicant discussed examples of how user correction of misrecognition can be beneficial with a shared language model. To avoid any possible misunderstanding that the example indicates any disclaimer by applicant on the scope of the claims (and it does not), applicant wishes to point out that no "syntactic language model" limitations are placed on the independent claims by the example's reference to a preferred embodiment that includes a syntactic language model. (See pages 7-8 of the Preliminary Amendent.)

CONCLUSION

With all claims having been indicated allowable after the Examiner's thorough and detailed examination, and applicant having highlighted above some of the important distinctions over various references in the same spirit, prompt passage of the application to issue is respectfully solicited. Please feel free to telephone the undersigned (who is also the applicant) if there are any questions.

Respectfully submitted,

Dated: September 10, 2004

Edwin A. Suominen
Reg. No. 43,174

14614 North Kierland Boulevard
Suite 300
Scottsdale, AZ 85254
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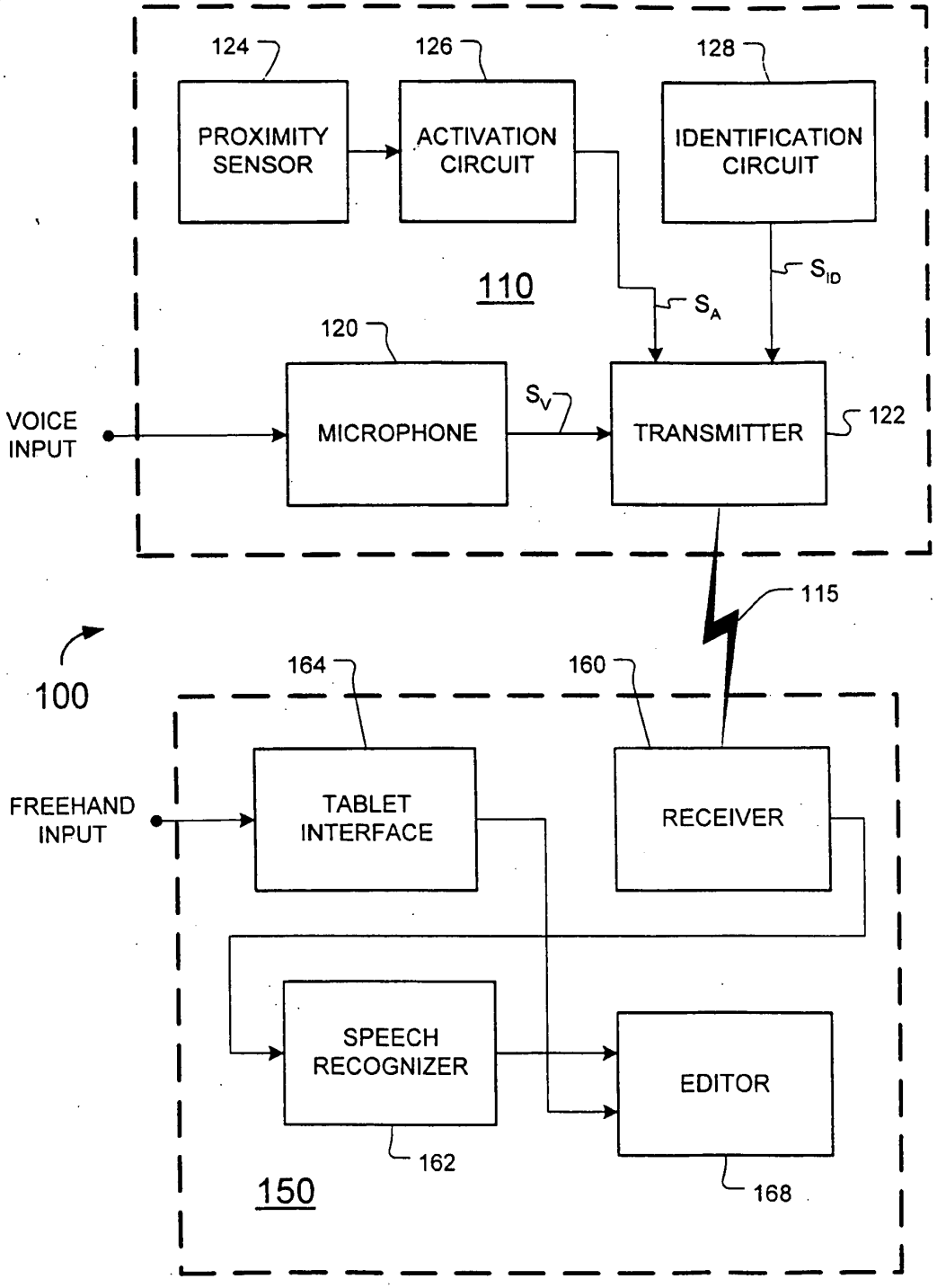


FIG. 1A

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant	:	Edwin A. Suominen	Art Unit:	:	2654
Serial No.	:	10/061,052	Examiner:	:	Nolan, D.
Filing Date	:	January 28, 2002			
Title	:	Message Recognition using Shared Language Model			

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Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT

Dear Sir:

Applicant discloses the following references, which are listed on form PTO-1449 attached to this document.

Pursuant to the Office's July 11, 2003 waiver of the requirement for copies of cited U.S. patents and published patent applications, no copy of such references is included.

Please feel free to telephone the undersigned (who is also the applicant) if there are any questions.

Respectfully submitted,

Dated: September 10, 2004

Edwin A. Suominen
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Form PTO-1449 (Modified)

List of Patents and Publications for Applicant's Information Disclosure Statement

Serial No.: 10/061,052
Applicant(s): Edwin A. Suominen
Group: 2654
Filed: January 28, 2002

U.S. PATENT DOCUMENTS

Examiner Initials		Document Number	Date	Name	Class	Subclass	Filing Date*
_____	A	6,340,967	01/02	Maxted	345	179	04/99
_____	B	6,393,395	05/02	Guha *et al.*	704	232	
_____	C	6,363,348	03/02	Besling *et al.*	704	270.1	

** Provided only for patents issued less than one year before applicant's earliest claimed filing date. May not be actual §102(e) date.*

U.S. PUBLISHED PATENT APPLICATIONS

Examiner Initials		Document Number	Pub. Date	Name	Class	Subclass	Filing Date**
_____	D	US 2003/0216913	11/03	Keely *et al.*	704	235	05/02
_____	E	US 2003/0212961	11/03	Soin *et al.*	715	530	05/02
_____	F	US 2003/0189603	10/03	Goyal *et al.*	345	863	04/02
_____	G	US 2002/0075300	06/02	Tang *et al.*	345	744	06/01

***Provided only for applications published less than one year before applicant's earliest claimed filing date. Only effective upon issuance of the cited application as a U.S. Patent. May not be actual §102(e) date.*

OTHER ART

Examiner Initials		Author, Title, Publication Name, Pertinent Pages, Date, *etc.*
_____	H	Bellegarda, J. *et al.* Research Report RC 17312, "Automatic Recognititon of Integrated Speech and Handwriting Information," IBM Research Division, dated August 1991.
_____	I	Falcigno, K. IBM T.J. Watson Research Center Library. Email of June 29, 2004 regarding Research Report RC 17312.
_____	J	Feng, W. "Using Handwriting and Gesture Recogititon to Correct Speech Recognition Errors," from Proc. Of the 10th Int'l Conf. On Adv. Sci. & Tech., pp. 105-112, dated March 1994. (Some images blank in available copy.)
_____	K	Meyer, A. "Pen Computing: A Technology Overview and a Vision", SIGCHI Bulletin, Vol. 27, No. 3, dated July 1995.
_____	L	Starner, T. *et al.* "On-Line Cursive Handwriting Recognition Using Speech Recognition Methods," in International Conference on Acoustics, Speech and Signal .Processing, Vol. 5, pp. 125-128, 1994.

Examiner: _____ Date Considered: _____

EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance *and* not considered. Include copy of this form with next communication to applicants.

Form PTO-1449 (Modified)

List of Patents and Publications for Applicant's Information Disclosure Statement

Serial No.: 10/061,052
Applicant(s): Edwin A. Suominen
Group: 2654
Filed: January 28, 2002

OTHER ART

Examiner Initials		Author, Title, Publication Name, Pertinent Pages, Date, *etc.*
_____	M	Suhm, B. *et al.* "Model-based and Empirical Evaluation of multimodal Interactive Error Correction," CHI '99 Conference Proceedings, pp. 584-591, dated May 1999.

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Examiner: _____ Date Considered: _____

EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance *and* not considered. Include copy of this form with next communication to applicants.

CLAIMS ONLY

9-10-04

Application Number	Filing Date
10/001052	
Applicant(s)	

* May be used for additional claims or amendments

CLAIMS	AS FILED		AFTER FIRST AMENDMENT		AFTER SECOND AMENDMENT		*			*		*	
	Indep	Depend	Indep	Depend	Indep	Depend		Indep	Depend	Indep	Depend	Indep	Depend
1							51						
2							52						
3							53						
4							54						
5							55						
6							56						
7							57						
8							58						
9							59						
10							60						
11							61						
12							62	1					
13							63						
14							64						
15							65						
16							66						
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18							68						
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30							80						
31							81		1				
32							82		1				
33							83	1					
34							84		1				
35							85		1				
36							86	1					
37							87		1				
38							88		1				
39							89		1				
40							90		1				
41							91		1				
42							92		1				
43							93		1				
44							94		1				
45							95		1				
46							96		1				
47							97						
48							98						
49							99						
50							100						
Total Indep							Total Indep	3					
Total Depend							Total Depend	14					
Total Claims							Total Claims	17					

CLAIMS ONLY

SERIAL NO. 10061052 | FILING DATE

APPLICANT(S)

CLAIMS

	AS FILED		AFTER 1st AMENDMENT		AFTER 2nd AMENDMENT	
	IND.	DEP.	IND.	DEP.	IND.	DEP.
1	1					
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26		1				
27	1					
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36						
37	1					
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40						
41						
42						
43	1					
44						
45						
46						
47						
48						
49						
50						
TOTAL IND.	12					
TOTAL DEP.	68					
TOTAL CLAIMS	80					

	*		*		*	
	IND.	DEP.	IND.	DEP.	IND.	DEP.
51	1					
52						
53						
54						
55						
56						
57						
58	1		1			
59						
60						
61						
62	1		1		1	
63						
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75	1					
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81				1		1
82				1		
83			1		1	
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99						
100						
TOTAL IND.	24		4		3	
TOTAL DEP.	9		4		14	
TOTAL CLAIMS	33		8		17	

* MAY BE USED FOR ADDITIONAL CLAIMS OR AMENDMENTS

FORM PTO-2022 (1-88)

U.S.DEPARTMENT OF COMMERCE
Patent and Trademark Office

*U.S. Government Printing Office: 1998 - 433-214/70060

Shelly Cpc 9-10-04

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
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P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

BIBDATASHEET

Bib Data Sheet

CONFIRMATION NO. 5352

SERIAL NUMBER	FILING OR 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
10/061,052	01/28/2002 RULE	704	2654	

APPLICANTS

Edwin A. Suominen, Valley, WA;

**** CONTINUING DATA **********

This application is a CON of 09/616,157 07/14/2000 ABN which claims benefit of 60/144,481 07/17/1999

**** FOREIGN APPLICATIONS **********

IF REQUIRED, FOREIGN FILING LICENSE GRANTED ** SMALL ENTITY **
** 04/01/2002

Foreign Priority claimed	35 USC 119 (a-d) conditions met	Verified and Acknowledged	STATE OR COUNTRY	SHEETS DRAWING	TOTAL CLAIMS	INDEPENDENT CLAIMS
☐ yes ☐ no	☐ yes ☐ no ☐ Met after Allowance	Examiner's Signature Initials	WA	17	7	4

ADDRESS

Edwin A. Suominen
Suite 300
14614 North Kierland Boulevard
Scottsdale ,AR 85254

TITLE

MESSAGE RECOGNITION USING SHARED LANGUAGE MODEL

FILING FEE RECEIVED	FEES: Authority has been given in Paper	
370	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

PTO/SB/06 (08-03)
Approved for use through 7/31/2006. OMB 0651-0032
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 displays a valid OMB control number.

PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number: 10/861,052

CLAIMS 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))				$____	OR		$____
TOTAL CLAIMS (37 CFR 1.16(c))	minus 20 =	*	X $____ =		OR	X $____ =	
INDEPENDENT CLAIMS (37 CFR 1.16(b))	minus 3 =	*	X $____ =		OR	X $____ =	
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(d))			+ $____ =		OR	+ $____ =	
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL		OR	TOTAL	

CLAIMS AS AMENDED – PART II

9-10-04

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(c))	* 17	Minus	** 20	=	X $____ =		OR	X $____ =	
Independent (37 CFR 1.16(b))	* 3	Minus	*** 12	=	X $____ =		OR	X $____ =	
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(d))					+ $____ =		OR	+ $____ =	
					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(c))	*	Minus	**	=	X $____ =		OR	X $____ =	
Independent (37 CFR 1.16(b))	*	Minus	***	=	X $____ =		OR	X $____ =	
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(d))					+ $____ =		OR	+ $____ =	
					TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

AMENDMENT C	(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(c))	*	Minus	**	=	X $____ =		OR	X $____ =	
Independent (37 CFR 1.16(b))	*	Minus	***	=	X $____ =		OR	X $____ =	
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(d))					+ $____ =		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.

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.

PATENT APPLICATION FEE DETERMINATION RECORD
Effective October 1, 2001

Application or Docket Number: 10/061052

CLAIMS AS FILED - PART I

	(Column 1)	(Column 2)
TOTAL CLAIMS	2	
FOR	NUMBER FILED	NUMBER EXTRA
TOTAL CHARGEABLE CLAIMS	20 minus 20=	* 0
INDEPENDENT CLAIMS	12 minus 3 =	* 0
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	370.00	OR	BASIC FEE	740.00
X$ 9=		OR	X$18=	
X42=		OR	X84=	
+140=		OR	+280=	
TOTAL	370	OR	TOTAL	

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	* 98	Minus	** 80	=
Independent	* 04	Minus	*** 12	=
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	* 8	Minus	** 80	=
Independent	* 4	Minus	*** 12	=
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	* 17	Minus	** 80	=
Independent	* 3	Minus	*** 12	=
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. 8/01)

☆U.S. GPO: 2001 482-124 / 59197

Patent and Trademark Office, U.S. DEPARTMENT OF COMMERCE

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/061,052	01/28/2002	Edwin A. Suominen		5352

7590 06/10/2004

Edwin A. Suominen
Suite 300
14614 North Kierland Boulevard
Scottsdale, AR 85254

EXAMINER	
NOLAN, DANIEL A	

ART UNIT	PAPER NUMBER
2654	16

DATE MAILED: 06/10/2004

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

PTO-90C (Rev. 10/03)

Office Action Summary	Application No.	Applicant(s)	
	10/061,052	SUOMINEN, EDWIN A.	
	Examiner	Art Unit	
	Daniel A. Nolan	2654	

-- 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) 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 the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- 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 *28 January 2002*.

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) *62 and 81-96* is/are pending in the application.

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

5)☒ Claim(s) *62 and 81-96* is/are allowed.

6)☐ Claim(s) _____ 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 *28 January 2002* 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-1449 or PTO/SB/08) Paper No(s)/Mail Date *5, 9*.
4) ☒ Interview Summary (PTO-413) Paper No(s)/Mail Date. *10*.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Response to Amendment

1. The amendments filed 28 January 2002, 05 August 2002 and 28 April 2004 were filed with the following effect:

- Claims 1-61 and 63-80 were cancelled.
- Claims 81-96 were added.

Information Disclosure Statement

2. The information disclosure statement filed 05 August 2002 fails to comply with 37 CFR 1.98(a)(2), which requires a legible copy of each U.S. and foreign patent; each publication or that portion which caused it to be listed; and all other information or that portion which caused it to be listed. It has been placed in the application file, but the information referred to therein has not been considered.

3. The listing of references in the specification is not a proper information disclosure statement (as, from the 2nd paragraph of the 1st page to the 2nd paragraph page 6, last full paragraphs on pages 14 & 16, etc.). 37 CFR 1.98(b) requires a list of all patents, publications, or other information submitted for consideration by the Office, and MPEP § 609 A(1) states, "the list may not be incorporated into the specification but must be

submitted in a separate paper." Therefore, unless the references have been cited by the examiner on form PTO-892, they have not been considered.

Specification

4. The lengthy specification has not been checked to the extent necessary to determine the presence of all possible minor errors. Applicant's cooperation is requested in correcting any errors of which applicant may become aware in the specification, such as:

- The term "model model" (line 18 page 38) should be "model".
- The terms "a shared" and "the shared" (claims 83 and 86, features (a) and (b), respectively) should be "said shared" for precision and to avoid problems of misunderstanding.

5. The title of the invention is not descriptive. A new title is required that is clearly indicative of the invention to which the claims are directed.

The following title is suggested: "*Recognition with Multiple Input Modes, Each Using Both Specific and Shared Language Models with Unlike Mode for Correction*".

6. The use of the trademarks such as "Naturally Speaking®", "Roentgen™" and "Gyricon™" and the like (lines 20-21 page 21 and lines 24 & 29 page 34 etc.) are noted

in this application. Trademarks and such property should be capitalized wherever they appear and be accompanied by the generic terminology.

Although the use of trademarks is permissible in patent applications, the proprietary nature of the marks should be respected and every effort made to prevent their use in any manner which might adversely affect their validity as trademarks.

Allowable Subject Matter

7. Claims 62 and 81-96 are allowed.

8. The present invention is directed to recognition of speech, writing, etc. using both device-specific and shared models, and using a different input mode for correcting.

- Claims 62, 83 and 86 identifies the uniquely distinct feature "*responsive to message input of a 1st type and a 2nd type, the 1st message recognizer in accordance with both the shared language model and the 1st model; and a 2nd message recognizer in accordance with both the shared language model and the 2nd model; where the shared language model is trainable responsive to user correction of misrecognition by either of the recognizers, improving accuracy of each.*
- The closest prior art, Qin *et al*, discloses *a shared language model* (column 3 lines 47-48); *(2) a 1st model specific to a 1st type of message recognition* (column 3 lines 32 & 40); *and (3) a 2nd model specific to a 2nd type of message recognition* (column 3 line 46); where *(d) the shared language model is trainable responsive to user*

correction of misrecognition by either of the 1st and 2nd message recognizers, thereby improving accuracy of each of the 1st and 2nd message recognizers (column 6 lines 10-14 – see column 1 line 62 thru column 2 line 2) but fails to anticipate or render the above underlined limitations obvious.

- Claims 81-82, 84-85 and 87-96 depend on claims that were allowed.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

9. As allowable subject matter has been indicated, applicant's reply must either comply with all formal requirements or specifically traverse each requirement not complied with. See 37 CFR 1.111(b) and MPEP § 707.07(a).

Conclusion

10. This application is in condition for allowance except for the following formal matters:

- The title must be changed to be more descriptive.
- The cited issues with the Specification must be remedied.
- Those formalities noted without exception to the claims must be considered.

Prosecution on the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

A shortened statutory period for reply to this action is set to expire **TWO MONTHS** from the mailing date of this letter.

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

- Qin *et al* (U.S. Patent 6,513,005) for correcting error characters in result of speech recognition by recognizing input based on character-shape, displaying candidate characters and selecting desired characters from candidate characters by user.
- Reynar *et al* (U.S. Patent 6,446,051) playback of a multiple-source written document on a display computer can visualize a text portion and audio dictation.
- Bellegarda *et al* (U.S. Patent 5,502,774 A) consistent message into computer recognizable message transformation method using automatic recognizer device which accepts multiple sources of information, and multiple input interface coupling display terminal to digital or analog transformation raw data input
- Bellegarda *et al* (U.S. Patent 5, 621,809 A) computerized multiple information source identity recognition system includes program modules to transform human generated messages into signal allowing derivation of weighting coefficient for formats.

Waibel *et al* (U.S. Patent 5,855,000 A) speech recognition engine output correction

method involves generating repair hypothesis for error located from secondary input signal including paraphrasing of a portion of utterance.

- Ditzik (U.S. Patent 6,167,376 A) writing and speech recognition for computer system involves converting input handwriting data into text/graphic and identifying matching speech & text, displayed with recognition errors.
- Sidoroff *et al* (U.S. Patent 6,292,857 B) coordinating input of asynchronous data for user input to computing system e.g. for pen input placing messages corresponding to user input information into message queue, differentiating between real-time messages such as handwritten data and ordered message such as cursor moves.
- Ditzik (U.S. Patent 6,415,256 B) handwriting and speech recognition program for computer telephony application has instructions for relating computer recognizable speech and handwriting data.
- Oberteuffer *et al* (U.S. Patent 6,438,523 B) integrated speech and hand-drawn input recognition method for computer systems.
- Snyder *et al* ("Low-Power Software For Low-Power People", Low Power Electronics, 1994. Digest of Technical Papers., IEEE Symposium, October 1994) portable terminals interact with the user via speech synthesis, automatic speech recognition, and handwriting recognition includes the development of hardware platforms, operating system (OS) and application software; and the adaptation of signal processing algorithms to these systems.
- Hunsinger *et al* ("A Speech Understanding Module For A Multimodal Mathematical Formula Editor", Acoustics, Speech, and Signal Processing, IEEE International

Conference on, June 2000) editor will support natural speech and handwriting interaction based on a multilevel statistical, expectation driven approach. Completely spoken realistic formulas as the basis for a multimodal semantic decoder incorporating combined script and speech analysis will enclose a multimodal probabilistic grammar.

- Vo *et al* ("Building an application framework for speech and pen input integration in multimodal learning interface", Acoustics, Speech, and Signal Processing, ICASSP-96. Conference Proceedings, May 1996) multimodal interface capable of jointly interpreting speech, pen-based gestures, and handwriting in dialog processing.
- Myers *et al* ("Flexi-modal and multi-machine user interfaces", Multimodal Interfaces, Proceedings. Fourth IEEE International Conference on, October 2002) allows multiple, geographically dispersed participants to simultaneously and flexibly mix different modalities using the right interface at the right time on one or more machines integrated in the system architecture.

12. Any inquiry concerning this communication or earlier communications from the Examiner should be directed to Daniel A. Nolan at telephone (703)305-1368 whose normal business hours are 7AM-5PM, Mon-Tue & Thu-Fri.

If attempts to contact the examiner by telephone are unsuccessful, supervisor Richemond Dorvil can be reached at (703)305-9645.

The fax phone number for Technology Center 2600 is (703)872-9314. Label informal and draft communications as “DRAFT” or “PROPOSED”, & designate formal

communications as "EXPEDITED PROCEDURE". Formal response to this action may be faxed according to the above instructions,

or mailed to:

P.O. Box 1450
Alexandria, VA 22313-1450

or hand-deliver to: Crystal Park 2,
2121 Crystal Drive, Arlington, VA,
Sixth Floor (Receptionist).

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to Technology Center 2600 Customer Service Office at telephone number (703)306-03776-0377.

Daniel A. Nolan
Examiner
Art Unit 265454

DAN/d
June 1, 2004

RICHEMOND DORVIL
SUPERVISORY PATENT EXAMINER

Notice of References Cited	Application/Control No. 10/061,052	Applicant(s)/Patent Under Reexamination SUOMINEN, EDWIN A.	
	Examiner Daniel A. Nolan	Art Unit 2654	Page 1 of 2

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
	A	US-5,502,774 A	03-1996	Bellegarda et al.	704/231
	B	US-5,621,809 A	04-1997	Bellegarda et al.	704/251
	C	US-5,855,000 A	12-1998	Waibel et al.	704/235
	D	US-6,167,376 A	12-2000	Ditzik, Richard Joseph	704/235
	E	US-6,292,857 B1	09-2001	Sidoroff et al.	704/231
	F	US-6,415,256 B1	07-2002	Ditzik, Richard Joseph	704/231
	G	US-6,438,523 B1	08-2002	Oberteuffer et al.	704/270
	H	US-6,513,005 B1	01-2003	Qin et al.	704/254
	I	US-6,446,041 B1	09-2002	Reynar et al.	704/260
	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	Snyder et al ("Low-power software for low-power people", Low Power Electronics, Digest of Technical Papers., IEEE Symposium October 1994)
	V	Hunsinger et al ("A speech understanding module for a multimodal mathematical formula editor", Acoustics, Speech, and Sign Processing, June 2000)
	W	Lin et al ("A recursively structured solution for handwriting and speech recognition", Multimedia Signal Processing, IEEE First Workshop on, June 1997)
	X	Vo et al ("Building an application framework for speech and pen input integration in multimodal learning interface", Acoustics, Speech, and Signal Processing, ICASSP-96. Conference Proceedings, May 1996)

*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.

Notice of References Cited	Application/Control No. 09/820,865	Applicant(s)/Patent Under Reexamination KORALL ET AL.	
	Examiner Daniel A. Nolan	Art Unit 2654	Page 2 of 2

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
	A	US-			
	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	Myers et al, ("Flexi-modal and multi-machine user interfaces", Multimodal Interfaces, Proceedings. Fourth IEEE International Conference on, October 2002)
	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.

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Form PTO-1449 (Modified)

List of Patents and Publications For Applicant's Information Disclosure Statement

Serial No.: 10/061,052

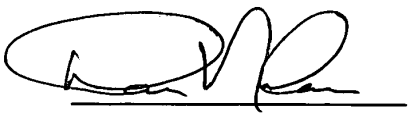
Applicant: Edwin A. Suominen

Filed: January 28, 2002 Group: 2641

U.S. PATENT DOCUMENTS

Examiner Initials		Document Number	Issue/Pub Date	Name	Class	Subclass	Filing Date*
DAN	A	6,285,785	09/04/01	Bellegarda, et al.	382	187	03/28/91
	B	5,946,499	08/31/99	Saunders	395	893	05/10/96
	C	5,937,422	08/10/99	Nelson et al.	707	531	04/15/97
	D	5,920,837	07/06/99	Gould et al.	704	251	06/26/97
	E	5,917,942	06/29/99	Ehsani et al.	382	189	12/28/95
	F	5,899,976	05/04/99	Rozak	704	270	10/31/96
	G	5,870,706	02/09/99	Alshawi	704	255	04/10/96
	H	5,870,492	02/09/99	Shimizu et al.	382	187	06/04/92
	I	5,855,000	12/29/98	Waibel et al.	704	235	10/01/96
	J	5,839,106	11/17/98	Bellegarda	704	257	12/17/96
	K	5,787,455	07/28/98	Seybold	711	100	12/28/95
	L	5,740,364	04/14/98	Drerup	395	200.09	
	M	5,682,439	10/28/97	Beernink et al.	382	187	
	N	5,666,438	09/09/97	Beernink et al.	382	189	
	O	5,594,640	01/14/97	Capps et al.	395	794	
	P	5,587,559	12/24/96	Fleck et al.	178	18	
	Q	5,581,783	12/03/96	Ohashi	395	825	
	R	5,574,804	11/12/96	Olschafskie et al.	382	313	
	S	5,546,565	08/13/96	Suzuki	395	500	
	T	5,546,538	08/13/96	Cobbley et al.	395	200.01	
	U	5,502,774	03/26/96	Bellegarda et al.	382	159	
	V	5,467,102	11/14/95	Kuno et al.	345	1	
	W	5,434,777	07/18/95	Luciw	364	419.13	
	X	5,425,129	06/13/95	Garman et al.	395	2.65	
	Y	5,150,424	09/22/92	Aguro et al.	382	13	
	Z	5,049,862	09/17/91	Dao et al.	340	706	
	AA	4,969,180	11/06/90	Watterson et al.	379	58	

* Document's earliest claimed priority date, provided only for patents issued within one year of applicant's July 17, 1999 provisional application filing date.

Examiner:  Date Considered: 31 May '04

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List of Patents and Publications For Applicant's Information Disclosure Statement

Serial No.: 10/061,052

Applicant: Edwin A. Suominen

Filed: January 28, 2002 Group: 2641

FOREIGN PATENT DOCUMENTS

Examiner Initials		Document Number	Date*	Country	Class	Subclass	Translation Yes / No
DAN	BB	WO 01/82127	11/01/01	PCT	G06F	17/28	
	CC	WO 95/25236	09/21/95	PCT	G10L	9/00	
	DD	EP 0 622 724	04/15/94	EPO	G06F	3/033	No Copy

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	EE	H. Ney and Ortmanns, "Dynamic Programming Search for Continuous Speech Recognition," IEEE Signal Processing Magazine, September 1999, pp. 64-83.
	FF	N. Deshmukh,et al, "Hierarchical Search for Large-Vocabulary Conversational Speech Recognition," IEEE Signal Processing Magazine, September 1999, pp. 84-107.
	GG	Advanced Recognition Technologies, Inc, Web page printed 1999 from **www.artcomp.com**.
	HH	Advanced Recognition Technologies, Inc, "Voice and Handwriting Recognition Software For Windows CE Palm-Size PCs," dated 1999.
	II	F. Walls, et al., "Probabilistic Models For Topic Detection And Tracking," in Proc. ICASSP-99, vol. 1, pp. 521-524, Phoenix, AZ, March 1999.
	JJ	R. Blasig, "Combination of Words and Word Categories in Varigram Histories," in Proc. ICASSP-99, vol. 1, pp. 529-532, Phoenix, AZ, March 1999.
	KK	C. Samuelsson and W. Reichl, "A Class-Based Language Model for Large-Vocabulary Speech Recognition Extracted From Part-of-Speech Statistics," in Proc. ICASSP-99, vol. 1, pp. 537-540, Phoenix, AZ, March 1999.
	LL	M. Mahajan, et al., "Improved Topic-Dependent Language Modeling Using Information Retrieval Techniques," in Proc. ICASSP-99, vol. 1, pp. 541-544, Phoenix, AZ, March 1999.

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List of Patents and Publications For Applicant's Information Disclosure Statement

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Applicant: Edwin A. Suominen

Filed: January 28, 2002 Group: 2641

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NN	E. Lee, "SAR-made Program Records Language as Text From Voice Input; System Helps PCs Recognise Cantonese," South China Morning Post Ltd., December 8, 1998.
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PP	Product Description, "Speech Mike Pro LFH 6184 with integrated Barcode reader," 1998.
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SS	S. Clergeau-Tournemire and R. Plamondon, "Integration of Lexical and Syntactical Knowledge in a Handwriting-Recognition System," Machine Vision and Applications, pp. 249-259, 1995.
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VV	J. Picone, et al., "Automated Speech Understanding: The Next Generation," Digital Signal Processing Technology, vol. CR57, pp. 101-114, 1995.
WW	"Integrated Pen and Microphone," IBM Technical Disclosure Bulletin, March 1995, pp. 125-6 (Abstract only).
XX	F. Olsen, "Voice Recognition for the PC Pushes Beyond Old Barriers," Government Computer News, November 7, 1994, p. 42.
YY	E. Woollacott, "Take a Letter, Computer," The Times, June 24, 1994.
ZZ	N. Boudette, "Portables Raise their Voices," PC Week, February 14, 1994, p. 1.
AAA	L. Binda, "IBM Aims To Bypass its Competition with New Multimedia Power PC Line," Computer Reseller News, 1994 (pp.9-10 of 10)
BBB	C. Schmandt, et al., "From Desktop Audio to Mobile Access," in Advances in Human-Computer Interaction, vol. 4, pp. 251-53, 256-283 (1993).

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Examiner: [signature] Date Considered: 31 May '04

EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance *and* not considered. Include copy of this form with next communication to applicants.

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List of Patents and Publications For Applicant's Information Disclosure Statement

Serial No.: 10/061,052

Applicant: Edwin A. Suominen

Filed: January 28, 2002 Group: 2641

OTHER ART

CCC	"Improved 'Added Word' User Interface Using Integrated Automatic Speech and Handwriting Recognition," IBM Technical Disclosure Bulletin, pp. 135-137, February 1993.
DDD	"Constructing Models for Command Word Spotting in Isolated Speech," IBM Technical Disclosure Bulletin, January 1993, p. 412.
EEE	H. Crane and D. Rtischev, "Pen and Voice Unite," Byte Magazine, October 1993, p. 98.
FFF	"Automatic Handwriting Recognition Enhancement Based on Syntactic and Semantic Cues," IBM Technical Disclosure Bulletin, pp. 463-465, June 1993.
GGG	"Decoding of a Consistent Message Using Both Speech and Handwriting Recognition," IBM Technical Disclosure Bulletin, pp. 415-418, January 1993.
HHH	"Pen-Mounted Microphone for Pen-And-Tablet Computers," IBM Technical Disclosure Bulletin, pp. 49-51, June 1992.
III	G. Talsky, "Inside Pen Computing," Windows Magazine, 1992, p. 130.
JJJ	N. Baran, "The Future of Pen Computing, Part 2," Byte Magazine, April 1992, p. 98.
KKK	M. Weiser, "The Computer for the 21st Century," Scientific American, September 1991, pp. 933-940.
LLL	J. Picone, "Next Generation Voice Recognition Systems Will Be Customer Programmable," Texas Instruments Technical Article, December 19, 1991.
MM M	R. Bakis and A. Cole, "Dynamic Modification of the Vocabulary of a Speech Recognition Machine," IBM Technical Disclosure Bulletin, pp. 3945-3946, December 1984.
NNN	F. Mims, "A Few Quick Pointers; Mouses, Touch Screens, Touch Pads, Light Pads, and the like can make your system easier to use," Computers & Electronics, May 1984, pp. 3-9 of 10-page DIALOG printout.
OOO	Pages 469-477 of book chapter entitled "Touch, Gesture, and Marking."
PPP	D. Goldberg and A. Goodisman, "Stylus User Interfaces for Manipulating Text."
QQQ	J. Makhoul and R. Schwartz, "State of the Art in Continuous Speech Recognition."
RRR	F. Weng, et al., "A Study of Multilingual Speech Recognition."

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Examiner: _____ Date Considered: 31 May '04

EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance *and* not considered. Include copy of this form with next communication to applicants.

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List of Patents and Publications for Applicant's Information Disclosure Statement

Serial No.: 10/061,052
Applicant(s): Edwin A. Suominen
Group: 2641
Filed: January 28, 2002

U.S. PATENT DOCUMENTS

Examiner Initials		Document Number	Date	Name	Class	Subclass	Filing Date*
DAN	A	6,513,005	01/03	Qin et al.	704	254	07/00
	B	6,456,975	09/02	Chang	704	270.1	01/00
	C	6,167,376	12/00	Ditzik	704	235	12/98
	D	6,154,722	11/00	Bellegarda	704	257	12/97
	E	5,991,726	11/99	Immarco et al.	704	270	05/97
	F	5,850,058	12/98	Tano et al.	178	18.01	11/96
	G	5,828,999	10/98	Bellegarda et al.	704	240	05/96
	H	5,818,949	10/98	Deremer et al.	381	172	11/96
	I	5,694,150	12/97	Sigona et al.	345	145	
	J	5,349,139	09/94	Verrier et al.	178	19	

**Provided only for patents issued less than one year before applicant's earliest claimed filing date. May not be actual §102(e) date.*

U.S. PUBLISHED PATENT APPLICATIONS

Examiner Initials		Document Number	Pub. Date	Name	Class	Subclass	Filing Date**
DAN	K	US 2003/0233237	12/03	Garside et al.	704	270	06/02
DAN	L	US 2002/0178008	11/02	Reynar	704	272	04/01

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DAN	M	A. EL-Yacoubi, et al., "An HMM-Based Approach for Off-Line Unconstrained Handwritten Word Modeling and Recognition," IEEE Transactions on Pattern Analysis and Machine Intellgence, Vol. 21, No. 8, August 1999.

Examiner:  Date Considered: 31 May 04

EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance *and* not considered. Include copy of this form with next communication to applicants.

L Number	Hits	Search Text	DB	Time stamp
1	9	(US-6513005-$ or US-6446041-$ or US-6438523-$ or US-6415256-$ or US-6292857-$ or US-6167376-$ or US-5855000-$ or US-5621809-$ or US-5502774-$).did.	USPAT	2004/06/01 11:28
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-	835	(voice speech) adj recogni$6 same handwrit$4	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 07:40
-	650	(voice speech) adj recogni$6 with handwrit$4	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 07:40
-	54	(6,285,785 5,946,499 5,937,422 5,920,837 5,917,942 5,899,976 5,870,706 5,870,492 5,855,000 5,839,106 5,787,455 5,740,364 5,682,439 5,666,438 5,594,640 5,587,559 5,581,783 5,574,804 5,546,565 5,546,538 5,502,774 5,467,102 5,434,777 5,425,129 5,150,424 5,049,862 4,969,180).pn.	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 07:40
-	1	10/061,052	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 07:40
-	63	(US-5638425-$ or US-6240448-$ or US-6138100-$ or US-6052657-$ or US-6005860-$ or US-5937168-$ or US-5650799-$ or US-5625814-$ or US-5608624-$ or US-5559940-$ or US-5500920-$ or US-5434777-$ or US-5265014-$ or US-4612416-$ or US-6609091-$ or US-4579533-$ or US-5625748-$ or US-6446041-$ or US-4406626-$ or US-5999595-$ or US-5956706-$ or US-5878423-$ or US-6581055-$ or US-6513005-$ or US-6438523-$ or US-6415256-$).did. or (US-6292857-$ or US-6167376-$ or US-5855000-$ or US-5621809-$ or US-5502774-$).did. or (US-5638425-$ or EP-892540-$).did.	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 07:40
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-	94	(("5454063" "5502774" "5621809" "6092043" "6101468" "5625748" "5956683" "6012030" "6018711" "6185535" "4348550" "4454586" RE32012 "6519479" "5479488" "5495553" "5475791" "4864623" "6563911" "5806031" "6594628" "6285786" "6216104" "6216104" "5615296" "6208959" "5890123" "5960394" "5995918" "5212821" "5632002" "5765131" "5937385" "6023697" "6175819" "6219638" "6219638" "6233559" "5850627" "6073097" "6085160" "5758319" "6163767" "6185530" "4922538" "5475792" "5778342" "6249765" "6240391" "6323846").pn.) and (@ad @pd @prad)<=20020128	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 07:45
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-	10	(((6,285,785 5,946,499 5,937,422 5,920,837 5,917,942 5,899,976 5,870,706 5,870,492 5,855,000 5,839,106 5,787,455 5,740,364 5,682,439 5,666,438 5,594,640 5,587,559 5,581,783 5,574,804 5,546,565 5,546,538 5,502,774 5,467,102 5,434,777 5,425,129 5,150,424 5,049,862 4,969,180).pn.) (704/231-257.ccls. and (@ad @pd @prad)<=20020128 and ((voice speech) adj recogni$6 with handwrit$4)) (("5454063" "5502774" "5621809" "6092043" "6101468" "5625748" "5956683" "6012030" "6018711" "6185535" "4348550" "4454586" RE32012 "6519479" "5479488" "5495553" "5475791" "4864623" "6563911" "5806031" "6594628" "6285786" "6216104" "6216104" "5615296" "6208959" "5890123" "5960394" "5995918" "5212821" "5632002" "5765131" "5937385" "6023697" "6175819" "6219638" "6219638" "6233559" "5850627" "6073097" "6085160" "5758319" "6163767" "6185530" "4922538" "5475792" "5778342" "6249765" "6240391" "6323846").pn.)) and (shar$4 common) same language with model$4	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 08:07

L Number	Hits	Search Text	DB	Time stamp
7	105	("6377296" "5265014" "6240448" "6473734" "6601026" "6292830" "6003070" "5999595" "5937422" "5937168" "6005860" "6067516" "6434547" "5802314" "5500920" "5956681" "6052657" "5418951" "5434777" "5608624" "5625814" "5708829" "5748841" "5918222" "5970460" "5991712" "6073095" "6298326" "6345252" "6345253" "6363380" "6377927" "6434524" "6532444" "6584179" "6615172" "5559940" "6014377" "6366299" "6138100" "6272495" "6397329" "4612416" "6094649" "6169985" "6353831" "6424980" "6456308" "5650799" "5832474").pn.	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:22
20	12	(((((5638425.pn. (("6377296" "5265014" "6240448" "6473734" "6601026" "6292830" "6003070" "5999595" "5937422" "5937168" "6005860" "6067516" "6434547" "5802314" "5500920" "5956681" "6052657" "5418951" "5434777" "5608624" "5625814" "5708829" "5748841" "5918222" "5970460" "5991712" "6073095" "6298326" "6345252" "6345253" "6363380" "6377927" "6434524" "6532444" "6584179" "6615172" "5559940" "6014377" "6366299" "6138100" "6272495" "6397329" "4612416" "6094649" "6169985" "6353831" "6424980" "6456308" "5650799" "5832474").pn.)) and @ad<=20010330) and (query or sql) with (db or data adj base or database)) and (voice or speech or acoustic$4 or audible or audio)) and (voice or speech or acoustic$4 or audible or audio) with (text$4 or graphic$4 or written or writing or key or keyboard or mouse)) and prompt	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:23
24	23	(((((5638425.pn. (("6377296" "5265014" "6240448" "6473734" "6601026" "6292830" "6003070" "5999595" "5937422" "5937168" "6005860" "6067516" "6434547" "5802314" "5500920" "5956681" "6052657" "5418951" "5434777" "5608624" "5625814" "5708829" "5748841" "5918222" "5970460" "5991712" "6073095" "6298326" "6345252" "6345253" "6363380" "6377927" "6434524" "6532444" "6584179" "6615172" "5559940" "6014377" "6366299" "6138100" "6272495" "6397329" "4612416" "6094649" "6169985" "6353831" "6424980" "6456308" "5650799" "5832474").pn.)) and @ad<=20010330) and (query or sql) with (db or data adj base or database)) and (voice or speech or acoustic$4 or audible or audio)) and (voice or speech or acoustic$4 or audible or audio) with (text$4 or graphic$4 or written or writing or key or keyboard or mouse)) and search	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:23
42	140	704/.ccls. and speech with text with (conver$4 or recogni$6) and speech with phoneme with (conver$4 or recogni$6)	USPAT	2004/06/01 13:24
49	13	((US-5638425-$ or US-6240448-$ or US-6138100-$ or US-6052657-$ or US-5625814-$ or US-5608624-$ or US-5559940-$ or US-5500920-$ or US-5434777-$ or US-5265014-$ or US-6609091-$ or US-5625748-$ or US-4579533-$ or US-4406626-$).did.) and (out output$8)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:25
50	4	((US-5638425-$ or US-6240448-$ or US-6138100-$ or US-6052657-$ or US-5625814-$ or US-5608624-$ or US-5559940-$ or US-5500920-$ or US-5434777-$ or US-5265014-$ or US-6609091-$ or US-5625748-$ or US-4579533-$ or US-4406626-$).did.) and (out output$8) with (speech and text)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:25
60	411	704/.ccls. and (WAP SMS)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:25
61	157	(704/.ccls. and (WAP SMS)) and (((speech or voice) adj recogni$6) and (WAP SMS))	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:26

63	1663	((speech or voice) adj recogni$6) and (WAP "SMS")	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:26
64	1393	((speech or voice) adj recogni$6) and (WAP "SMS")	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:26
88	10	((5638425.pn. (("6377296" "5265014" "6240448" "6473734" "6601026" "6292830" "6003070" "5999595" "5937422" "5937168" "6005860" "6067516" "6434547" "5802314" "5500920" "5956681" "6052657" "5418951" "5434777" "5608624" "5625814" "5708829" "5748841" "5918222" "5970460" "5991712" "6073095" "6298326" "6345252" "6345253" "6363380" "6377927" "6434524" "6532444" "6584179" "6615172" "5559940" "6014377" "6366299" "6138100" "6272495" "6397329" "4612416" "6094649" "6169985" "6353831" "6424980" "6456308" "5650799" "5832474").pn.)) and @ad<=20010330) and (message or mail) with (id or identification or caller)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:28
99	31	(variable or vary$4) adj number with (query or question) same (data$4 index field)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:29
108	152	(database or base) same (number quantity amount volume) with (query$4 prompt$4 question$4 return response interrogat$4) same (threshold limit) and stop with (operation or process)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:30
107	145	((database or base) same (number quantity amount volume) with (query$4 prompt$4 question$4 return response interrogat$4) same (threshold limit) and stop with (operation or process)) not ((data$4 same (number quantity amount volume) with (query$4 prompt$4 question$4 interrogat$4) same (threshold limit)) and (voice speech) adj recogni$6)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:30
118	37	(((US-5638425-$ or US-6240448-$ or US-6138100-$ or US-6052657-$ or US-5625814-$ or US-5608624-$ or US-5559940-$ or US-5500920-$ or US-5434777-$ or US-5265014-$ or US-6609091-$ or US-5625748-$ or US-4579533-$ or US-4406626-$).did.) ((5638425.pn. (("6377296" "5265014" "6240448" "6473734" "6601026" "6292830" "6003070" "5999595" "5937422" "5937168" "6005860" "6067516" "6434547" "5802314" "5500920" "5956681" "6052657" "5418951" "5434777" "5608624" "5625814" "5708829" "5748841" "5918222" "5970460" "5991712" "6073095" "6298326" "6345252" "6345253" "6363380" "6377927" "6434524" "6532444" "6584179" "6615172" "5559940" "6014377" "6366299" "6138100" "6272495" "6397329" "4612416" "6094649" "6169985" "6353831" "6424980" "6456308" "5650799" "5832474").pn.)) and @ad<=20010330)) and (map video photograph)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:31

126	63	(((5638425.pn. (("6377296" "5265014" "6240448" "6473734" "6601026" "6292830" "6003070" "5999595" "5937422" "5937168" "6005860" "6067516" "6434547" "5802314" "5500920" "5956681" "6052657" "5418951" "5434777" "5608624" "5625814" "5708829" "5748841" "5918222" "5970460" "5991712" "6073095" "6298326" "6345252" "6345253" "6363380" "6377927" "6434524" "6532444" "6584179" "6615172" "5559940" "6014377" "6366299" "6138100" "6272495" "6397329" "4612416" "6094649" "6169985" "6353831" "6424980" "6456308" "5650799" "5832474").pn.)) and @ad<=20010330) ((US-5638425-$ or US-6240448-$ or US-6138100-$ or US-6052657-$ or US-6005860-$ or US-5937168-$ or US-5650799-$ or US-5625814-$ or US-5608624-$ or US-5559940-$ or US-5500920-$ or US-5434777-$ or US-5265014-$ or US-4612416-$ or US-6609091-$ or US-5625748-$ or US-4579533-$ or US-4406626-$ or US-5999595-$ or US-6581055-$ or US-5956706-$ or US-5878423-$).did. or (EP-892540-$).did.)) and (location address)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:32
135	58	(((5638425.pn. (("6377296" "5265014" "6240448" "6473734" "6601026" "6292830" "6003070" "5999595" "5937422" "5937168" "6005860" "6067516" "6434547" "5802314" "5500920" "5956681" "6052657" "5418951" "5434777" "5608624" "5625814" "5708829" "5748841" "5918222" "5970460" "5991712" "6073095" "6298326" "6345252" "6345253" "6363380" "6377927" "6434524" "6532444" "6584179" "6615172" "5559940" "6014377" "6366299" "6138100" "6272495" "6397329" "4612416" "6094649" "6169985" "6353831" "6424980" "6456308" "5650799" "5832474").pn.)) and @ad<=20010330) ((US-5638425-$ or US-6240448-$ or US-6138100-$ or US-6052657-$ or US-6005860-$ or US-5937168-$ or US-5650799-$ or US-5625814-$ or US-5608624-$ or US-5559940-$ or US-5500920-$ or US-5434777-$ or US-5265014-$ or US-4612416-$ or US-6609091-$ or US-5625748-$ or US-4579533-$ or US-4406626-$ or US-5999595-$ or US-6581055-$ or US-5956706-$ or US-5878423-$).did. or (EP-892540-$).did.)) and language	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:32
4	1	09/820,865	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:33
5	2	09/836,165 09/840,005	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:33
6	2	5638425.pn.	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:33
8	57	((5638425.pn. (("6377296" "5265014" "6240448" "6473734" "6601026" "6292830" "6003070" "5999595" "5937422" "5937168" "6005860" "6067516" "6434547" "5802314" "5500920" "5956681" "6052657" "5418951" "5434777" "5608624" "5625814" "5708829" "5748841" "5918222" "5970460" "5991712" "6073095" "6298326" "6345252" "6345253" "6363380" "6377927" "6434524" "6532444" "6584179" "6615172" "5559940" "6014377" "6366299" "6138100" "6272495" "6397329" "4612416" "6094649" "6169985" "6353831" "6424980" "6456308" "5650799" "5832474").pn.)) and @ad<=20010330) and (query or sql)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:33

9	43	((5638425.pn. (("6377296" "5265014" "6240448" "6473734" "6601026" "6292830" "6003070" "5999595" "5937422" "5937168" "6005860" "6067516" "6434547" "5802314" "5500920" "5956681" "6052657" "5418951" "5434777" "5608624" "5625814" "5708829" "5748841" "5918222" "5970460" "5991712" "6073095" "6298326" "6345252" "6345253" "6363380" "6377927" "6434524" "6532444" "6584179" "6615172" "5559940" "6014377" "6366299" "6138100" "6272495" "6397329" "4612416" "6094649" "6169985" "6353831" "6424980" "6456308" "5650799" "5832474").pn.)) and @ad<=20010330) and (query or sql) with (db or data adj base or database)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:33
10	28	(((5638425.pn. (("6377296" "5265014" "6240448" "6473734" "6601026" "6292830" "6003070" "5999595" "5937422" "5937168" "6005860" "6067516" "6434547" "5802314" "5500920" "5956681" "6052657" "5418951" "5434777" "5608624" "5625814" "5708829" "5748841" "5918222" "5970460" "5991712" "6073095" "6298326" "6345252" "6345253" "6363380" "6377927" "6434524" "6532444" "6584179" "6615172" "5559940" "6014377" "6366299" "6138100" "6272495" "6397329" "4612416" "6094649" "6169985" "6353831" "6424980" "6456308" "5650799" "5832474").pn.)) and @ad<=20010330) and (query or sql) with (db or data adj base or database)) and (voice or speech)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:33
11	32	(((5638425.pn. (("6377296" "5265014" "6240448" "6473734" "6601026" "6292830" "6003070" "5999595" "5937422" "5937168" "6005860" "6067516" "6434547" "5802314" "5500920" "5956681" "6052657" "5418951" "5434777" "5608624" "5625814" "5708829" "5748841" "5918222" "5970460" "5991712" "6073095" "6298326" "6345252" "6345253" "6363380" "6377927" "6434524" "6532444" "6584179" "6615172" "5559940" "6014377" "6366299" "6138100" "6272495" "6397329" "4612416" "6094649" "6169985" "6353831" "6424980" "6456308" "5650799" "5832474").pn.)) and @ad<=20010330) and (query or sql) with (db or data adj base or database)) and (voice or speech or acoustic$4 or audible or audio)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:33
12	27	((((5638425.pn. (("6377296" "5265014" "6240448" "6473734" "6601026" "6292830" "6003070" "5999595" "5937422" "5937168" "6005860" "6067516" "6434547" "5802314" "5500920" "5956681" "6052657" "5418951" "5434777" "5608624" "5625814" "5708829" "5748841" "5918222" "5970460" "5991712" "6073095" "6298326" "6345252" "6345253" "6363380" "6377927" "6434524" "6532444" "6584179" "6615172" "5559940" "6014377" "6366299" "6138100" "6272495" "6397329" "4612416" "6094649" "6169985" "6353831" "6424980" "6456308" "5650799" "5832474").pn.)) and @ad<=20010330) and (query or sql) with (db or data adj base or database)) and (voice or speech or acoustic$4 or audible or audio)) and (voice or speech or acoustic$4 or audible or audio) with (text$4 or graphic$4 or written or writing or key or keyboard or mouse)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:33
13	6	(((((5638425.pn. (("6377296" "5265014" "6240448" "6473734" "6601026" "6292830" "6003070" "5999595" "5937422" "5937168" "6005860" "6067516" "6434547" "5802314" "5500920" "5956681" "6052657" "5418951" "5434777" "5608624" "5625814" "5708829" "5748841" "5918222" "5970460" "5991712" "6073095" "6298326" "6345252" "6345253" "6363380" "6377927" "6434524" "6532444" "6584179" "6615172" "5559940" "6014377" "6366299" "6138100" "6272495" "6397329" "4612416" "6094649" "6169985" "6353831" "6424980" "6456308" "5650799" "5832474").pn.)) and @ad<=20010330) and (query or sql) with (db or data adj base or database)) and (voice or speech or acoustic$4 or audible or audio)) and (voice or speech or acoustic$4 or audible or audio) with (text$4 or graphic$4 or written or writing or key or keyboard or mouse)) and (synthetic or synthesi$4)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:33
15	2	((((5638425.pn. (("6377296" "5265014" "6240448" "6473734" "6601026" "6292830" "6003070" "5999595" "5937422" "5937168" "6005860" "6067516" "6434547" "5802314" "5500920" "5956681" "6052657" "5418951" "5434777" "5608624" "5625814" "5708829" "5748841" "5918222" "5970460" "5991712" "6073095" "6298326" "6345252" "6345253" "6363380" "6377927" "6434524" "6532444" "6584179" "6615172" "5559940" "6014377" "6366299" "6138100" "6272495" "6397329" "4612416" "6094649" "6169985" "6353831" "6424980" "6456308" "5650799" "5832474").pn.)) and @ad<=20010330) and (query or sql) with (db or data adj base or database)) and (voice or speech or acoustic$4 or audible or audio)) and (voice or speech or acoustic$4 or audible or audio) with (text$4 or graphic$4 or written or writing or key or keyboard or mouse) same (result or output or produc$4) with (method or form$4 or mode or type) with (either any "or")	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:33

16	12	(US-5638425-$ o[redacted]5265014-$ or US-5434777-$ or US-5500920-$ or US-5559940-$ or US-56[redacted]-$ or US-5625814-$ or US-6052657-$ or US-6138100-$ or US-6240448-$ or US-4579533-$ or US-5625748-$ or US-6609091-$).did.	USPAT	2004/06/01 13:33
17	132	704/.ccls. and (voice or speech or acoustic$4 or audible or audio) with (text$4 or graphic$4 or written or writing or key or keyboard or mouse) same (result or output or produc$4) with (method or form$4 or mode or type) with (either any "or")	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:33
18	2	((US-5638425-$ or US-5265014-$ or US-5434777-$ or US-5500920-$ or US-5559940-$ or US-5608624-$ or US-5625814-$ or US-6052657-$ or US-6138100-$ or US-6240448-$ or US-4579533-$ or US-5625748-$ or US-6609091-$).did.) and query with formulat$4	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:33
19	8	((5638425.pn. (("6377296" "5265014" "6240448" "6473734" "6601026" "6292830" "6003070" "5999595" "5937422" "5937168" "6005860" "6067516" "6434547" "5802314" "5500920" "5956681" "6052657" "5418951" "5434777" "5608624" "5625814" "5708829" "5748841" "5918222" "5970460" "5991712" "6073095" "6298326" "6345252" "6345253" "6363380" "6377927" "6434524" "6532444" "6584179" "6615172" "5559940" "6014377" "6366299" "6138100" "6272495" "6397329" "4612416" "6094649" "6169985" "6353831" "6424980" "6456308" "5650799" "5832474").pn.)) and @ad<=20010330) and query with formulat$4	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:33
21	13	(((((5638425.pn. (("6377296" "5265014" "6240448" "6473734" "6601026" "6292830" "6003070" "5999595" "5937422" "5937168" "6005860" "6067516" "6434547" "5802314" "5500920" "5956681" "6052657" "5418951" "5434777" "5608624" "5625814" "5708829" "5748841" "5918222" "5970460" "5991712" "6073095" "6298326" "6345252" "6345253" "6363380" "6377927" "6434524" "6532444" "6584179" "6615172" "5559940" "6014377" "6366299" "6138100" "6272495" "6397329" "4612416" "6094649" "6169985" "6353831" "6424980" "6456308" "5650799" "5832474").pn.)) and @ad<=20010330) and (query or sql) with (db or data adj base or database)) and (voice or speech or acoustic$4 or audible or audio)) and (voice or speech or acoustic$4 or audible or audio) with (text$4 or graphic$4 or written or writing or key or keyboard or mouse)) and prompt$4	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:33
22	14	(((((5638425.pn. (("6377296" "5265014" "6240448" "6473734" "6601026" "6292830" "6003070" "5999595" "5937422" "5937168" "6005860" "6067516" "6434547" "5802314" "5500920" "5956681" "6052657" "5418951" "5434777" "5608624" "5625814" "5708829" "5748841" "5918222" "5970460" "5991712" "6073095" "6298326" "6345252" "6345253" "6363380" "6377927" "6434524" "6532444" "6584179" "6615172" "5559940" "6014377" "6366299" "6138100" "6272495" "6397329" "4612416" "6094649" "6169985" "6353831" "6424980" "6456308" "5650799" "5832474").pn.)) and @ad<=20010330) and (query or sql) with (db or data adj base or database)) and (voice or speech or acoustic$4 or audible or audio)) and (voice or speech or acoustic$4 or audible or audio) with (text$4 or graphic$4 or written or writing or key or keyboard or mouse)) and meaning$4	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:33
23	4	(((((5638425.pn. (("6377296" "5265014" "6240448" "6473734" "6601026" "6292830" "6003070" "5999595" "5937422" "5937168" "6005860" "6067516" "6434547" "5802314" "5500920" "5956681" "6052657" "5418951" "5434777" "5608624" "5625814" "5708829" "5748841" "5918222" "5970460" "5991712" "6073095" "6298326" "6345252" "6345253" "6363380" "6377927" "6434524" "6532444" "6584179" "6615172" "5559940" "6014377" "6366299" "6138100" "6272495" "6397329" "4612416" "6094649" "6169985" "6353831" "6424980" "6456308" "5650799" "5832474").pn.)) and @ad<=20010330) and (query or sql) with (db or data adj base or database)) and (voice or speech or acoustic$4 or audible or audio)) and (voice or speech or acoustic$4 or audible or audio) with (text$4 or graphic$4 or written or writing or key or keyboard or mouse)) and noise	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:33

25	15	(((((5638425.pn. (("6377296" "5265014" "6240448" "6473734" "6601026" "6292830" "6003070" "5999595" "5937422" "5937168" "6005860" "6067516" "6434547" "5802314" "5500920" "5956681" "6052657" "5418951" "5434777" "5608624" "5625814" "5708829" "5748841" "5918222" "5970460" "5991712" "6073095" "6298326" "6345252" "6345253" "6363380" "6377927" "6434524" "6532444" "6584179" "6615172" "5559940" "6014377" "6366299" "6138100" "6272495" "6397329" "4612416" "6094649" "6169985" "6353831" "6424980" "6456308" "5650799" "5832474").pn.)) and @ad<=20010330) and (query or sql) with (db or data adj base or database)) and (voice or speech or acoustic$4 or audible or audio)) and (voice or speech or acoustic$4 or audible or audio) with (text$4 or graphic$4 or written or writing or key or keyboard or mouse)) and search with data$4	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:33
26	17	(((((5638425.pn. (("6377296" "5265014" "6240448" "6473734" "6601026" "6292830" "6003070" "5999595" "5937422" "5937168" "6005860" "6067516" "6434547" "5802314" "5500920" "5956681" "6052657" "5418951" "5434777" "5608624" "5625814" "5708829" "5748841" "5918222" "5970460" "5991712" "6073095" "6298326" "6345252" "6345253" "6363380" "6377927" "6434524" "6532444" "6584179" "6615172" "5559940" "6014377" "6366299" "6138100" "6272495" "6397329" "4612416" "6094649" "6169985" "6353831" "6424980" "6456308" "5650799" "5832474").pn.)) and @ad<=20010330) and (query or sql) with (db or data adj base or database)) and (voice or speech or acoustic$4 or audible or audio)) and (voice or speech or acoustic$4 or audible or audio) with (text$4 or graphic$4 or written or writing or key or keyboard or mouse)) and search$4 with data$4	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:33
27	20	(((((5638425.pn. (("6377296" "5265014" "6240448" "6473734" "6601026" "6292830" "6003070" "5999595" "5937422" "5937168" "6005860" "6067516" "6434547" "5802314" "5500920" "5956681" "6052657" "5418951" "5434777" "5608624" "5625814" "5708829" "5748841" "5918222" "5970460" "5991712" "6073095" "6298326" "6345252" "6345253" "6363380" "6377927" "6434524" "6532444" "6584179" "6615172" "5559940" "6014377" "6366299" "6138100" "6272495" "6397329" "4612416" "6094649" "6169985" "6353831" "6424980" "6456308" "5650799" "5832474").pn.)) and @ad<=20010330) and (query or sql) with (db or data adj base or database)) and (voice or speech or acoustic$4 or audible or audio)) and (voice or speech or acoustic$4 or audible or audio) with (text$4 or graphic$4 or written or writing or key or keyboard or mouse)) and data$4 with text	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:33
28	4	((US-5638425-$ or US-5265014-$ or US-5434777-$ or US-5500920-$ or US-5559940-$ or US-5608624-$ or US-5625814-$ or US-6052657-$ or US-6138100-$ or US-6240448-$ or US-4579533-$ or US-5625748-$ or US-6609091-$).did.) and phoneme	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:33
29	4	(((((5638425.pn. (("6377296" "5265014" "6240448" "6473734" "6601026" "6292830" "6003070" "5999595" "5937422" "5937168" "6005860" "6067516" "6434547" "5802314" "5500920" "5956681" "6052657" "5418951" "5434777" "5608624" "5625814" "5708829" "5748841" "5918222" "5970460" "5991712" "6073095" "6298326" "6345252" "6345253" "6363380" "6377927" "6434524" "6532444" "6584179" "6615172" "5559940" "6014377" "6366299" "6138100" "6272495" "6397329" "4612416" "6094649" "6169985" "6353831" "6424980" "6456308" "5650799" "5832474").pn.)) and @ad<=20010330) and (query or sql) with (db or data adj base or database)) and (voice or speech or acoustic$4 or audible or audio)) and (voice or speech or acoustic$4 or audible or audio) with (text$4 or graphic$4 or written or writing or key or keyboard or mouse)) and phoneme	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:33
30	13	((5638425.pn. (("6377296" "5265014" "6240448" "6473734" "6601026" "6292830" "6003070" "5999595" "5937422" "5937168" "6005860" "6067516" "6434547" "5802314" "5500920" "5956681" "6052657" "5418951" "5434777" "5608624" "5625814" "5708829" "5748841" "5918222" "5970460" "5991712" "6073095" "6298326" "6345252" "6345253" "6363380" "6377927" "6434524" "6532444" "6584179" "6615172" "5559940" "6014377" "6366299" "6138100" "6272495" "6397329" "4612416" "6094649" "6169985" "6353831" "6424980" "6456308" "5650799" "5832474").pn.)) and @ad<=20010330) and phoneme	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:33

31	1	((5638425.pn. (("6377296" "5265014" "6240448" "6473734" "6601026" "6292830" "6003070" "5999595" "5937422" "5937168" "6005860" "6067516" "6434547" "5802314" "5500920" "5956681" "6052657" "5418951" "5434777" "5608624" "5625814" "5708829" "5748841" "5918222" "5970460" "5991712" "6073095" "6298326" "6345252" "6345253" "6363380" "6377927" "6434524" "6532444" "6584179" "6615172" "5559940" "6014377" "6366299" "6138100" "6272495" "6397329" "4612416" "6094649" "6169985" "6353831" "6424980" "6456308" "5650799" "5832474").pn.)) and @ad<=20010330) and speech with phoneme same conver$4	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:33
32	22	(((((5638425.pn. (("6377296" "5265014" "6240448" "6473734" "6601026" "6292830" "6003070" "5999595" "5937422" "5937168" "6005860" "6067516" "6434547" "5802314" "5500920" "5956681" "6052657" "5418951" "5434777" "5608624" "5625814" "5708829" "5748841" "5918222" "5970460" "5991712" "6073095" "6298326" "6345252" "6345253" "6363380" "6377927" "6434524" "6532444" "6584179" "6615172" "5559940" "6014377" "6366299" "6138100" "6272495" "6397329" "4612416" "6094649" "6169985" "6353831" "6424980" "6456308" "5650799" "5832474").pn.)) and @ad<=20010330) and (query or sql) with (db or data adj base or database)) and (voice or speech or acoustic$4 or audible or audio)) and (voice or speech or acoustic$4 or audible or audio) with (text$4 or graphic$4 or written or writing or key or keyboard or mouse)) and speech with text	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:33
34	1	10/422,933 09/842,358 09/845,769	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:33
35	12	(US-5638425-$ or US-6240448-$ or US-6138100-$ or US-6052657-$ or US-5625814-$ or US-5608624-$ or US-5559940-$ or US-5500920-$ or US-5434777-$ or US-5265014-$ or US-6609091-$ or US-5625748-$ or US-4579533-$).did.	USPAT	2004/06/01 13:33
36	1	((US-5638425-$ or US-6240448-$ or US-6138100-$ or US-6052657-$ or US-5625814-$ or US-5608624-$ or US-5559940-$ or US-5500920-$ or US-5434777-$ or US-5265014-$ or US-6609091-$ or US-5625748-$ or US-4579533-$).did.) and speech with text and speech with phoneme	USPAT	2004/06/01 13:33
37	84	(704/.ccls. and (voice or speech or acoustic$4 or audible or audio) with (text$4 or graphic$4 or written or writing or key or keyboard or mouse) same (result or output or produc$4) with (method or form$4 or mode or type) with (either any "or")) and @ad<=20010330	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:33
38	3	((5638425.pn. (("6377296" "5265014" "6240448" "6473734" "6601026" "6292830" "6003070" "5999595" "5937422" "5937168" "6005860" "6067516" "6434547" "5802314" "5500920" "5956681" "6052657" "5418951" "5434777" "5608624" "5625814" "5708829" "5748841" "5918222" "5970460" "5991712" "6073095" "6298326" "6345252" "6345253" "6363380" "6377927" "6434524" "6532444" "6584179" "6615172" "5559940" "6014377" "6366299" "6138100" "6272495" "6397329" "4612416" "6094649" "6169985" "6353831" "6424980" "6456308" "5650799" "5832474").pn.)) and @ad<=20010330) and speech with text and speech with phoneme	USPAT	2004/06/01 13:33
39	1	((US-5638425-$ or US-6240448-$ or US-6138100-$ or US-6052657-$ or US-5625814-$ or US-5608624-$ or US-5559940-$ or US-5500920-$ or US-5434777-$ or US-5265014-$ or US-6609091-$ or US-5625748-$ or US-4579533-$).did.) and ((speech with text) and (speech with phoneme))	USPAT	2004/06/01 13:33
40	13	((704/.ccls. and (voice or speech or acoustic$4 or audible or audio) with (text$4 or graphic$4 or written or writing or key or keyboard or mouse) same (result or output or produc$4) with (method or form$4 or mode or type) with (either any "or")) and @ad<=20010330) and speech with text and speech with phoneme	USPAT	2004/06/01 13:33
41	4	((704/.ccls. and (voice or speech or acoustic$4 or audible or audio) with (text$4 or graphic$4 or written or writing or key or keyboard or mouse) same (result or output or produc$4) with (method or form$4 or mode or type) with (either any "or")) and @ad<=20010330) and speech with text with (conver$4 or recogni$6) and speech with phoneme with (conver$4 or recogni$6)	USPAT	2004/06/01 13:33

44	3	(704/.ccls. and speech with text with (conver$4 or recogni$6) and speech with phoneme with (conver$4 or recogni$6) and @ad<=20010330) and ((5638425.pn. (("6377296" "5265014" "6240448" "6473734" "6601026" "6292830" "6003070" "5999595" "5937422" "5937168" "6005860" "6067516" "6434547" "5802314" "5500920" "5956681" "6052657" "5418951" "5434777" "5608624" "5625814" "5708829" "5748841" "5918222" "5970460" "5991712" "6073095" "6298326" "6345252" "6345253" "6363380" "6377927" "6434524" "6532444" "6584179" "6615172" "5559940" "6014377" "6366299" "6138100" "6272495" "6397329" "4612416" "6094649" "6169985" "6353831" "6424980" "6456308" "5650799" "5832474").pn.)) and @ad<=20010330)	USPAT	2004/06/01 13:33
45	134	704/.ccls. and speech with text with (conver$4 or recogni$6) and speech with phoneme with (conver$4 or recogni$6) and @ad<=20010330	USPAT	2004/06/01 13:33
46	134	704/.ccls. and speech with text with (conver$4 or recogni$6) and speech with phoneme with (conver$4 or recogni$6) and @ad<=20010330	USPAT	2004/06/01 13:33
47	2	((US-5638425-$ or US-6240448-$ or US-6138100-$ or US-6052657-$ or US-5625814-$ or US-5608624-$ or US-5559940-$ or US-5500920-$ or US-5434777-$ or US-5265014-$ or US-6609091-$ or US-5625748-$ or US-4579533-$ or US-4406626-$).did.) and confidence	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:33
48	5	((US-5638425-$ or US-6240448-$ or US-6138100-$ or US-6052657-$ or US-5625814-$ or US-5608624-$ or US-5559940-$ or US-5500920-$ or US-5434777-$ or US-5265014-$ or US-6609091-$ or US-5625748-$ or US-4579533-$ or US-4406626-$).did.) and (probab$6 assur$4 confidence convict$4)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:33
51	4	((US-5638425-$ or US-6240448-$ or US-6138100-$ or US-6052657-$ or US-5625814-$ or US-5608624-$ or US-5559940-$ or US-5500920-$ or US-5434777-$ or US-5265014-$ or US-6609091-$ or US-5625748-$ or US-4579533-$ or US-4406626-$).did.) and (out output$8) with ((speech synthe$8) and (text gui graphic$4 print))	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:33
52	3	((US-5638425-$ or US-6240448-$ or US-6138100-$ or US-6052657-$ or US-5625814-$ or US-5608624-$ or US-5559940-$ or US-5500920-$ or US-5434777-$ or US-5265014-$ or US-6609091-$ or US-5625748-$ or US-4579533-$ or US-4406626-$).did.) and (moblie radio cellular) with (phone telephone)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:33
53	3	(((US-5638425-$ or US-6240448-$ or US-6138100-$ or US-6052657-$ or US-5625814-$ or US-5608624-$ or US-5559940-$ or US-5500920-$ or US-5434777-$ or US-5265014-$ or US-6609091-$ or US-5625748-$ or US-4579533-$ or US-4406626-$).did.) and (moblie radio cellular) with (phone telephone)) and (WEB WAP text SMS.)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:33
62	90	((704/.ccls. and (WAP SMS)) and (((speech or voice) adj recogni$6) and (WAP SMS))) and @ad<=20010330	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:33
65	90	(704/.ccls. and (WAP SMS)) and (((speech or voice) adj recogni$6) and (WAP "SMS")) and @ad<=20010330	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:33

66	90	(704/.ccls. and (WAP SMS)) and (((speech or voice) adj recogni$6) and (WAP "SMS")) and @ad<=20010330	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:33
67	20	((704/.ccls. and (WAP SMS)) and (((speech or voice) adj recogni$6) and (WAP "SMS")) and @ad<=20010330) and (messaging messager)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:33
68	1	((US-5638425-$ or US-6240448-$ or US-6138100-$ or US-6052657-$ or US-5625814-$ or US-5608624-$ or US-5559940-$ or US-5500920-$ or US-5434777-$ or US-5265014-$ or US-6609091-$ or US-5625748-$ or US-4579533-$ or US-4406626-$).did.) and (messaging messager)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:33
70	6	((US-5638425-$ or US-6240448-$ or US-6138100-$ or US-6052657-$ or US-5625814-$ or US-5608624-$ or US-5559940-$ or US-5500920-$ or US-5434777-$ or US-5265014-$ or US-6609091-$ or US-5625748-$ or US-4579533-$ or US-4406626-$).did.) AND SPELL$4	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:33
71	1	((US-5638425-$ or US-6240448-$ or US-6138100-$ or US-6052657-$ or US-5625814-$ or US-5608624-$ or US-5559940-$ or US-5500920-$ or US-5434777-$ or US-5265014-$ or US-6609091-$ or US-5625748-$ or US-4579533-$ or US-4406626-$).did.) AND SPELL$4 with (request$4 or ask$4)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:33
72	10	((US-5638425-$ or US-6240448-$ or US-6138100-$ or US-6052657-$ or US-5625814-$ or US-5608624-$ or US-5559940-$ or US-5500920-$ or US-5434777-$ or US-5265014-$ or US-6609091-$ or US-5625748-$ or US-4579533-$ or US-4406626-$).did.) AND associat$4	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:33
73	1	((US-5638425-$ or US-6240448-$ or US-6138100-$ or US-6052657-$ or US-5625814-$ or US-5608624-$ or US-5559940-$ or US-5500920-$ or US-5434777-$ or US-5265014-$ or US-6609091-$ or US-5625748-$ or US-4579533-$ or US-4406626-$).did.) AND associat$4 same link$4 same search	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:33
74	1	((US-5638425-$ or US-6240448-$ or US-6138100-$ or US-6052657-$ or US-5625814-$ or US-5608624-$ or US-5559940-$ or US-5500920-$ or US-5434777-$ or US-5265014-$ or US-6609091-$ or US-5625748-$ or US-4579533-$ or US-4406626-$).did.) AND ((associat$4 same link$4 same search) or assoc$6 with name)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:33
76	2	((US-5638425-$ or US-6240448-$ or US-6138100-$ or US-6052657-$ or US-5625814-$ or US-5608624-$ or US-5559940-$ or US-5500920-$ or US-5434777-$ or US-5265014-$ or US-6609091-$ or US-5625748-$ or US-4579533-$ or US-4406626-$).did.) AND (name with (close or near$2 or approximate))	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:33
77	3	((US-5638425-$ or US-6240448-$ or US-6138100-$ or US-6052657-$ or US-5625814-$ or US-5608624-$ or US-5559940-$ or US-5500920-$ or US-5434777-$ or US-5265014-$ or US-6609091-$ or US-5625748-$ or US-4579533-$ or US-4406626-$).did.) AND (name with (close or near$2 or approximate similar$4))	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:33

78	5	((US-5638425-$ or US-6240448-$ or US-6138100-$ or US-6052657-$ or US-5625814-$ or US-5608624-$ or US-5559940-$ or US-5500920-$ or US-5434777-$ or US-5265014-$ or US-6609091-$ or US-5625748-$ or US-4579533-$ or US-4406626-$).did.) AND (name with (close or near$2 or approximate similar$4 phone address))	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:33
79	8	((US-5638425-$ or US-6240448-$ or US-6138100-$ or US-6052657-$ or US-5625814-$ or US-5608624-$ or US-5559940-$ or US-5500920-$ or US-5434777-$ or US-5265014-$ or US-6609091-$ or US-5625748-$ or US-4579533-$ or US-4406626-$).did.) AND (name with (close or near$2 or approximate similar$4 phone address office home fax))	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:33
80	13	((US-5638425-$ or US-6240448-$ or US-6138100-$ or US-6052657-$ or US-5625814-$ or US-5608624-$ or US-5559940-$ or US-5500920-$ or US-5434777-$ or US-5265014-$ or US-6609091-$ or US-5625748-$ or US-4579533-$ or US-4406626-$).did.) AND (priority or preference or first or order)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:33
81	8	((US-5638425-$ or US-6240448-$ or US-6138100-$ or US-6052657-$ or US-5625814-$ or US-5608624-$ or US-5559940-$ or US-5500920-$ or US-5434777-$ or US-5265014-$ or US-6609091-$ or US-5625748-$ or US-4579533-$ or US-4406626-$).did.) AND (priority or preference or first or order format) with (display out output$4 writ$4 produc$4 generat$4)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:33
82	13	(US-5638425-$ or US-6240448-$ or US-6138100-$ or US-6052657-$ or US-5625814-$ or US-5608624-$ or US-5559940-$ or US-5500920-$ or US-5434777-$ or US-5265014-$ or US-6609091-$ or US-5625748-$ or US-4579533-$ or US-4406626-$).did.	USPAT	2004/06/01 13:33
83	11	((US-5638425-$ or US-6240448-$ or US-6138100-$ or US-6052657-$ or US-5625814-$ or US-5608624-$ or US-5559940-$ or US-5500920-$ or US-5434777-$ or US-5265014-$ or US-6609091-$ or US-5625748-$ or US-4579533-$ or US-4406626-$).did.) and connect$4	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:33
84	1	"4979206".PN.	USPAT	2004/06/01 13:33
85	13	((US-5638425-$ or US-6240448-$ or US-6138100-$ or US-6052657-$ or US-5625814-$ or US-5608624-$ or US-5559940-$ or US-5500920-$ or US-5434777-$ or US-5265014-$ or US-6609091-$ or US-5625748-$ or US-4579533-$ or US-4406626-$).did.) and (telephone or number)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:33
86	2	((US-5638425-$ or US-6240448-$ or US-6138100-$ or US-6052657-$ or US-5625814-$ or US-5608624-$ or US-5559940-$ or US-5500920-$ or US-5434777-$ or US-5265014-$ or US-6609091-$ or US-5625748-$ or US-4579533-$ or US-4406626-$).did.) and message with (id or identification or caller)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:33
87	8	((5638425.pn. (("6377296" "5265014" "6240448" "6473734" "6601026" "6292830" "6003070" "5999595" "5937422" "5937168" "6005860" "6087516" "6434547" "5802314" "5500920" "5956681" "6052657" "5418951" "5434777" "5608624" "5625814" "5708829" "5748841" "5918222" "5970460" "5991712" "6073095" "6298326" "6345252" "6345253" "6363380" "6377927" "6434524" "6532444" "6584179" "6615172" "5559940" "6014377" "6366299" "6138100" "6272495" "6397329" "4612416" "6094649" "6169985" "6353831" "6424980" "6456308" "5650799" "5832474").pn.)) and @ad<=20010330) and message with (id or identification or caller)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:33

89	10	((5638425.pn. (("6377296" "5265014" "6240448" "6473734" "6601026" "6292830" "6003070" "5999595" "5937422" "5937168" "6005860" "6067516" "6434547" "5802314" "5500920" "5956681" "6052657" "5418951" "5434777" "5608624" "5625814" "5708829" "5748841" "5918222" "5970460" "5991712" "6073095" "6298326" "6345252" "6345253" "6363380" "6377927" "6434524" "6532444" "6584179" "6615172" "5559940" "6014377" "6366299" "6138100" "6272495" "6397329" "4612416" "6094649" "6169985" "6353831" "6424980" "6456308" "5650799" "5832474").pn.)) and @ad<=20010330) and (message or mail or e-mail or email) with (id or identification or caller)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:33
90	2	((US-5638425-$ or US-6240448-$ or US-6138100-$ or US-6052657-$ or US-5625814-$ or US-5608624-$ or US-5559940-$ or US-5500920-$ or US-5434777-$ or US-5265014-$ or US-6609091-$ or US-5625748-$ or US-4579533-$ or US-4406626-$).did.) and (text or photo$6 or audio or video) with (id or identification or caller)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:33
91	15	((5638425.pn. (("6377296" "5265014" "6240448" "6473734" "6601026" "6292830" "6003070" "5999595" "5937422" "5937168" "6005860" "6067516" "6434547" "5802314" "5500920" "5956681" "6052657" "5418951" "5434777" "5608624" "5625814" "5708829" "5748841" "5918222" "5970460" "5991712" "6073095" "6298326" "6345252" "6345253" "6363380" "6377927" "6434524" "6532444" "6584179" "6615172" "5559940" "6014377" "6366299" "6138100" "6272495" "6397329" "4612416" "6094649" "6169985" "6353831" "6424980" "6456308" "5650799" "5832474").pn.)) and @ad<=20010330) and (text or photo$6 or audio or video) with (id or identification or caller)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:33
92	52	((5638425.pn. (("6377296" "5265014" "6240448" "6473734" "6601026" "6292830" "6003070" "5999595" "5937422" "5937168" "6005860" "6067516" "6434547" "5802314" "5500920" "5956681" "6052657" "5418951" "5434777" "5608624" "5625814" "5708829" "5748841" "5918222" "5970460" "5991712" "6073095" "6298326" "6345252" "6345253" "6363380" "6377927" "6434524" "6532444" "6584179" "6615172" "5559940" "6014377" "6366299" "6138100" "6272495" "6397329" "4612416" "6094649" "6169985" "6353831" "6424980" "6456308" "5650799" "5832474").pn.)) and @ad<=20010330) and (size or entry)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:33
93	42	((5638425.pn. (("6377296" "5265014" "6240448" "6473734" "6601026" "6292830" "6003070" "5999595" "5937422" "5937168" "6005860" "6067516" "6434547" "5802314" "5500920" "5956681" "6052657" "5418951" "5434777" "5608624" "5625814" "5708829" "5748841" "5918222" "5970460" "5991712" "6073095" "6298326" "6345252" "6345253" "6363380" "6377927" "6434524" "6532444" "6584179" "6615172" "5559940" "6014377" "6366299" "6138100" "6272495" "6397329" "4612416" "6094649" "6169985" "6353831" "6424980" "6456308" "5650799" "5832474").pn.)) and @ad<=20010330) and (size or entries)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:33
94	33	((5638425.pn. (("6377296" "5265014" "6240448" "6473734" "6601026" "6292830" "6003070" "5999595" "5937422" "5937168" "6005860" "6067516" "6434547" "5802314" "5500920" "5956681" "6052657" "5418951" "5434777" "5608624" "5625814" "5708829" "5748841" "5918222" "5970460" "5991712" "6073095" "6298326" "6345252" "6345253" "6363380" "6377927" "6434524" "6532444" "6584179" "6615172" "5559940" "6014377" "6366299" "6138100" "6272495" "6397329" "4612416" "6094649" "6169985" "6353831" "6424980" "6456308" "5650799" "5832474").pn.)) and @ad<=20010330) and (size or entries) same data$4	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:33
95	6	((5638425.pn. (("6377296" "5265014" "6240448" "6473734" "6601026" "6292830" "6003070" "5999595" "5937422" "5937168" "6005860" "6067516" "6434547" "5802314" "5500920" "5956681" "6052657" "5418951" "5434777" "5608624" "5625814" "5708829" "5748841" "5918222" "5970460" "5991712" "6073095" "6298326" "6345252" "6345253" "6363380" "6377927" "6434524" "6532444" "6584179" "6615172" "5559940" "6014377" "6366299" "6138100" "6272495" "6397329" "4612416" "6094649" "6169985" "6353831" "6424980" "6456308" "5650799" "5832474").pn.)) and @ad<=20010330) and (size or entries) same data$4 same search	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:33

97	5	variable with (prompt or question) same (size or entries) same data$4 same search	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:33
98	69	(variable or vary$4) adj number with (query or question) and data$4	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:33
100	31	(variable or vary$4) adj number with (query or question) same (data$4 index field key$4)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:33
101	5	(variable or vary$4) adj number with (query or question) same (data$4 index field key$4) same result	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:33
102	127	(data$4 same (number quantity amount volume) with (query$4 prompt$4 question$4 interrogat$4) same (threshold limit)) and (voice speech) adj recogni$6	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:33
103	82	(database or base) same (number quantity amount volume) with (query$4 prompt$4 question$4 interrogat$4) same (threshold limit) and (voice speech) adj recogni$6	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:33
104	53	(database or base) same (number quantity amount volume) with (query$4 prompt$4 question$4 interrogat$4) same (threshold limit) and stop with (operation or process)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:33
105	12	((database or base) same (number quantity amount volume) with (query$4 prompt$4 question$4 interrogat$4) same (threshold limit) and (voice speech) adj recogni$6) and 704/.ccls.	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:33
108	99	((database or base) same (number quantity amount volume) with (query$4 prompt$4 question$4 return response interrogat$4) same (threshold limit) and stop with (operation or process)) not (((data$4 same (number quantity amount volume) with (query$4 prompt$4 question$4 interrogat$4) same (threshold limit)) and (voice speech) adj recogni$6) ((database or base) same (number quantity amount volume) with (query$4 prompt$4 question$4 interrogat$4) same (threshold limit) and stop with (operation or process)) ((database or base) same (number quantity amount volume) with (query$4 prompt$4 question$4 interrogat$4) same (threshold limit) and (voice speech) adj recogni$6))	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:33

109	75	(((database or base) same (number quantity amount volume) with (query$4 prompt$4 question$4 [illegible] response interrogat$4) same (threshold limit) and stop with (operation or process)) not (((data$4 same (number quantity amount volume) with (query$4 prompt$4 question$4 interrogat$4) same (threshold limit)) and (voice speech) adj recogni$6) ((database or base) same (number quantity amount volume) with (query$4 prompt$4 question$4 interrogat$4) same (threshold limit) and stop with (operation or process)) ((database or base) same (number quantity amount volume) with (query$4 prompt$4 question$4 interrogat$4) same (threshold limit) and (voice speech) adj recogni$6))) and @ad<=20010330	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:33
110	15	((US-5638425-$ or US-6240448-$ or US-6138100-$ or US-5625814-$ or US-6052657-$ or US-5608624-$ or US-5559940-$ or US-5500920-$ or US-5434777-$ or US-5265014-$ or US-6609091-$ or US-5625748-$ or US-4579533-$ or US-4406626-$ or US-4612416-$ or US-6581055-$ or US-5878423-$ or US-5956706-$).did.) and (operator human)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:33
113	2	((5638425.pn. (("6377296" "5265014" "6240448" "6473734" "6601026" "6292830" "6003070" "5999595" "5937422" "5937168" "6005860" "6067516" "6434547" "5802314" "5500920" "5956681" "6052657" "5418951" "5434777" "5608624" "5625814" "5708829" "5748841" "5918222" "5970460" "5991712" "6073095" "6298326" "6345252" "6345253" "6363380" "6377927" "6434524" "6532444" "6584179" "6615172" "5559940" "6014377" "6366299" "6138100" "6272495" "6397329" "4612416" "6094649" "6169985" "6353831" "6424980" "6456308" "5650799" "5832474").pn.)) and @ad<=20010330) and (operator human) same (confidence or probability or probable)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:33
114	6	(((US-5638425-$ or US-6240448-$ or US-6138100-$ or US-6052657-$ or US-5625814-$ or US-5608624-$ or US-5559940-$ or US-5500920-$ or US-5434777-$ or US-5265014-$ or US-6609091-$ or US-5625748-$ or US-4579533-$ or US-4406626-$).did.) ((5638425.pn. (("6377296" "5265014" "6240448" "6473734" "6601026" "6292830" "6003070" "5999595" "5937422" "5937168" "6005860" "6067516" "6434547" "5802314" "5500920" "5956681" "6052657" "5418951" "5434777" "5608624" "5625814" "5708829" "5748841" "5918222" "5970460" "5991712" "6073095" "6298326" "6345252" "6345253" "6363380" "6377927" "6434524" "6532444" "6584179" "6615172" "5559940" "6014377" "6366299" "6138100" "6272495" "6397329" "4612416" "6094649" "6169985" "6353831" "6424980" "6456308" "5650799" "5832474").pn.)) and @ad<=20010330)) and remote with database	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:33
115	16	(((US-5638425-$ or US-6240448-$ or US-6138100-$ or US-6052657-$ or US-5625814-$ or US-5608624-$ or US-5559940-$ or US-5500920-$ or US-5434777-$ or US-5265014-$ or US-6609091-$ or US-5625748-$ or US-4579533-$ or US-4406626-$).did.) ((5638425.pn. (("6377296" "5265014" "6240448" "6473734" "6601026" "6292830" "6003070" "5999595" "5937422" "5937168" "6005860" "6067516" "6434547" "5802314" "5500920" "5956681" "6052657" "5418951" "5434777" "5608624" "5625814" "5708829" "5748841" "5918222" "5970460" "5991712" "6073095" "6298326" "6345252" "6345253" "6363380" "6377927" "6434524" "6532444" "6584179" "6615172" "5559940" "6014377" "6366299" "6138100" "6272495" "6397329" "4612416" "6094649" "6169985" "6353831" "6424980" "6456308" "5650799" "5832474").pn.)) and @ad<=20010330)) and remot$4 same data$4	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:33
116	26	(((US-5638425-$ or US-6240448-$ or US-6138100-$ or US-6052657-$ or US-5625814-$ or US-5608624-$ or US-5559940-$ or US-5500920-$ or US-5434777-$ or US-5265014-$ or US-6609091-$ or US-5625748-$ or US-4579533-$ or US-4406626-$).did.) ((5638425.pn. (("6377296" "5265014" "6240448" "6473734" "6601026" "6292830" "6003070" "5999595" "5937422" "5937168" "6005860" "6067516" "6434547" "5802314" "5500920" "5956681" "6052657" "5418951" "5434777" "5608624" "5625814" "5708829" "5748841" "5918222" "5970460" "5991712" "6073095" "6298326" "6345252" "6345253" "6363380" "6377927" "6434524" "6532444" "6584179" "6615172" "5559940" "6014377" "6366299" "6138100" "6272495" "6397329" "4612416" "6094649" "6169985" "6353831" "6424980" "6456308" "5650799" "5832474").pn.)) and @ad<=20010330)) and remot$4	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:33

117	25	(((US-5638425-$ or US-6240448-$ or US-6138100-$ or US-6052657-$ or US-5625814-$ or US-5608624-$ or US-5559940-$ or US-5500920-$ or US-5434777-$ or US-5265014-$ or US-6609091-$ or US-5625748-$ or US-4579533-$ or US-4406626-$).did.) ((5638425.pn. (("6377296" "5265014" "6240448" "6473734" "6601026" "6292830" "6003070" "5999595" "5937422" "5937168" "6005860" "6067516" "6434547" "5802314" "5500920" "5956681" "6052657" "5418951" "5434777" "5608624" "5625814" "5708829" "5748841" "5918222" "5970460" "5991712" "6073095" "6298326" "6345252" "6345253" "6363380" "6377927" "6434524" "6532444" "6584179" "6615172" "5559940" "6014377" "6366299" "6138100" "6272495" "6397329" "4612416" "6094649" "6169985" "6353831" "6424980" "6456308" "5650799" "5832474").pn.)) and @ad<=20010330)) and remot$4 and data$4	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:33
119	2	5638425.pn.	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:33
120	104	(5638425.pn. (("6377296" "5265014" "6240448" "6473734" "6601026" "6292830" "6003070" "5999595" "5937422" "5937168" "6005860" "6067516" "6434547" "5802314" "5500920" "5956681" "6052657" "5418951" "5434777" "5608624" "5625814" "5708829" "5748841" "5918222" "5970460" "5991712" "6073095" "6298326" "6345252" "6345253" "6363380" "6377927" "6434524" "6532444" "6584179" "6615172" "5559940" "6014377" "6366299" "6138100" "6272495" "6397329" "4612416" "6094649" "6169985" "6353831" "6424980" "6456308" "5650799" "5832474").pn.)) and @ad<=20010330	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:33
121	21	(US-5638425-$ or US-6240448-$ or US-6138100-$ or US-6052657-$ or US-6005860-$ or US-5937168-$ or US-5650799-$ or US-5625814-$ or US-5608624-$ or US-5559940-$ or US-5500920-$ or US-5434777-$ or US-5265014-$ or US-4612416-$ or US-6609091-$ or US-5625748-$ or US-4579533-$ or US-4406626-$ or US-5999595-$ or US-6581055-$ or US-5956706-$ or US-5878423-$).did. or (EP-892540-$).did.	USPAT; DERWENT	2004/06/01 13:33
122	62	(((5638425.pn. (("6377296" "5265014" "6240448" "6473734" "6601026" "6292830" "6003070" "5999595" "5937422" "5937168" "6005860" "6067516" "6434547" "5802314" "5500920" "5956681" "6052657" "5418951" "5434777" "5608624" "5625814" "5708829" "5748841" "5918222" "5970460" "5991712" "6073095" "6298326" "6345252" "6345253" "6363380" "6377927" "6434524" "6532444" "6584179" "6615172" "5559940" "6014377" "6366299" "6138100" "6272495" "6397329" "4612416" "6094649" "6169985" "6353831" "6424980" "6456308" "5650799" "5832474").pn.)) and @ad<=20010330) ((US-5638425-$ or US-6240448-$ or US-6138100-$ or US-6052657-$ or US-6005860-$ or US-5937168-$ or US-5650799-$ or US-5625814-$ or US-5608624-$ or US-5559940-$ or US-5500920-$ or US-5434777-$ or US-5265014-$ or US-4612416-$ or US-6609091-$ or US-5625748-$ or US-4579533-$ or US-4406626-$ or US-5999595-$ or US-6581055-$ or US-5956706-$ or US-5878423-$).did. or (EP-892540-$).did.)) and (map display$4 pict$8 graph$4)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:33
123	17	(((US-5638425-$ or US-6240448-$ or US-6138100-$ or US-6052657-$ or US-6005860-$ or US-5937168-$ or US-5650799-$ or US-5625814-$ or US-5608624-$ or US-5559940-$ or US-5500920-$ or US-5434777-$ or US-5265014-$ or US-4612416-$ or US-6609091-$ or US-5625748-$ or US-4579533-$ or US-4406626-$ or US-5999595-$ or US-6581055-$ or US-5956706-$ or US-5878423-$).did. or (EP-892540-$).did.)) and (map display$4 pict$8 graph$4)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:33
124	11	(((US-5638425-$ or US-6240448-$ or US-6138100-$ or US-6052657-$ or US-6005860-$ or US-5937168-$ or US-5650799-$ or US-5625814-$ or US-5608624-$ or US-5559940-$ or US-5500920-$ or US-5434777-$ or US-5265014-$ or US-4612416-$ or US-6609091-$ or US-5625748-$ or US-4579533-$ or US-4406626-$ or US-5999595-$ or US-6581055-$ or US-5956706-$ or US-5878423-$).did. or (EP-892540-$).did.)) and (pict$8 graph$4)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:33

125	33	(((5638425.pn. (("6377296" "5265014" "6240448" "6473734" "6601026" "6292830" "6003070" "5999595" "5937422" "5937168" "6005860" "6067516" "6434547" "5802314" "5500920" "5956681" "6052657" "5418951" "5434777" "5608624" "5625814" "5708829" "5748841" "5918222" "5970460" "5991712" "6073095" "6298326" "6345252" "6345253" "6363380" "6377927" "6434524" "6532444" "6584179" "6615172" "5559940" "6014377" "6366299" "6138100" "6272495" "6397329" "4612416" "6094649" "6169985" "6353831" "6424980" "6456308" "5650799" "5832474").pn.)) and @ad<=20010330) ((US-5638425-$ or US-6240448-$ or US-6138100-$ or US-6052657-$ or US-6005860-$ or US-5937168-$ or US-5650799-$ or US-5625814-$ or US-5608624-$ or US-5559940-$ or US-5500920-$ or US-5434777-$ or US-5265014-$ or US-4612416-$ or US-6609091-$ or US-5625748-$ or US-4579533-$ or US-4406626-$ or US-5999595-$ or US-6581055-$ or US-5956706-$ or US-5878423-$).did. or (EP-892540-$).did.)) and (text with (data adj base or database))	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:33
127	19	((US-5638425-$ or US-6240448-$ or US-6138100-$ or US-6052657-$ or US-6005860-$ or US-5937168-$ or US-5650799-$ or US-5625814-$ or US-5608624-$ or US-5559940-$ or US-5500920-$ or US-5434777-$ or US-5265014-$ or US-4612416-$ or US-6609091-$ or US-5625748-$ or US-4579533-$ or US-4406626-$ or US-5999595-$ or US-6581055-$ or US-5956706-$ or US-5878423-$).did. or (EP-892540-$).did.) and (location address)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:33
128	11	(((5638425.pn. (("6377296" "5265014" "6240448" "6473734" "6601026" "6292830" "6003070" "5999595" "5937422" "5937168" "6005860" "6067516" "6434547" "5802314" "5500920" "5956681" "6052657" "5418951" "5434777" "5608624" "5625814" "5708829" "5748841" "5918222" "5970460" "5991712" "6073095" "6298326" "6345252" "6345253" "6363380" "6377927" "6434524" "6532444" "6584179" "6615172" "5559940" "6014377" "6366299" "6138100" "6272495" "6397329" "4612416" "6094649" "6169985" "6353831" "6424980" "6456308" "5650799" "5832474").pn.)) and @ad<=20010330) ((US-5638425-$ or US-6240448-$ or US-6138100-$ or US-6052657-$ or US-6005860-$ or US-5937168-$ or US-5650799-$ or US-5625814-$ or US-5608624-$ or US-5559940-$ or US-5500920-$ or US-5434777-$ or US-5265014-$ or US-4612416-$ or US-6609091-$ or US-5625748-$ or US-4579533-$ or US-4406626-$ or US-5999595-$ or US-6581055-$ or US-5956706-$ or US-5878423-$).did. or (EP-892540-$).did.)) and (subscri$6)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:33
129	1	(((5638425.pn. (("6377296" "5265014" "6240448" "6473734" "6601026" "6292830" "6003070" "5999595" "5937422" "5937168" "6005860" "6067516" "6434547" "5802314" "5500920" "5956681" "6052657" "5418951" "5434777" "5608624" "5625814" "5708829" "5748841" "5918222" "5970460" "5991712" "6073095" "6298326" "6345252" "6345253" "6363380" "6377927" "6434524" "6532444" "6584179" "6615172" "5559940" "6014377" "6366299" "6138100" "6272495" "6397329" "4612416" "6094649" "6169985" "6353831" "6424980" "6456308" "5650799" "5832474").pn.)) and @ad<=20010330) ((US-5638425-$ or US-6240448-$ or US-6138100-$ or US-6052657-$ or US-6005860-$ or US-5937168-$ or US-5650799-$ or US-5625814-$ or US-5608624-$ or US-5559940-$ or US-5500920-$ or US-5434777-$ or US-5265014-$ or US-4612416-$ or US-6609091-$ or US-5625748-$ or US-4579533-$ or US-4406626-$ or US-5999595-$ or US-6581055-$ or US-5956706-$ or US-5878423-$).did. or (EP-892540-$).did.)) and (subscri$6 with address)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:33
130	2	(((5638425.pn. (("6377296" "5265014" "6240448" "6473734" "6601026" "6292830" "6003070" "5999595" "5937422" "5937168" "6005860" "6067516" "6434547" "5802314" "5500920" "5956681" "6052657" "5418951" "5434777" "5608624" "5625814" "5708829" "5748841" "5918222" "5970460" "5991712" "6073095" "6298326" "6345252" "6345253" "6363380" "6377927" "6434524" "6532444" "6584179" "6615172" "5559940" "6014377" "6366299" "6138100" "6272495" "6397329" "4612416" "6094649" "6169985" "6353831" "6424980" "6456308" "5650799" "5832474").pn.)) and @ad<=20010330) ((US-5638425-$ or US-6240448-$ or US-6138100-$ or US-6052657-$ or US-6005860-$ or US-5937168-$ or US-5650799-$ or US-5625814-$ or US-5608624-$ or US-5559940-$ or US-5500920-$ or US-5434777-$ or US-5265014-$ or US-4612416-$ or US-6609091-$ or US-5625748-$ or US-4579533-$ or US-4406626-$ or US-5999595-$ or US-6581055-$ or US-5956706-$ or US-5878423-$).did. or (EP-892540-$).did.)) and (subscri$6 same address)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:34

131	7	(((5638425.pn. (("6377296" "5265014" "6240448" "6473734" "6601026" "6292830" "6003070" "5999595" "5937422" "5937168" "6005860" "6067516" "6434547" "5802314" "5500920" "5956681" "6052657" "5418951" "5434777" "5608624" "5625814" "5708829" "5748841" "5918222" "5970460" "5991712" "6073095" "6298326" "6345252" "6345253" "6363380" "6377927" "6434524" "6532444" "6584179" "6615172" "5559940" "6014377" "6366299" "6138100" "6272495" "6397329" "4612416" "6094649" "6169985" "6353831" "6424980" "6456308" "5650799" "5832474").pn.)) and @ad<=20010330) ((US-5638425-$ or US-6240448-$ or US-6138100-$ or US-6052657-$ or US-6005860-$ or US-5937168-$ or US-5650799-$ or US-5625814-$ or US-5608624-$ or US-5559940-$ or US-5500920-$ or US-5434777-$ or US-5265014-$ or US-4612416-$ or US-6609091-$ or US-5625748-$ or US-4579533-$ or US-4406626-$ or US-5999595-$ or US-6581055-$ or US-5956706-$ or US-5878423-$).did. or (EP-892540-$).did.)) and (subscri$6 and address)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:34
132	28	(((5638425.pn. (("6377296" "5265014" "6240448" "6473734" "6601026" "6292830" "6003070" "5999595" "5937422" "5937168" "6005860" "6067516" "6434547" "5802314" "5500920" "5956681" "6052657" "5418951" "5434777" "5608624" "5625814" "5708829" "5748841" "5918222" "5970460" "5991712" "6073095" "6298326" "6345252" "6345253" "6363380" "6377927" "6434524" "6532444" "6584179" "6615172" "5559940" "6014377" "6366299" "6138100" "6272495" "6397329" "4612416" "6094649" "6169985" "6353831" "6424980" "6456308" "5650799" "5832474").pn.)) and @ad<=20010330) ((US-5638425-$ or US-6240448-$ or US-6138100-$ or US-6052657-$ or US-6005860-$ or US-5937168-$ or US-5650799-$ or US-5625814-$ or US-5608624-$ or US-5559940-$ or US-5500920-$ or US-5434777-$ or US-5265014-$ or US-4612416-$ or US-6609091-$ or US-5625748-$ or US-4579533-$ or US-4406626-$ or US-5999595-$ or US-6581055-$ or US-5956706-$ or US-5878423-$).did. or (EP-892540-$).did.)) and (real adj time)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:34
133	38	(((5638425.pn. (("6377296" "5265014" "6240448" "6473734" "6601026" "6292830" "6003070" "5999595" "5937422" "5937168" "6005860" "6067516" "6434547" "5802314" "5500920" "5956681" "6052657" "5418951" "5434777" "5608624" "5625814" "5708829" "5748841" "5918222" "5970460" "5991712" "6073095" "6298326" "6345252" "6345253" "6363380" "6377927" "6434524" "6532444" "6584179" "6615172" "5559940" "6014377" "6366299" "6138100" "6272495" "6397329" "4612416" "6094649" "6169985" "6353831" "6424980" "6456308" "5650799" "5832474").pn.)) and @ad<=20010330) ((US-5638425-$ or US-6240448-$ or US-6138100-$ or US-6052657-$ or US-6005860-$ or US-5937168-$ or US-5650799-$ or US-5625814-$ or US-5608624-$ or US-5559940-$ or US-5500920-$ or US-5434777-$ or US-5265014-$ or US-4612416-$ or US-6609091-$ or US-5625748-$ or US-4579533-$ or US-4406626-$ or US-5999595-$ or US-6581055-$ or US-5956706-$ or US-5878423-$).did. or (EP-892540-$).did.)) and (real adj time or interactive)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:34
134	45	(((5638425.pn. (("6377296" "5265014" "6240448" "6473734" "6601026" "6292830" "6003070" "5999595" "5937422" "5937168" "6005860" "6067516" "6434547" "5802314" "5500920" "5956681" "6052657" "5418951" "5434777" "5608624" "5625814" "5708829" "5748841" "5918222" "5970460" "5991712" "6073095" "6298326" "6345252" "6345253" "6363380" "6377927" "6434524" "6532444" "6584179" "6615172" "5559940" "6014377" "6366299" "6138100" "6272495" "6397329" "4612416" "6094649" "6169985" "6353831" "6424980" "6456308" "5650799" "5832474").pn.)) and @ad<=20010330) ((US-5638425-$ or US-6240448-$ or US-6138100-$ or US-6052657-$ or US-6005860-$ or US-5937168-$ or US-5650799-$ or US-5625814-$ or US-5608624-$ or US-5559940-$ or US-5500920-$ or US-5434777-$ or US-5265014-$ or US-4612416-$ or US-6609091-$ or US-5625748-$ or US-4579533-$ or US-4406626-$ or US-5999595-$ or US-6581055-$ or US-5956706-$ or US-5878423-$).did. or (EP-892540-$).did.)) and (real adj time or interactive on-line or on adj line)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:34
136	15	((US-5638425-$ or US-6240448-$ or US-6138100-$ or US-6052657-$ or US-6005860-$ or US-5937168-$ or US-5650799-$ or US-5625814-$ or US-5608624-$ or US-5559940-$ or US-5500920-$ or US-5434777-$ or US-5265014-$ or US-4612416-$ or US-6609091-$ or US-5625748-$ or US-4579533-$ or US-4406626-$ or US-5999595-$ or US-6581055-$ or US-5956706-$ or US-5878423-$).did. or (EP-892540-$).did.) and language	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:34

137	23	(((5638425.pn. (("6[redacted]96" "5265014" "6240448" "6473734" "6601026" "6292830" "6003070" "599[redacted] "5937422" "5937168" "6005860" "6067516" "6434547" "5802314" "5500920" "5956681" "6052657" "5418951" "5434777" "5608624" "5625814" "5708829" "5748841" "5918222" "5970460" "5991712" "6073095" "6298326" "6345252" "6345253" "6363380" "6377927" "6434524" "6532444" "6584179" "6615172" "5559940" "6014377" "6366299" "6138100" "6272495" "6397329" "4612416" "6094649" "6169985" "6353831" "6424980" "6456308" "5650799" "5832474").pn.)) and @ad<=20010330) ((US-5638425-$ or US-6240448-$ or US-6138100-$ or US-6052657-$ or US-6005860-$ or US-5937168-$ or US-5650799-$ or US-5625814-$ or US-5608624-$ or US-5559940-$ or US-5500920-$ or US-5434777-$ or US-5265014-$ or US-4612416-$ or US-6609091-$ or US-5625748-$ or US-4579533-$ or US-4406626-$ or US-5999595-$ or US-6581055-$ or US-5956706-$ or US-5878423-$).did. or (EP-892540-$).did.)) and (ambigu$8 disambig$8 unambigu$8)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:34
138	5	(((5638425.pn. (("6377296" "5265014" "6240448" "6473734" "6601026" "6292830" "6003070" "5999595" "5937422" "5937168" "6005860" "6067516" "6434547" "5802314" "5500920" "5956681" "6052657" "5418951" "5434777" "5608624" "5625814" "5708829" "5748841" "5918222" "5970460" "5991712" "6073095" "6298326" "6345252" "6345253" "6363380" "6377927" "6434524" "6532444" "6584179" "6615172" "5559940" "6014377" "6366299" "6138100" "6272495" "6397329" "4612416" "6094649" "6169985" "6353831" "6424980" "6456308" "5650799" "5832474").pn.)) and @ad<=20010330) ((US-5638425-$ or US-6240448-$ or US-6138100-$ or US-6052657-$ or US-6005860-$ or US-5937168-$ or US-5650799-$ or US-5625814-$ or US-5608624-$ or US-5559940-$ or US-5500920-$ or US-5434777-$ or US-5265014-$ or US-4612416-$ or US-6609091-$ or US-5625748-$ or US-4579533-$ or US-4406626-$ or US-5999595-$ or US-6581055-$ or US-5956706-$ or US-5878423-$).did. or (EP-892540-$).did.)) and (ambigu$8 disambig$8 unambigu$8) with data$4	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:34
139	1	1999-083967	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:34
140	1	10/405,166 09/842,358 10/422,933 09/845,769	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:34
141	1	09/834,852	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:34
142	24	(US-5638425-$ or US-6240448-$ or US-6138100-$ or US-6052657-$ or US-6005860-$ or US-5937168-$ or US-5650799-$ or US-5625814-$ or US-5608624-$ or US-5559940-$ or US-5500920-$ or US-5434777-$ or US-5265014-$ or US-4612416-$ or US-5956706-$ or US-5878423-$ or US-6609091-$ or US-5625748-$ or US-4579533-$ or US-4406626-$ or US-5999595-$ or US-6581055-$).did. or (US-5638425-$ or EP-892540-$).did.	USPAT; DERWENT	2004/06/01 13:34
143	17	((US-5638425-$ or US-6240448-$ or US-6138100-$ or US-6052657-$ or US-6005860-$ or US-5937168-$ or US-5650799-$ or US-5625814-$ or US-5608624-$ or US-5559940-$ or US-5500920-$ or US-5434777-$ or US-5265014-$ or US-4612416-$ or US-5956706-$ or US-5878423-$ or US-6609091-$ or US-5625748-$ or US-4579533-$ or US-4406626-$ or US-5999595-$ or US-6581055-$).did. or (US-5638425-$ or EP-892540-$).did.) and messag$4	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:34

144	15	((US-5638425-$ or US-6240448-$ or US-6138100-$ or US-6052657-$ or US-6005860-$ or US-5937168-$ or US-5650799-$ or US-5625814-$ or US-5608624-$ or US-5559940-$ or US-5500920-$ or US-5434777-$ or US-5265014-$ or US-4612416-$ or US-5956706-$ or US-5878423-$ or US-6609091-$ or US-5625748-$ or US-4579533-$ or US-4406626-$ or US-5999595-$ or US-6581055-$).did. or (US-5638425-$ or EP-892540-$).did.) and name	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:34
145	22	((US-5638425-$ or US-6240448-$ or US-6138100-$ or US-6052657-$ or US-6005860-$ or US-5937168-$ or US-5650799-$ or US-5625814-$ or US-5608624-$ or US-5559940-$ or US-5500920-$ or US-5434777-$ or US-5265014-$ or US-4612416-$ or US-5956706-$ or US-5878423-$ or US-6609091-$ or US-5625748-$ or US-4579533-$ or US-4406626-$ or US-5999595-$ or US-6581055-$).did. or (US-5638425-$ or EP-892540-$).did.) and (nam$4 person individual employee)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:34
146	24	((US-5638425-$ or US-6240448-$ or US-6138100-$ or US-6052657-$ or US-6005860-$ or US-5937168-$ or US-5650799-$ or US-5625814-$ or US-5608624-$ or US-5559940-$ or US-5500920-$ or US-5434777-$ or US-5265014-$ or US-4612416-$ or US-5956706-$ or US-5878423-$ or US-6609091-$ or US-5625748-$ or US-4579533-$ or US-4406626-$ or US-5999595-$ or US-6581055-$).did. or (US-5638425-$ or EP-892540-$).did.) and (nam$4 person individual employee identi$8)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:34
147	14	((US-5638425-$ or US-6240448-$ or US-6138100-$ or US-6052657-$ or US-6005860-$ or US-5937168-$ or US-5650799-$ or US-5625814-$ or US-5608624-$ or US-5559940-$ or US-5500920-$ or US-5434777-$ or US-5265014-$ or US-4612416-$ or US-5956706-$ or US-5878423-$ or US-6609091-$ or US-5625748-$ or US-4579533-$ or US-4406626-$ or US-5999595-$ or US-6581055-$).did. or (US-5638425-$ or EP-892540-$).did.) and name and database	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:34
148	7	(US-6005860-$ or US-5956706-$ or US-5625814-$ or US-5608624-$ or US-6609091-$ or US-5638425-$).did. or (US-5638425-$).did.	USPAT; DERWENT	2004/06/01 13:34
149	7	((((US-5638425-$ or US-6240448-$ or US-6138100-$ or US-6052657-$ or US-6005860-$ or US-5937168-$ or US-5650799-$ or US-5625814-$ or US-5608624-$ or US-5559940-$ or US-5500920-$ or US-5434777-$ or US-5265014-$ or US-4612416-$ or US-5956706-$ or US-5878423-$ or US-6609091-$ or US-5625748-$ or US-4579533-$ or US-4406626-$ or US-5999595-$ or US-6581055-$).did. or (US-5638425-$ or EP-892540-$).did.) and name and database) and ((US-6005860-$ or US-5956706-$ or US-5625814-$ or US-5608624-$ or US-6609091-$ or US-5638425-$).did. or (US-5638425-$).did.)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:34
150	4	((((US-5638425-$ or US-6240448-$ or US-6138100-$ or US-6052657-$ or US-6005860-$ or US-5937168-$ or US-5650799-$ or US-5625814-$ or US-5608624-$ or US-5559940-$ or US-5500920-$ or US-5434777-$ or US-5265014-$ or US-4612416-$ or US-5956706-$ or US-5878423-$ or US-6609091-$ or US-5625748-$ or US-4579533-$ or US-4406626-$ or US-5999595-$ or US-6581055-$).did. or (US-5638425-$ or EP-892540-$).did.) and name and database) and ((US-6005860-$ or US-5956706-$ or US-5625814-$ or US-5608624-$ or US-6609091-$ or US-5638425-$).did. or (US-5638425-$).did.)) and database with name with (interrogat$6 query$4 quest$4 search$4 find$4 locat$4 list$4)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:34
151	4	((US-6005860-$ or US-5956706-$ or US-5625814-$ or US-5608624-$ or US-6609091-$ or US-5638425-$).did. or (US-5638425-$).did.) and database with name with (interrogat$6 query$4 quest$4 search$4 find$4 locat$4 list$4)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/06/01 13:34

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1 **Integrating speech and two-dimensional gesture input-a study of redundancy between modes**
McKenzie Mills, K.; Alty, J.L.;
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Pages:6 - 13

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2 **An improved speaker identification technique employing multiple representations of the linear prediction coefficients**
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3 **A multi-input current-mode fuzzy integrated circuit for pattern recognition**
Gu Lin; Bingxue Shi;
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Mikhael, W.B.; Premakanthan, P.;
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2641 2654 #8 IC AA

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant	:	Edwin A. Suominen	Art Unit:	:	2641
Serial No.	:	10/061,052	Examiner:	:	Nolan, D.
Filing Date	:	January 28, 2002			
Title	:	Text Processing System			

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

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RESPONSE TO OFFICE ACTION

Dear Sir:

Prior to examination of this Continuation Application, applicant submits the following amendments:

- **Amendments to the Claims** are reflected in the listing of claims that begins on page 2 of this paper.
- **Remarks** are on page 7 of this paper.

An Information Disclosure Statement with Form PTO-1449 is enclosed with a copy of a non-patent reference cited therein.

Also enclosed is a copy of one page from applicant's original preliminary amendment in this application, as discussed in the remarks below.

No fees are due.

AMENDMENTS TO THE CLAIMS

Claims 1-61 (cancelled).

Claim 62 (previously presented) A system for generating text responsive to message input of a first type and a second type, the system comprising:

(a) a unified message model including:

(1) a shared language model;

(2) a first model specific to a first type of message recognition; and

(3) a second model specific to a second type of message recognition;

(b) a first message recognizer, responsive to the first type of message input to provide text data in accordance with both the shared language model and the first model; and

(c) a second message recognizer, responsive to the second type of message input to provide text data in accordance with both the shared language model and the second model;

wherein

(d) the shared language model is trainable responsive to user correction of misrecognition by either of the first and second message recognizers, thereby improving accuracy of each of the first and second message recognizers.

Claims 63-80 (cancelled).

Claim 81 (currently amended) The ~~method~~ system of claim 62 wherein:

(a) the first type of message recognition is speech recognition, the first type of message input is voice input, and the first model is an acoustic model; and

(b) the second type of message recognition is handwriting recognition, the second type of message input is freehand input, and the second model is a handwriting model.

Claim 82 (previously presented) The system of claim 62 wherein the shared language model comprises a syntactic model and a semantic model.

Claim 83 (currently amended) A method for performing message recognition with a shared language model, the method comprising:

(a) performing message recognition of a first type, responsive to a first type of message input, to provide text data in accordance with both a shared language model and a first model specific to the first type of message recognition;

(b) performing message recognition of a ~~first~~ second type, responsive to a ~~first~~ second type of message input, to provide text data in accordance with both the shared language model and a second model specific to the second type of message recognition; and

(c) training the shared language model responsive to user correction of error in message recognition of either of the first and second types, thereby improving accuracy of each of the first and second types of message recognition.

Claim 84 (previously presented) The method of claim 83 wherein:

(a) performing the first type of message recognition comprises performing speech recognition responsive to voice input in accordance with the shared language model and a first model that is an acoustic model; and

(b) performing the second type of message recognition comprises performing handwriting recognition responsive to freehand input in accordance with the shared language model and a second model that is a handwriting model.

Claim 85 (currently amended) The method of claim 83 wherein performing message recognition in accordance with the shared language model comprises performing message recognition in accordance with a syntactic model and a semantic model.

Claim 86 (previously presented) A system for performing message recognition with a shared language model, the system comprising:

(a) means for performing message recognition of a first type, responsive to a first type of message input, to provide text data in accordance with both a shared language model and a first model specific to the first type of message recognition; and

(b) means for performing message recognition of a second type, responsive to a second type of message input, to provide text data in accordance with both the shared language model and a second model specific to the second type of message recognition.

Claim 87 (new) The system of claim 86 wherein:

(a) the first type of message recognition is speech recognition, the first type of message input is voice input, and the first model is an acoustic model; and

(b) the second type of message recognition is handwriting recognition, the second type of message input is freehand input, and the second model is a handwriting model.

Claim 88 (new) The system of claim 86 wherein the shared language model comprises a syntactic model and a semantic model.

Claim 89 (new) The system of claim 86 further comprising means for training the shared language model responsive to user correction of error in message recognition of either of the first and second types, thereby improving accuracy of each of the first and second types of message recognition.

Claim 90 (new) The system of claim 89 wherein the means for training the shared language model includes means for (a) specifying a selection from visual indicia of dictated text that has been erroneously generated, and (b) correcting the selection.

Claim 91 (new) The system of claim 81 further comprising a stylus, wherein the shared language model is trainable responsive to user correction of misrecognition by the first message recognizer by (a) movement of the stylus across visual indicia of dictated text that has been erroneously generated to specify a selection from the text, and (b) correction of the selection.

Claim 92 (new) The system of claim 91 wherein:

(a) the stylus includes a pointing interface and a microphone;

(b) the system further comprises a tablet responsive to the pointing interface;

(c) the voice input is from the microphone; and

(d) the freehand input is from the pointing interface being manually manipulated on the tablet.

Claim 93 (new) The system of claim 92 wherein the visual indicia of dictated text appears on the tablet.

Claim 94 (new) The method of claim 84 wherein training the shared language model includes (a) moving a stylus across visual indicia of dictated text that has been erroneously generated to specify a selection from the text, and (b) correcting the selection.

Claim 95 (new) The method of claim 94 wherein:

(a) performing speech recognition responsive to voice input includes responding to voice input from a microphone in the stylus; and

(b) performing handwriting recognition responsive to freehand input includes responding to manual manipulation of the stylus on a tablet.

Claim 96 (new) The method of claim 95 wherein the visual indicia of dictated text appears on the tablet.

REMARKS

In a telephone call to the undersigned on April 27, the Examiner indicated that page 12 of the Supplemental Preliminary Amendment mailed July 30, 2002 is missing from the official file. A copy of that page from the undersigned's file of this application is enclosed.

Responsive to the Examiner's query in the telephone call, claim 85 is amended to include a reference to its parent claim 83. Other typographical errors are corrected in claims 81 and 83. Applicant has also added 10 new dependent claims.

Applicant respectfully requests allowance of all 17 claims now pending in the application. Please feel free to telephone the undersigned (who is also the applicant) if it would in any way advance prosecution of this application.

Respectfully submitted,

Dated: April 28, 2004

Edwin A. Suominen
Reg. No. 43,174

LOUIS J. HOFFMAN, P.C.
14614 North Kierland Boulevard
Suite 300
Scottsdale, AZ 85254
(480) 948-3295

O I P E JC109 APR 2 8 2004 PATENT & TRADEMARK OFFICE

ABSTRACT

Certain disclosed methods and systems perform multiple different types of message recognition using a shared language model. Message recognition of a first type is performed responsive to a first type of message input (e.g., speech), to provide text data in accordance with both the shared language model and a first model specific to the first type of message recognition (e.g., an acoustic model). Message recognition of a second type is performed responsive to a second type of message input (e.g., handwriting), to provide text data in accordance with both the shared language model and a second model specific to the second type of message recognition (e.g., a model that determines basic units of handwriting conveyed by freehand input). Accuracy of both such message recognizers can be improved by user correction of misrecognition by either one of them. Numerous other methods and systems are also disclosed.

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#9 a/A 5/12/04

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant	:	Edwin A. Suominen	Art Unit:	:	2641
Serial No.	:	10/061,052	Examiner:	:	Nolan, D.
Filing Date	:	January 28, 2002			
Title	:	Text Processing System			

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT

Dear Sir:

Applicant discloses the following references, which are listed on Form PTO-1449 attached to this document. Pursuant to the OG Notice of August 5, 2003, copies of the cited U.S. Patents and published patent applications are not included.

Five of the U.S. patent references, listed on the PTO-1449 as items C, F, G, I, and J, were cited by the Examiner in the parent application Serial No. 09/616,157.

In view of the discussion in the parent application of two patents to Bellegarda *et al.* (U.S. Patents 5,502,774 and 5,828,999), applicant wishes to note that two additional Bellegarda references, U.S. Patents 6,154,722 (cited herein) and 6,285,785 (cited with the application's original IDS), are now of record in the present application.

Please feel free to telephone the undersigned (who is also the applicant) if it would in any way advance prosecution of this application.

Respectfully submitted,

Dated: April 28, 2004

Edwin A. Suominen
Reg. No. 43,174

14614 North Kierland Boulevard
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Scottsdale, AZ 85254
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RESPONSE TO NOTICE

Dear Sir:

Responsive to the Notice to File Corrected Application Papers mailed April 1, 2002, applicant submits the following:

- Supplemental Preliminary Amendment that includes the required abstract of the disclosure as well as various amendments and remarks.
- Corrected drawing sheets, as required.
- Information Disclosure Statement with Form PTO-1449 and copies of recently published reference not cited in the parent to this application.
- Check for $200 to cover the small-entity fee for a requested two-month extension of time.

Please feel free to telephone the undersigned (who is also the applicant) if it would in any way advance prosecution of this application.

Respectfully submitted,

Dated: July 30, 2002

By: _____

Edwin A. Suominen
Reg. No. 43,174

14614 North Kierland Boulevard
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(480) 948-3295

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(Name) (Signature)

SUPPLEMENTAL PRELIMINARY AMENDMENT

Dear Sir:

Applicant submits the following amendments and remarks prior to examination of this application. Upon entry of this amendment, claims 62 and 81-86 are pending in the application. Claims 62, 83, and 86 are independent.

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Amendments

Below are instructions identifying locations for deletion, replacement, or addition of paragraphs and claims. Marked-up versions of any replacement paragraphs or amended claims are provided toward the end of this amendment in a section entitled Version with Markings to Show Changes Made. Please note that the marked-up version does not include any added or deleted claims or paragraphs.

ABSTRACT:

PLEASE ADD the abstract enclosed on a separate sheet at the end of this amendment.

IN THE CLAIMS:

PLEASE CANCEL claim 58 without prejudice.

PLEASE AMEND the following claim by substituting the like-numbered claim below:

62. A system for generating text responsive to message input of a first type and a second type, the system comprising:

(a) a unified message model including:

(1) a shared language model;

(2) a first model specific to a first type of message recognition; and

(3) a second model specific to a second type of message recognition;

(b) a first message recognizer, responsive to the first type of message input to provide text data in accordance with both the shared language model and the first model; and

(c) a second message recognizer, responsive to the second type of message input to provide text data in accordance with both the shared language model and the second model;

wherein

(d) the shared language model is trainable responsive to user correction of misrecognition by either of the first and second message recognizers, thereby improving accuracy of each of the first and second message recognizers.

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PLEASE ADD the following claims:

81. The method of claim 62 wherein:

(a) the first type of message recognition is speech recognition, the first type of message input is voice input, and the first model is an acoustic model; and

(b) the second type of message recognition is handwriting recognition, the second type of message input is freehand input, and the second model is a handwriting model.

82. The system of claim 62 wherein the shared language model comprises a syntactic model and a semantic model.

83. A method for performing message recognition with a shared language model, the method comprising:

(a) performing message recognition of a first type, responsive to a first type of message input, to provide text data in accordance with both a shared language model and a first model specific to the first type of message recognition;

(b) performing message recognition of a first type, responsive to a first type of message input, to provide text data in accordance with both the shared language model and a second model specific to the second type of message recognition; and

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(c) training the shared language model responsive to user correction of error in message recognition of either of the first and second types, thereby improving accuracy of each of the first and second types of message recognition.

84. The method of claim 83 wherein:

(a) performing the first type of message recognition comprises performing speech recognition responsive to voice input in accordance with the shared language model and a first model that is an acoustic model; and

(b) performing the second type of message recognition comprises performing handwriting recognition responsive to freehand input in accordance with the shared language model and a second model that is a handwriting model.

85. The method of claim wherein performing message recognition in accordance with the shared language model comprises performing message recognition in accordance with a syntactic model and a semantic model.

86. A system for performing message recognition with a shared language model, the system comprising:

(a) means for performing message recognition of a first type, responsive to a first type of message input, to provide text data in accordance with both a shared language model and a first model specific to the first type of message recognition; and

(b) means for performing message recognition of a second type, responsive to a second type of message input, to provide text data in accordance with both the shared language model and a second model specific to the second type of message recognition.

Remarks

This continuation application was filed with a preliminary amendment cancelling all claims except independent claims 58 and 62 to limit excess claim fees. With this Supplemental Preliminary Amendment, applicant now cancels claim 58, amends claim 62, and adds various generally related claims.

It is applicant's hope that the amendment to claim 62 will clarify its recitation of a shared language model and thus simplify the Examiner's task of reconsidering, in light of applicant's remarks below, the pertinent rejections made in the parent to this application. It is with the same hope that applicant has chosen not to seek allowance of other independent claims rejected in the parent application at this time, although some of the subject matter may be reinstated later.

20030250.2007

THE REJECTION BASED ON DITZIK ALONE

Part I of the Rejection

In the parent application, claims 62-64 (now claims 62 and 81-82) were rejected as obvious over U.S. Patent 6,167,376 to Ditzik alone. Independent claim 62 is directed to a message recognition system that includes:

> a unified message model including: (1) a shared language model;[1] (2) a first model specific to a first type of message recognition; and (3) a second model specific to a second type of message recognition.

1 Emphasis added, as with all quotations taken from the application's specification and claims.

The Examiner acknowledged that Ditzik does not specifically claim a shared language model. Applicant agrees, and notes that Ditzik does not teach or suggest a shared language model either. However, the rejection asserts that

> it would have been obvious [in view of Ditzik?] . . . to avoid the problems that would arise in attempting to distinguish between differences in vocabularies and errors in recognition.

Respectfully, applicant does not know that such problems are even an issue in message recognition, and is unaware of how recognition errors can be caused by "differences in vocabularies." And, even if accurate in some unrelated context, the rejection fails to show any suggestion or motivation to modify Ditzik to yield a shared language model of any sort, much less one that can be trained in the manner of claim 62. Without such a showing, the rejection cannot stand. Sibia Neurosciences vs. Cadus Pharmaceutical, 55 U.S.P.Q. 2d 1927, 1931 (Fed. Cir. 2000) (Allowing for possibility of obviousness over a single prior art reference but requiring "a showing of a suggestion or motivation to modify the teachings of that reference to the claimed invention in order to support the obviousness conclusion").

Part II of the Rejection

The rejection then goes on to acknowledge (apparently) that sharing functions of a language model may not be clearly disclosed in Ditzik[2] but states that "it is well within the typical design capabilities of the DSP processor . . . to do so." While this statement is perhaps relevant to the claims' allowability under 35 U.S.C. § 112 as enabled by applicant's specification, it clearly does not show any teaching or suggestion in any cited reference that would support a § 103 rejection.

In addition, applicant notes that claim 62 does not merely recite a shared language model *per se*. Other claim limitations are present, and "the claimed invention as a whole must be considered." MPEP 2141.02.

2 Applicant finds the rejection somewhat confusing on this point. It says, "[w]hile Ditzik combines the two processes, *sharing* the functions in a single process may be clearly disclosed although it is well within the typical design capabilities of the *DSP processor* (column 6 lines 25-27) to do so." The only reading of the statement that makes sense to applicant is one in which the word "not" was inadvertently omitted between "may" and "be."

In addition to the shared language model limitation quoted above, claim 62 recites at least two message recognizers. One is

> responsive to the first type of message input to provide text data in accordance with both the shared language model and the first model.

The other message recognizer (and again, there can be more than two) is

> responsive to the second type of message input to provide text data in accordance with both the shared language model and the second model.

The shared language model is

> trainable responsive to user correction of misrecognition by either of the first and second message recognizers, thereby improving accuracy of each of the first and second message recognizers.

By sharing a single language model while also employing their own separate models, the two message recognizers of the invention of claim 62 can both rely on a common, mutually beneficial language model while also facilitating training of that model by user correction of errors they separately make during message recognition. Advantageously, such training improves accuracy of both message recognizers in subsequent message recognition.

An example of this beneficial sharing of a language model may be better understood with reference to FIG. 3B and a descriptive portion of that figure in applicant's specification:

> Local message model 316 includes a language model 350, an acoustic model 356, and a handwriting model 358. . . . Speech recognizer 312 generates text data in accordance with acoustic model 356 and shared language model 350. Advantageously, user training of language model 350 can improve accuracy of both speech recognizer 312 and handwriting recognizer 314. For example, user correction of misrecognition by speech recognizer 312 adapts syntactic model 352 of shared language model 350. Both speech recognizer 312 and handwriting recognizer 314 then operate in accordance with the adapted syntactic model. [P32/L26 - P33/L9]

The claimed arrangement achieves advantageous results that are not provided by its elements in any conventional configuration. One such result is that

> the shared language model may be trained by user correction of any[3] type of erroneous message recognition performed by the message recognizer. [P32/L13]

Another example may provide a still clearer understanding of this point. Consider the case of a user who enters a sequence of words by writing them by hand, corrects a mistake in a handwriting recognizer's attempt to provide text data responsive to the freehand input, and later enters the same sequence of words by dictating them, i.e., with voice input. By correcting the handwriting recognizer's error, the user can refine a syntactic language model to better predict that sequence of words in subsequent handwritten entry of those words.

Significantly, the accuracy improvement does not stop with the handwriting recognizer when things happen in accordance with claim 62. Advantageously, the speech recognizer also benefits from the user correction because it is able to also do a better job on the same sequence of words when the user (in this example) later dictates them. The claimed arrangement makes this improvement possible because it allows the speech recognizer to share the syntactic language model with the handwriting recognizer. The user's correction of the handwriting recognition mistake thus also helps the speech recognizer to better predict the sequence of words in question.

In sum, the clear distinctions between claim 62 (in both its original and amended forms) over Ditzik make the claim and its dependents plainly allowable over that reference.

3 The word "any" indicates a case where the message recognizer performs only message recogntion that can be corrected in a way that trains the shared language model. Exceptions that still fall within the scope of claim 62 are clearly possible, for example where a third type of message recognition is also performed without the possibility of such correction.

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THE REJECTION BASED ON DITZIK AND BELLEGARDA

Claims 62-64 were further rejected in the parent application as obvious over Ditzik in view of U.S. Patent 5,502,774 to Bellegarda et al. Applicant discussed that reference in the "Background of the Invention" section of his application as filed:

> U.S. Patent 5,502,774 to Bellegarda discloses a multi-source message recognizer that includes both a speech recognizer and a handwriting recognizer. [Bellegarda] briefly states, at column 4, lines 54-58, that the training of respective source parameters for speech and handwriting recognizers may be done globally using weighted sum formulae of likelihood scores with weighted coefficients. [P5/L6-12, emphasis added]

In citing Bellegarda, however, the rejection asserts that,

> since Bellegarda *et al.* does share processes as cited above [with reference to Ditzik], it would have been obvious . . . to incorporate recognition of both as a means to reduce the overhead of supporting and maintaining separate processes for ostensibly the same function.

This assertion fails to note the significant distinction between Bellegarda's global training using weighted sum formulae (see, e.g., Bellegarda FIG. 1) and the arrangement of claim 62 (as originally filed or as amended) of a shared language model with type-specific message models.

As discussed above, the claimed arrangement allows user correction of one type of message recognition to also improve subsequent accuracy of another type of message recognition. None of the cited references contains any suggestion or motivation for one of ordinary skill in the art to combine the Ditzik and Bellegarda references in a way that would arrive at that claimed arrangement and its advantageous result.

The rejections fail to satisfy a requirement that has been firmly maintained by the Federal Circuit -- to show a suggestion or motivation to combine references in a conclusion of obviousness. In a recent decision overturning a board-affirmed rejection, the Federal Circuit admonished that "the factual inquiry whether to combine references must be thorough and searching," and "must be based on objective evidence of record." In re Sang-Su Lee, 61 U.S.P.Q. 2d 1430 (2002). The court found an examiner's statement

that "[a] motivation would be that the automatic demonstration mode is user friendly and it functions as a tutorial" to "inadequately address the issue of motivation to combine." Id. The court concluded that "[t]his factual question of motivation . . . could not be resolved on subjective belief and unknown authority." Id.

CONCLUSION

Because none of the references of record teach or suggest any modification to Ditzik or Bellegarda -- or suggest any combination of references -- that would meet the limitations of claim 62, applicant respectfully requests allowance of that claim. For similar reasons, applicant solicits allowance of claims 81-82 (which depend on claim 62), method claim 83 and its dependent claims 84-85, and means-plus-function claim 86.

Please feel free to telephone the undersigned (who is also the applicant) if it would in any way advance prosecution of this application.

Respectfully submitted,

Dated: July 30, 2002

By: _____

Edwin A. Suominen
Reg. No. 43,174

14614 North Kierland Boulevard
Suite 300
Scottsdale, Arizona 85254
(480) 948-3295

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

PLEASE AMEND the following claim:

62. A system for generating text responsive to message input of a first type and a second type, the system comprising:

(a) a unified message model including:

(1) a shared language model;

(2) a first model specific to a first type of message recognition; and

(3) a second model specific to a second type of message recognition;

(b) a first message recognizer, responsive to the first type of message input to provide text data in accordance with both the shared language model and the first model; and

(c) a second message recognizer, responsive to the second type of message input to provide text data in accordance with both the shared language model and the second model;

wherein

(d) the shared language model is trainable responsive to user correction of misrecognition by either of the first and second message recognizers, thereby improving accuracy of each of the first and second message recognizers.

ABSTRACT

Certain disclosed methods and systems perform multiple different types of message recognition using a shared language model. Message recognition of a first type is performed responsive to a first type of message input (e.g., speech), to provide text data in accordance with both the shared language model and a first model specific to the first type of message recognition (e.g., an acoustic model). Message recognition of a second type is performed responsive to a second type of message input (e.g., handwriting), to provide text data in accordance with both the shared language model and a second model specific to the second type of message recognition (e.g., a model that determines basic units of handwriting conveyed by freehand input). Accuracy of both such message recognizers can be improved by user correction of misrecognition by either one of them. Numerous other methods and systems are also disclosed.

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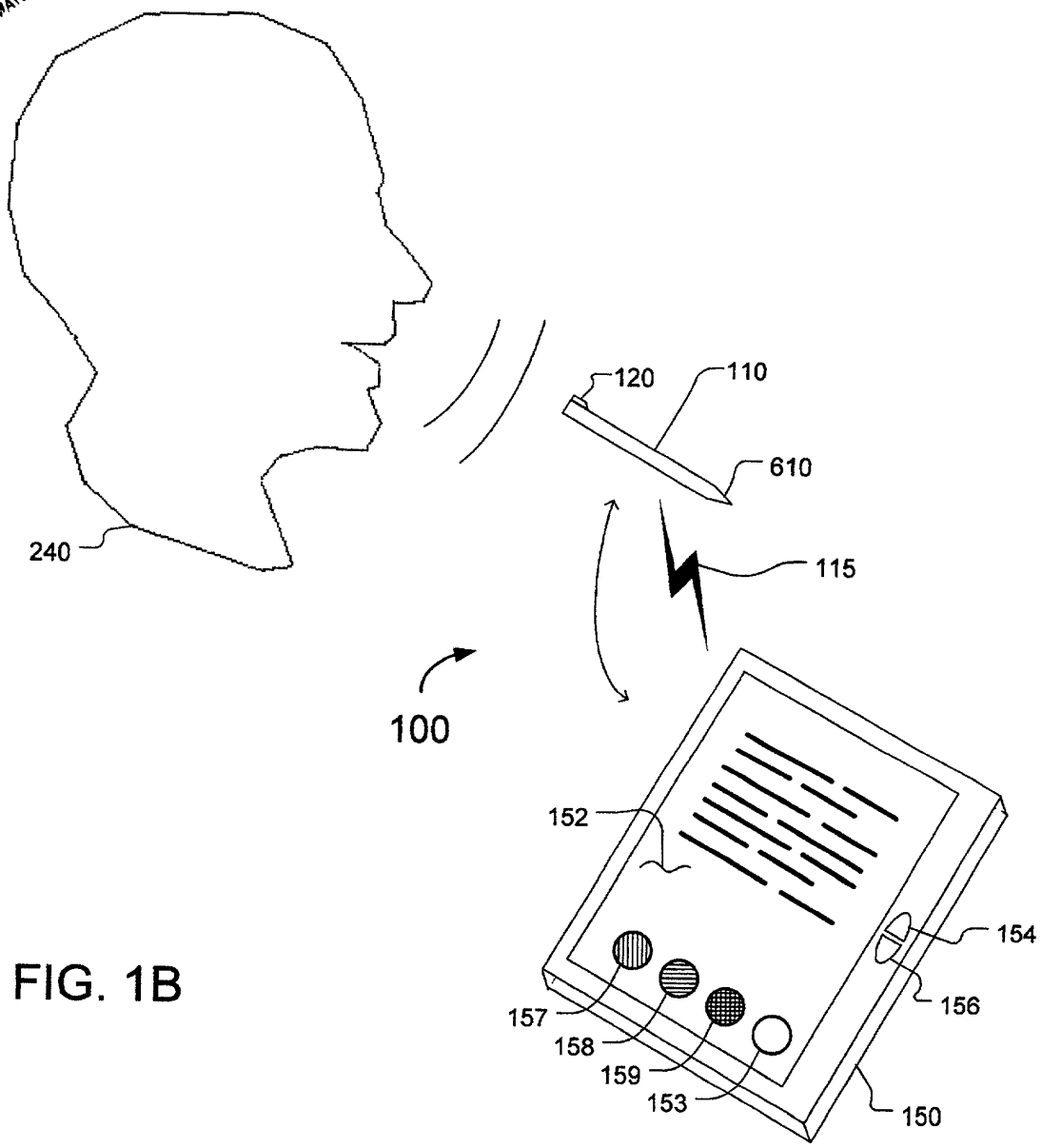


FIG. 1B

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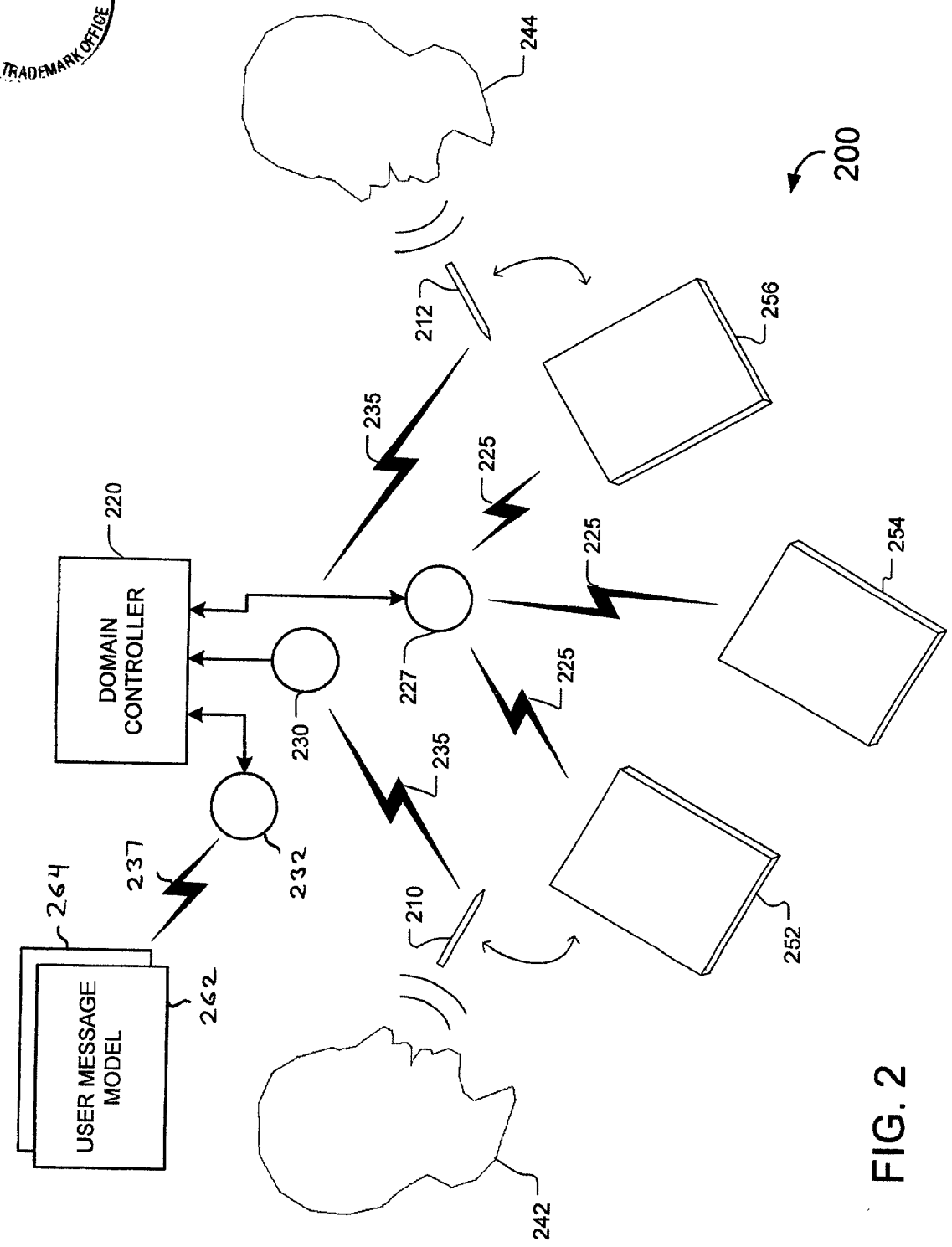
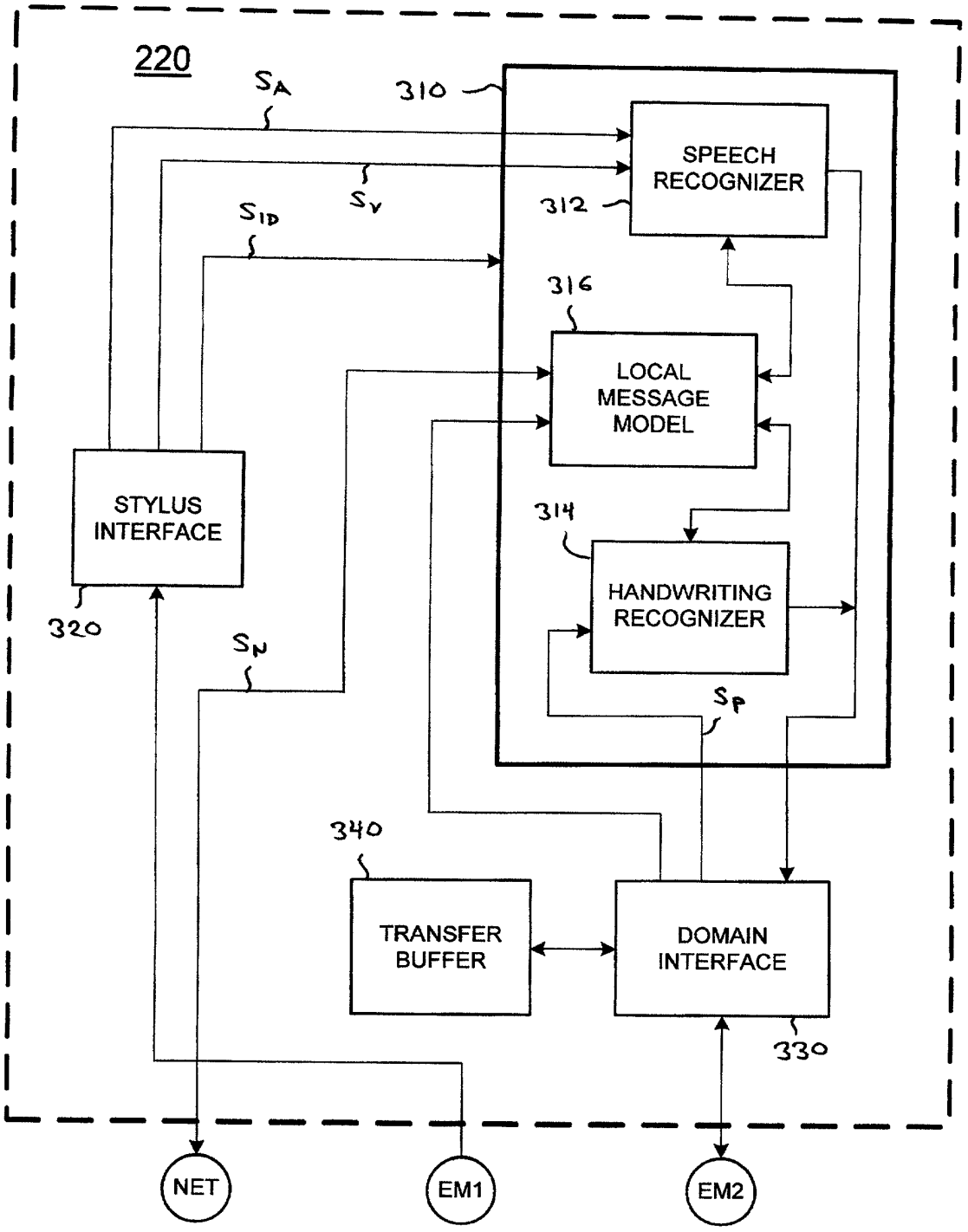


FIG. 2

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FIG. 3A



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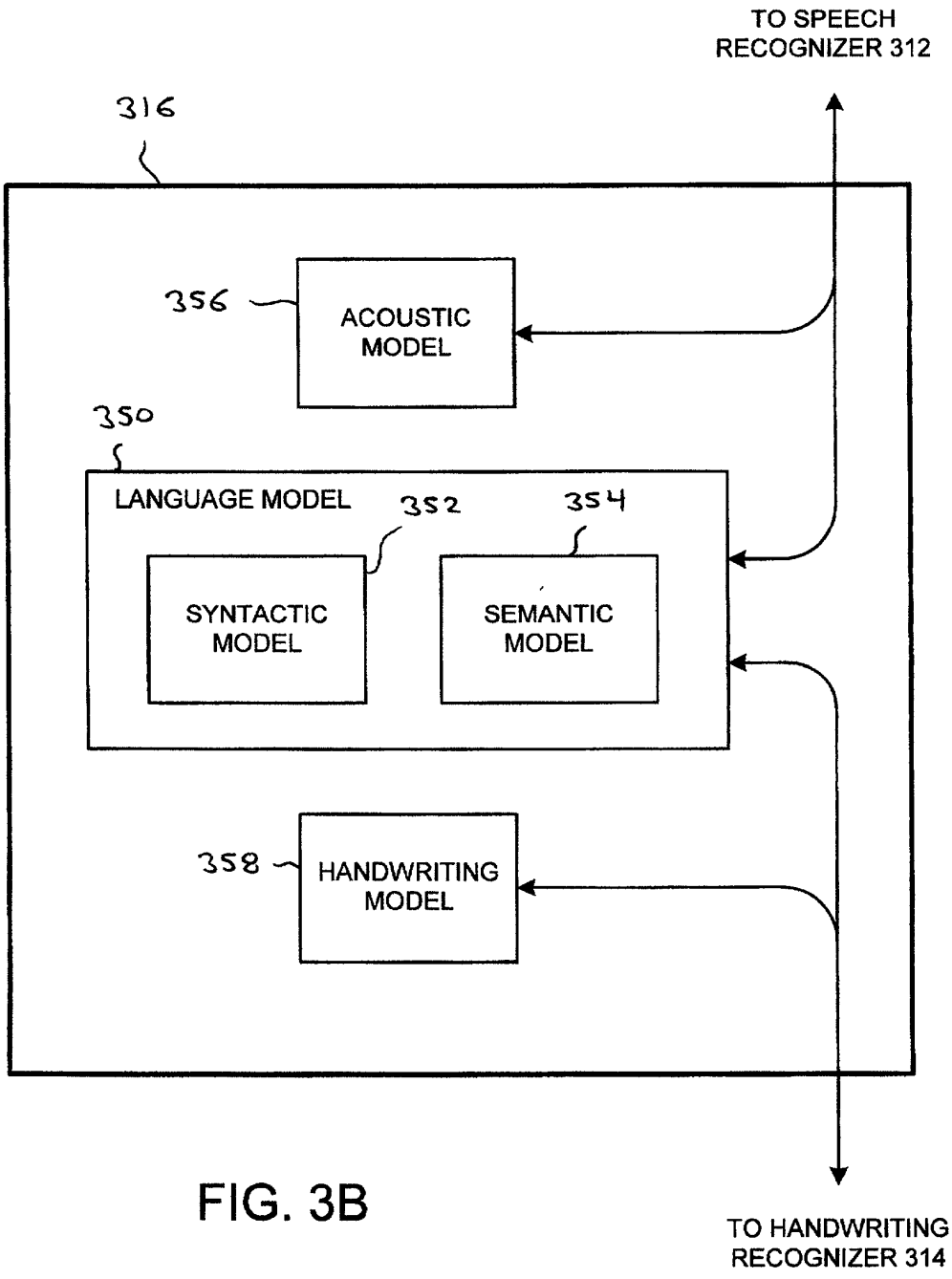


FIG. 3B

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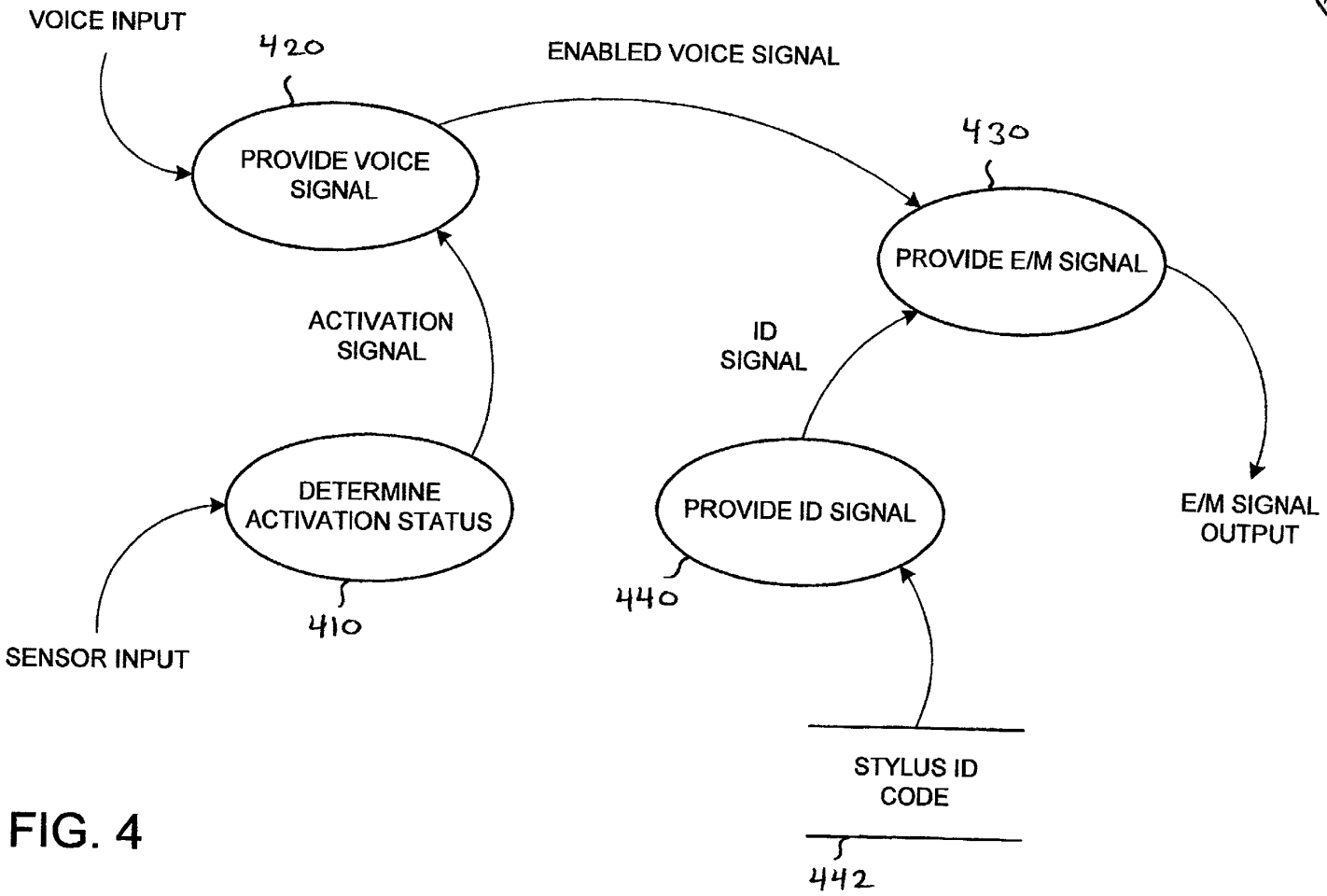
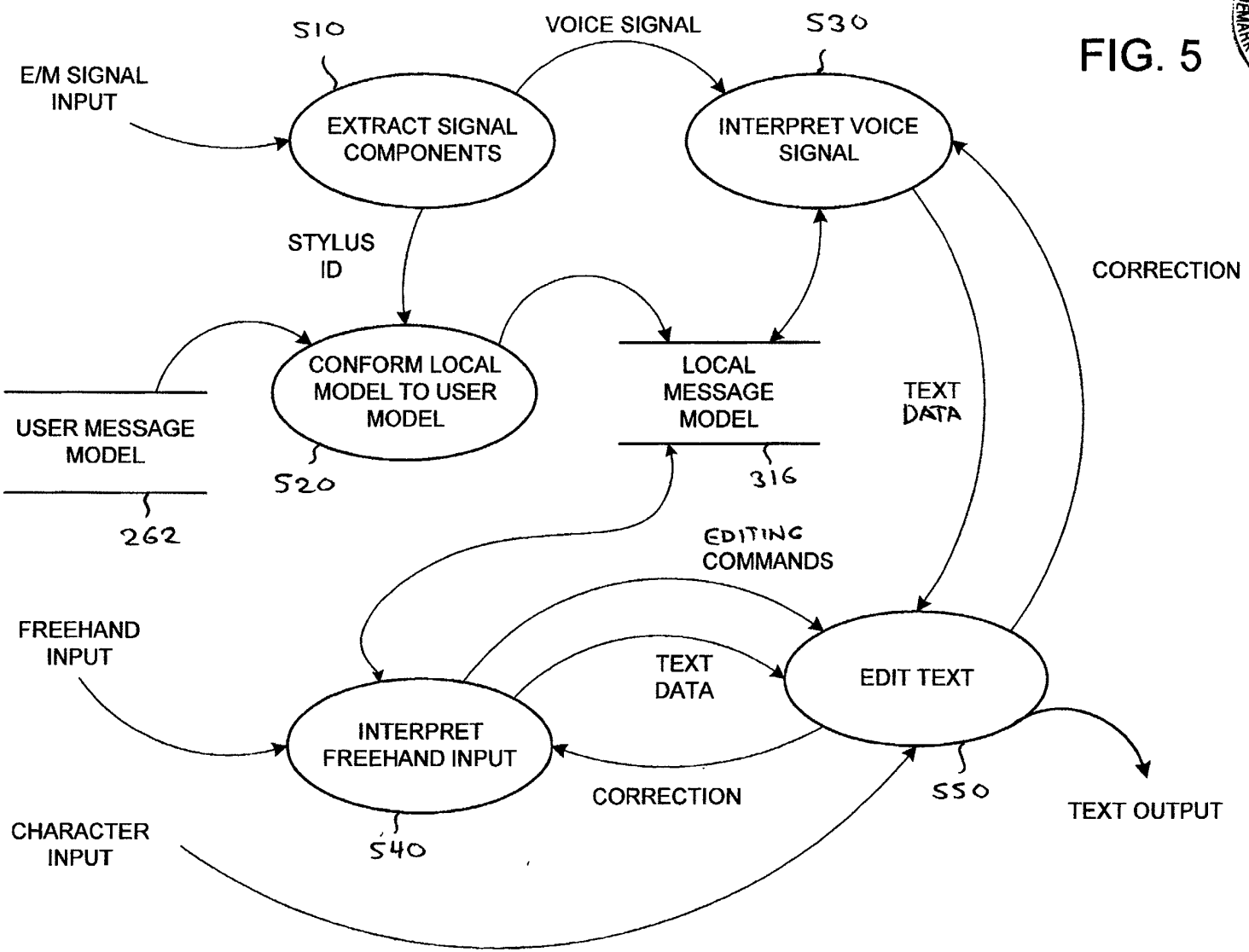


FIG. 4

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FIG. 5



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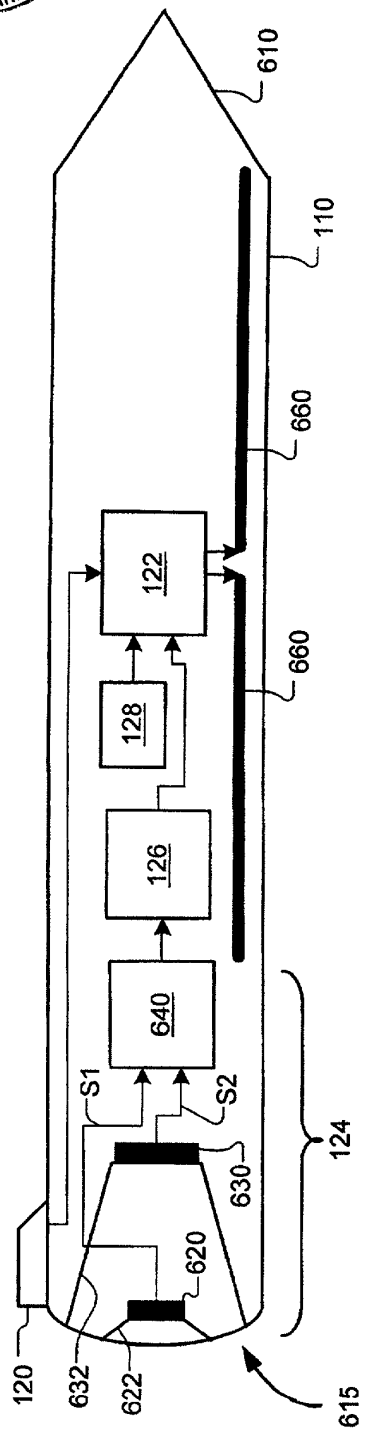


FIG. 6A

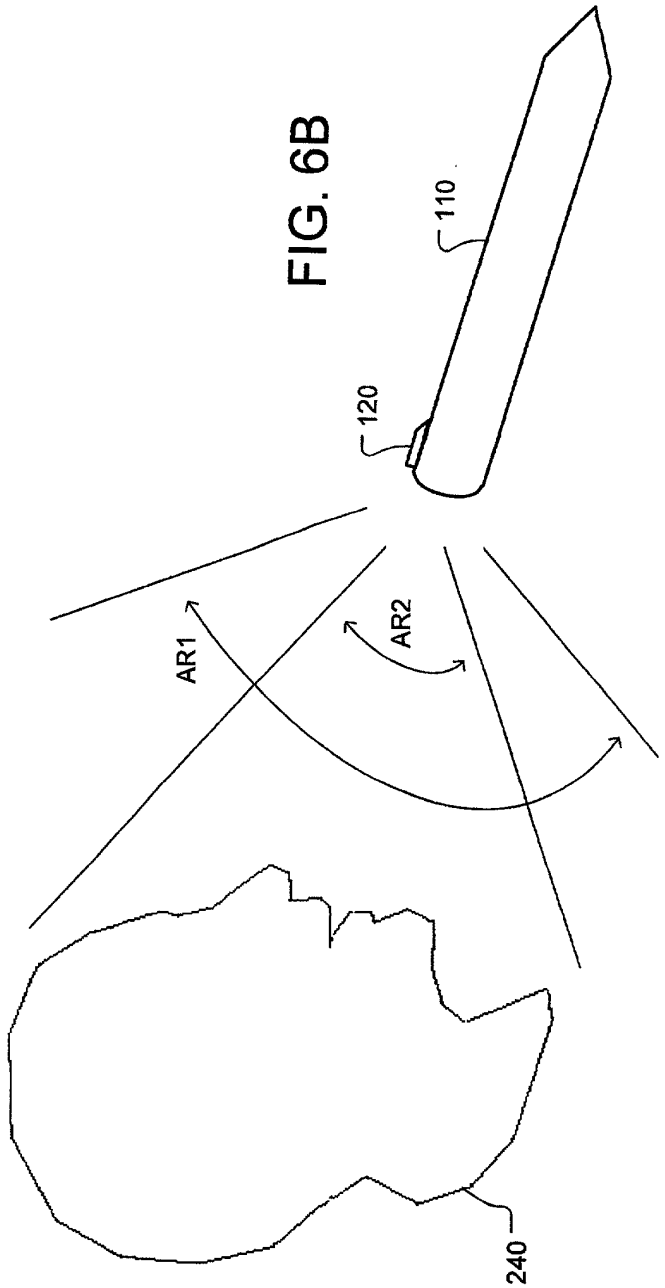


FIG. 6B

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FIG. 8A

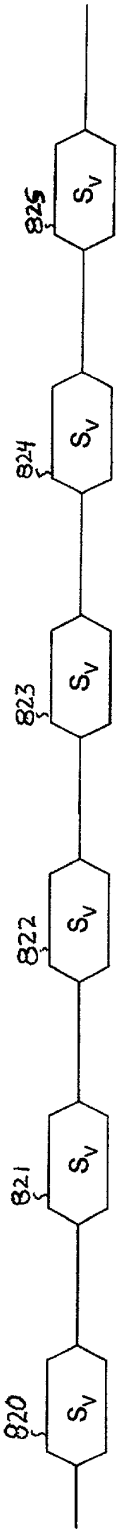


FIG. 8B



FIG. 8C

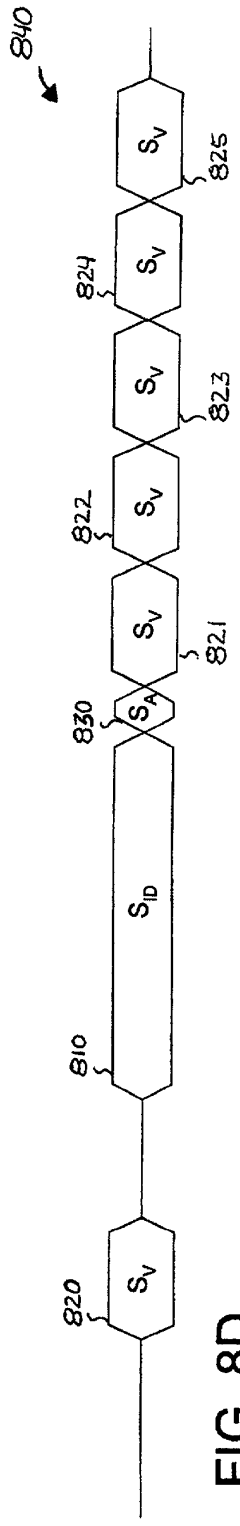
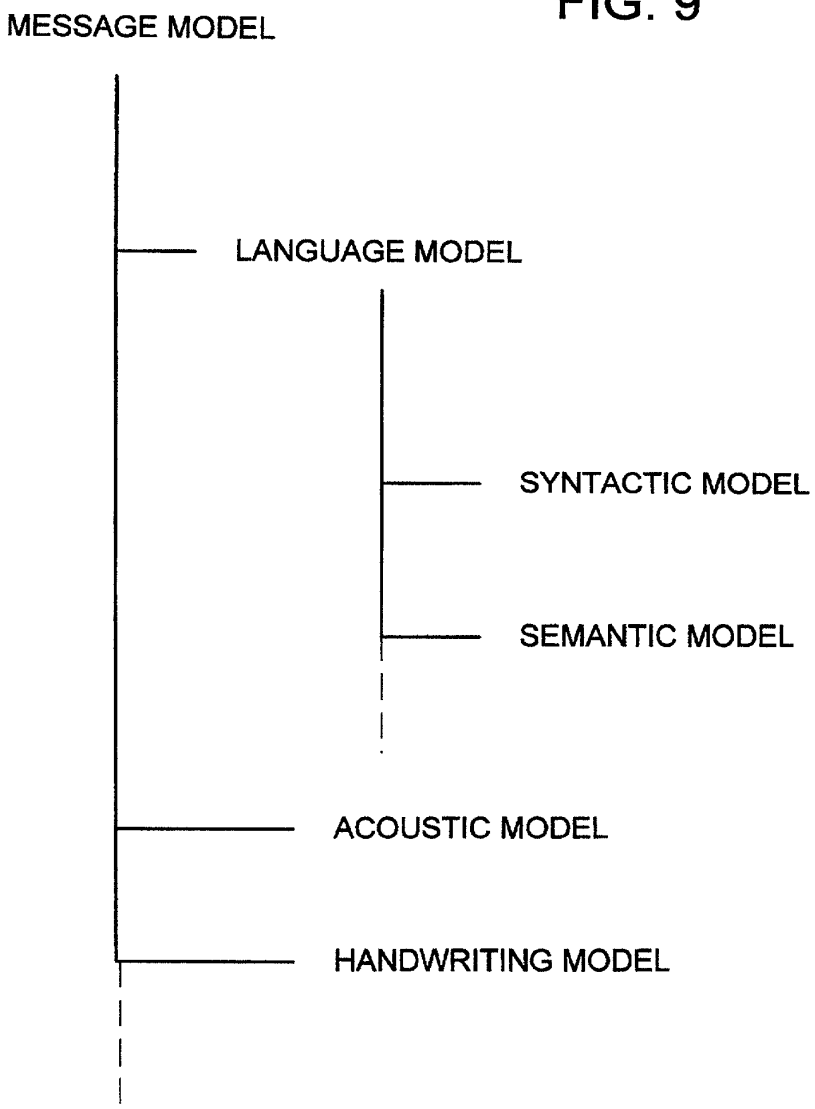


FIG. 8D

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FIG. 9



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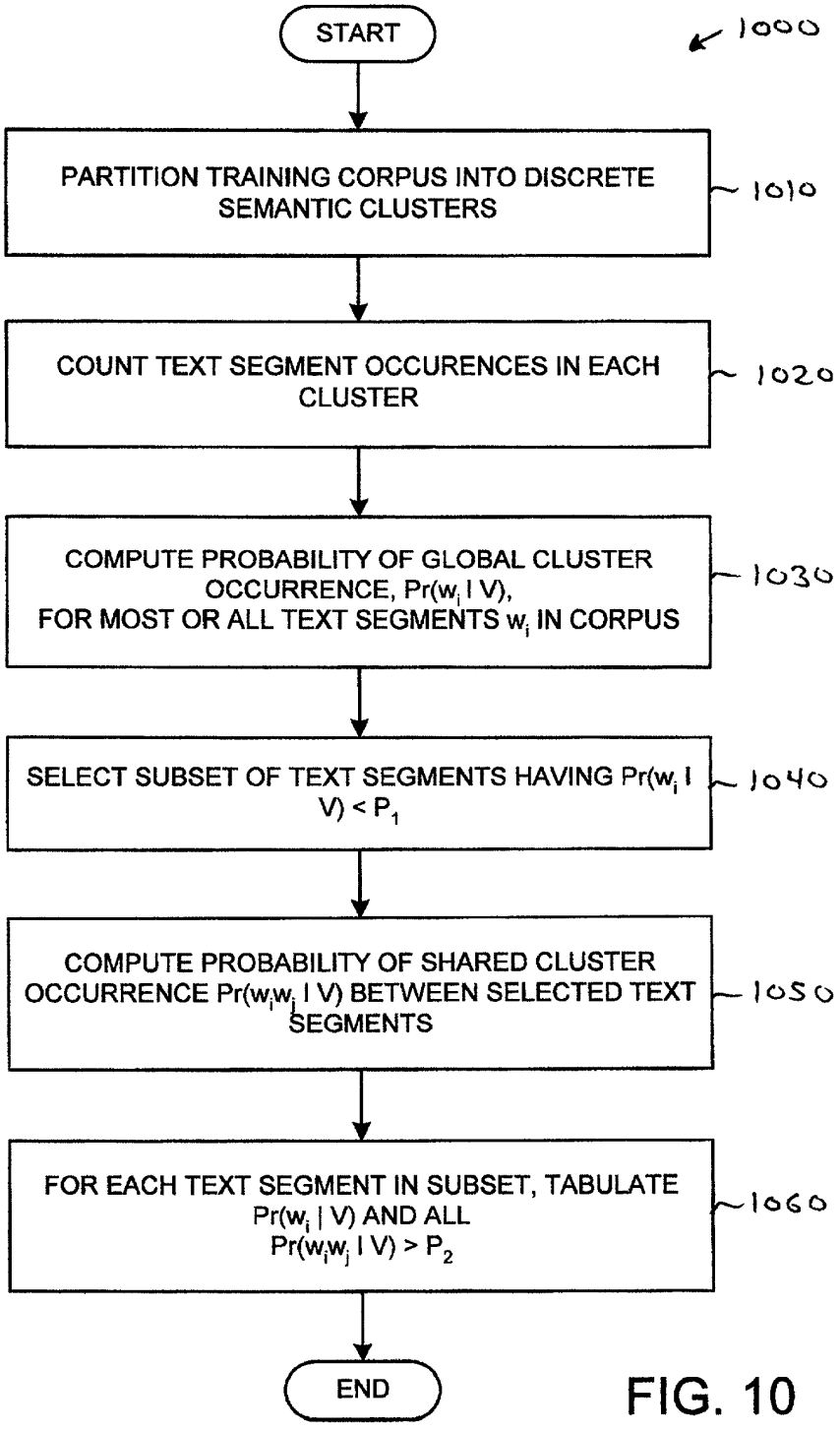


FIG. 10

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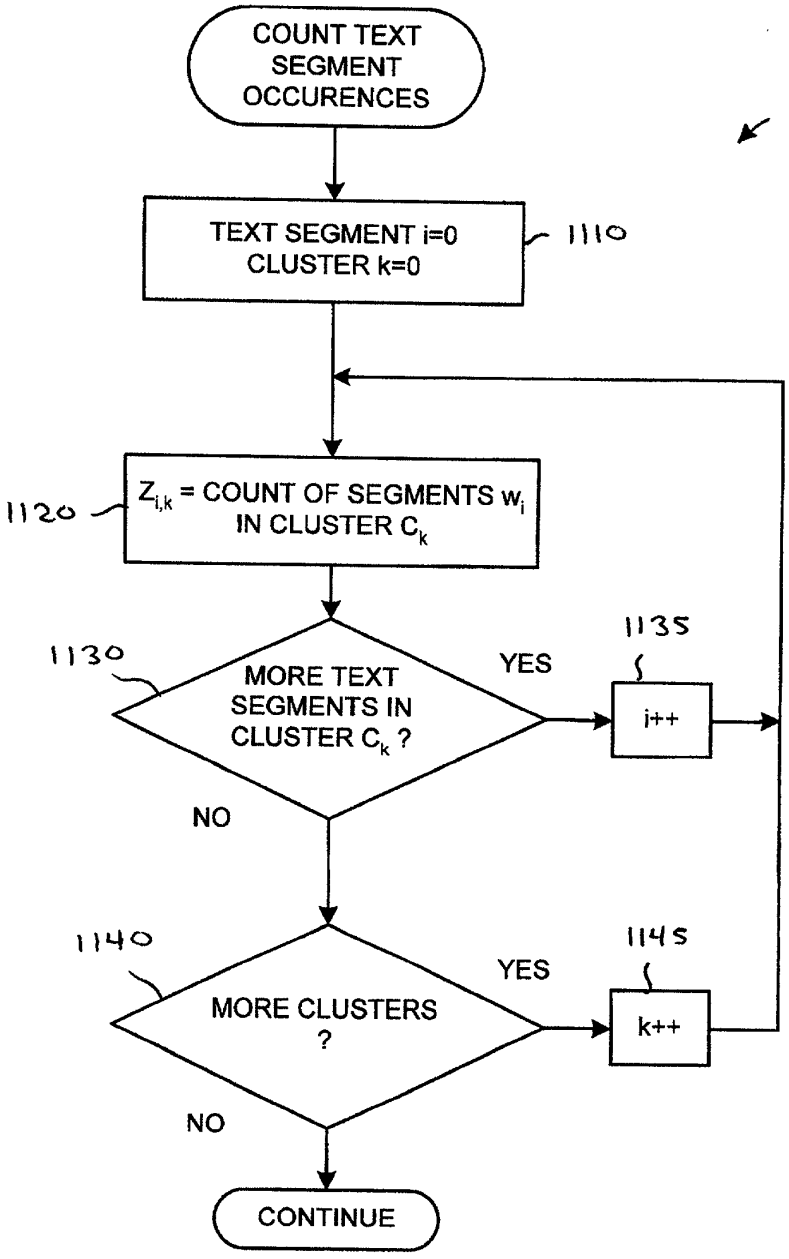


FIG. 11

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W_0 HEADER - "UNCLE", RECORDS = ...
PR(W_0 | V) = ...
W_{0A} - AUNT - PR(W_0W_{0A} | V) = ...
W_{0B} - NEPHEW - PR(W_0W_{0B} | V) = ...
W_{0C} - RELATIVE - PR(W_0W_{0C} | V) = ...
W_{0D} - BROTHER - PR(W_0W_{0D} | V) = ...
. . .
W_1 HEADER - "COORS", RECORDS = ...
PR(W_1 | V) = ...
W_{1A} - BAR - PR(W_1W_{1A} | V) = ...
W_{1B} - BEER - PR(W_1W_{1B} | V) = ...
W_{1C} - CAN - PR(W_1W_{1C} | V) = ...
W_{1D} - BREWING - PR(W_1W_{1D} | V) = ...
. . .
W_2 HEADER - "BEACH", RECORDS = ...
PR(W_2 | V) = ...
W_{2A} - WATER - PR(W_2W_{2A} | V) = ...
W_{2B} - SAND - PR(W_2W_{2B} | V) = ...
W_{2C} - OCEAN - PR(W_2W_{2C} | V) = ...
W_{2D} - PACIFIC - PR(W_2W_{2D} | V) = ...

FIG. 12

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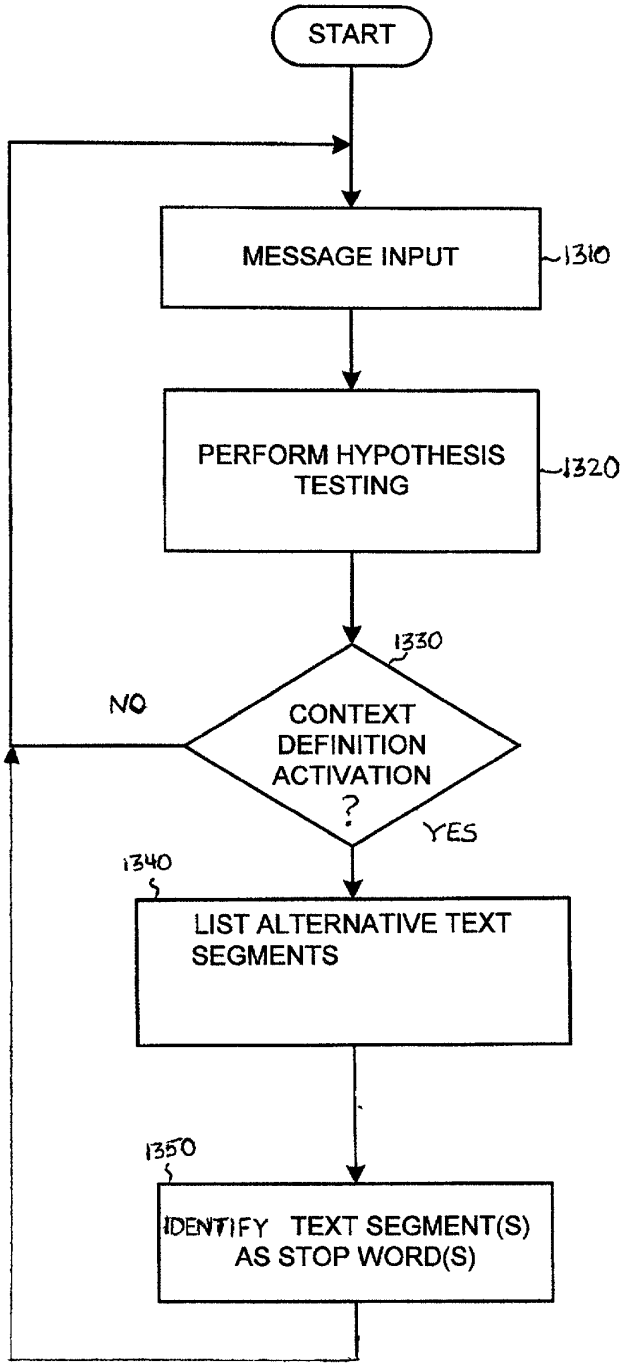


FIG. 13

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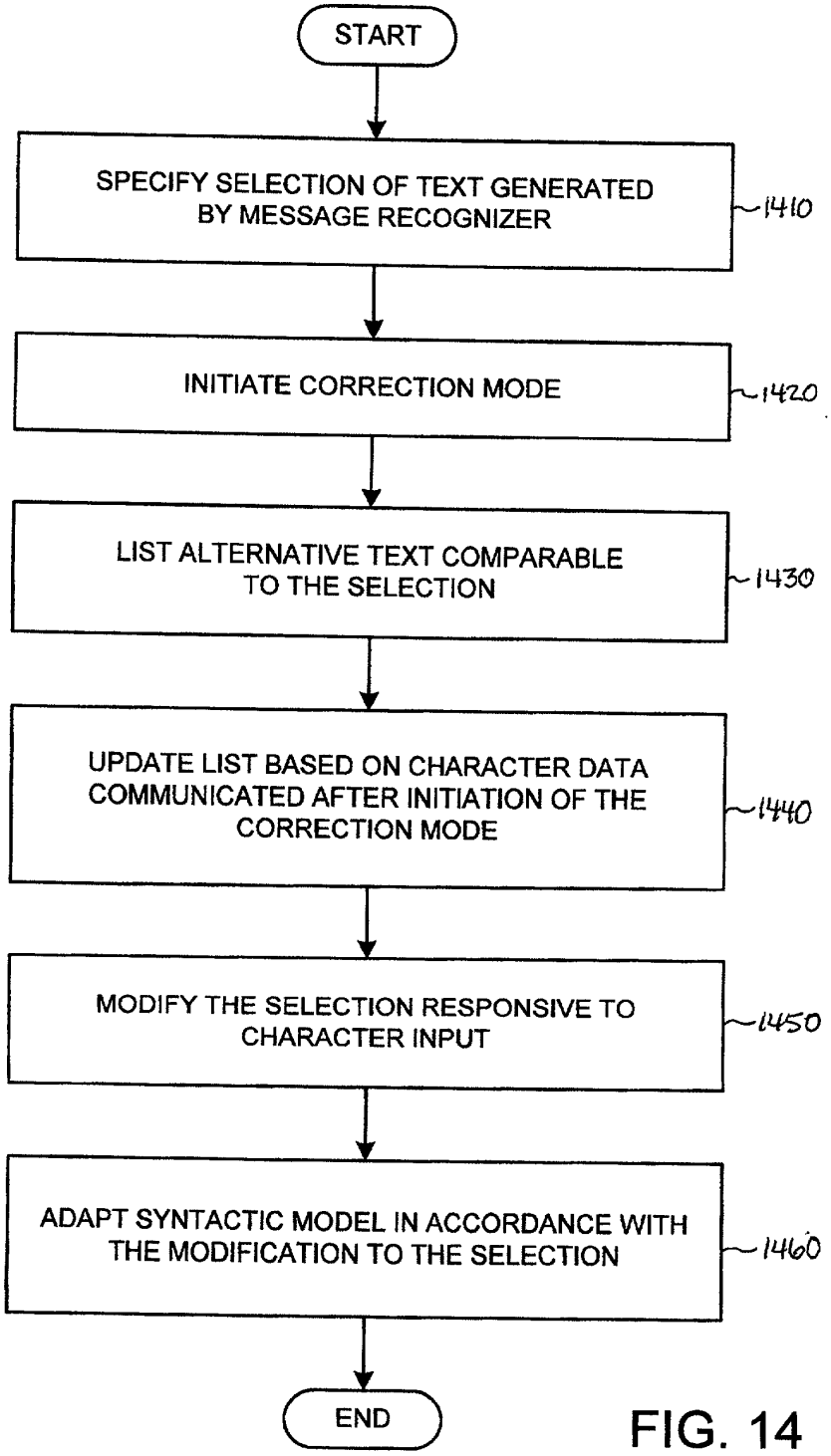


FIG. 14

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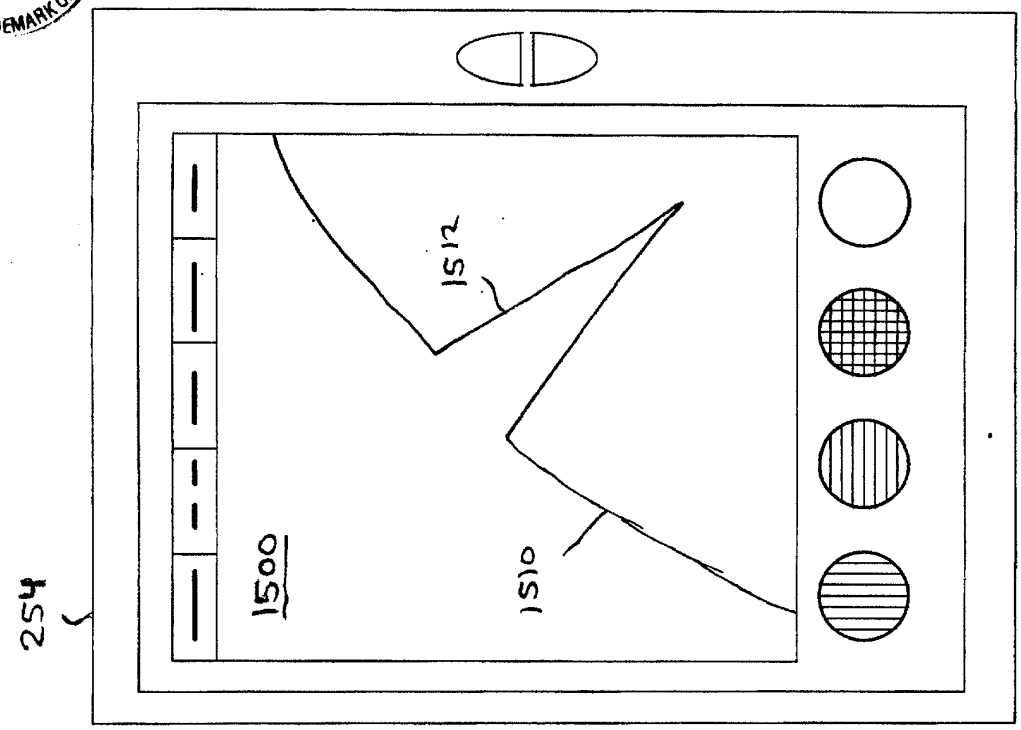


FIG. 15B

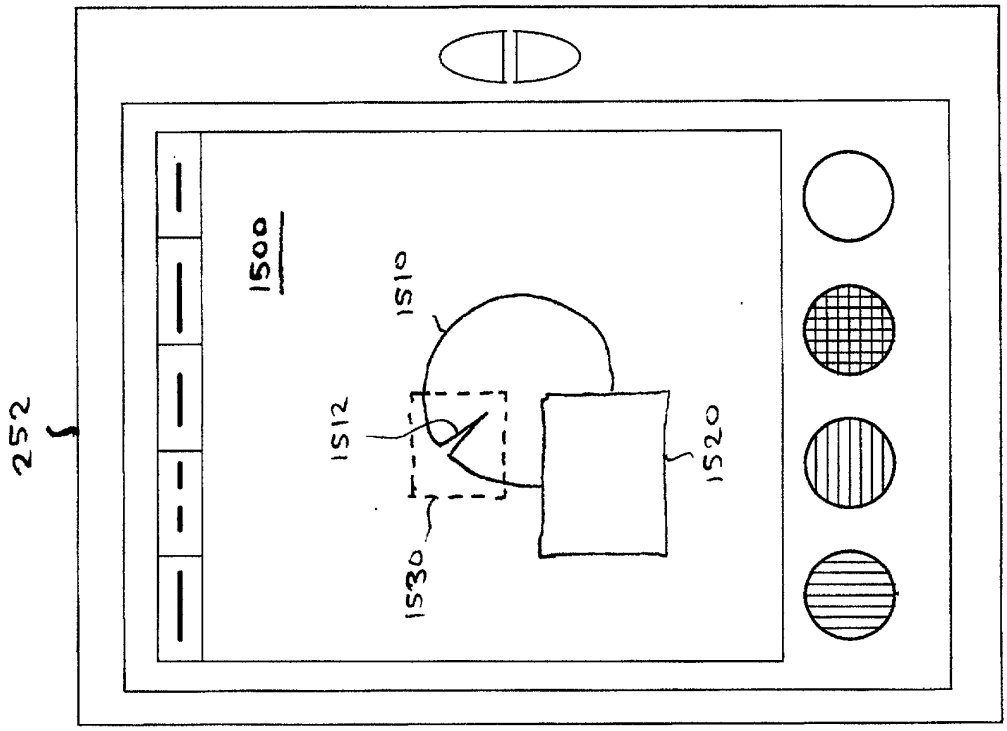


FIG. 15A

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant	:	Edwin A. Suominen	Art Unit:	:	2641
Serial No.	:	10/061,052	Examiner*:	:	Nolan, D.
Filing Date	:	January 28, 2002	* *In parent application*		
Title	:	Text Processing System			

Assistant Commissioner for Patents
Washington, DC 20231

CERTIFICATE OF MAILING UNDER 37 CFR 1.8: I hereby certify that this correspondence is being deposited on July 30, 2002 with the United States Postal Service, with sufficient postage as first class mail in an envelope addressed to: Assistant Commissioner for Patents Washington, DC. 20231

by: Edwin A. Suominen
(Name) (Signature)

SUPPLEMENTAL PRELIMINARY AMENDMENT

Dear Sir:

Applicant submits the following amendments and remarks prior to examination of this application. Upon entry of this amendment, claims 62 and 81-86 are pending in the application. Claims 62, 83, and 86 are independent.

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Technology Center 2600

Amendments

Below are instructions identifying locations for deletion, replacement, or addition of paragraphs and claims. Marked-up versions of any replacement paragraphs or amended claims are provided toward the end of this amendment in a section entitled Version with Markings to Show Changes Made. Please note that the marked-up version does not include any added or deleted claims or paragraphs.

ABSTRACT:

PLEASE ADD the abstract enclosed on a separate sheet at the end of this amendment.

IN THE CLAIMS:

PLEASE CANCEL claim 58 without prejudice.

PLEASE AMEND the following claim by substituting the like-numbered claim below:

62. A system for generating text responsive to message input of a first type and a second type, the system comprising:

(a) a unified message model including:

(1) a shared language model;

(2) a first model specific to a first type of message recognition; and

(3) a second model specific to a second type of message recognition;

(b) a first message recognizer, responsive to the first type of message input to provide text data in accordance with both the shared language model and the first model; and

(c) a second message recognizer, responsive to the second type of message input to provide text data in accordance with both the shared language model and the second model;

wherein

(d) the shared language model is trainable responsive to user correction of misrecognition by either of the first and second message recognizers, thereby improving accuracy of each of the first and second message recognizers.

PLEASE ADD the following claims:

81. The method of claim 62 wherein:

(a) the first type of message recognition is speech recognition, the first type of message input is voice input, and the first model is an acoustic model; and

(b) the second type of message recognition is handwriting recognition, the second type of message input is freehand input, and the second model is a handwriting model.

82. The system of claim 62 wherein the shared language model comprises a syntactic model and a semantic model.

83. A method for performing message recognition with a shared language model, the method comprising:

(a) performing message recognition of a first type, responsive to a first type of message input, to provide text data in accordance with both a shared language model and a first model specific to the first type of message recognition;

(b) performing message recognition of a first type, responsive to a first type of message input, to provide text data in accordance with both the shared language model and a second model specific to the second type of message recognition; and

(c) training the shared language model responsive to user correction of error in message recognition of either of the first and second types, thereby improving accuracy of each of the first and second types of message recognition.

84. The method of claim 83 wherein:

(a) performing the first type of message recognition comprises performing speech recognition responsive to voice input in accordance with the shared language model and a first model that is an acoustic model; and

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(b) performing the second type of message recognition comprises performing handwriting recognition responsive to freehand input in accordance with the shared language model and a second model that is a handwriting model.

85. The method of claim wherein performing message recognition in accordance with the shared language model comprises performing message recognition in accordance with a syntactic model and a semantic model.

86. A system for performing message recognition with a shared language model, the system comprising:

(a) means for performing message recognition of a first type, responsive to a first type of message input, to provide text data in accordance with both a shared language model and a first model specific to the first type of message recognition; and

(b) means for performing message recognition of a second type, responsive to a second type of message input, to provide text data in accordance with both the shared language model and a second model specific to the second type of message recognition.

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Remarks

This continuation application was filed with a preliminary amendment cancelling all claims except independent claims 58 and 62 to limit excess claim fees. With this Supplemental Preliminary Amendment, applicant now cancels claim 58, amends claim 62, and adds various generally related claims.

It is applicant's hope that the amendment to claim 62 will clarify its recitation of a shared language model and thus simplify the Examiner's task of reconsidering, in light of applicant's remarks below, the pertinent rejections made in the parent to this application. It is with the same hope that applicant has chosen not to seek allowance of other independent claims rejected in the parent application at this time, although some of the subject matter may be reinstated later.

20550.2005

THE REJECTION BASED ON DITZIK ALONE

Part I of the Rejection

In the parent application, claims 62-64 (now claims 62 and 81-82) were rejected as obvious over U.S. Patent 6,167,376 to Ditzik alone. Independent claim 62 is directed to a message recognition system that includes:

> a unified message model including: (1) a shared language model;[1] (2) a first model specific to a first type of message recognition; and (3) a second model specific to a second type of message recognition.

1 Emphasis added, as with all quotations taken from the application's specification and claims.

The Examiner acknowledged that Ditzik does not specifically claim a shared language model. Applicant agrees, and notes that Ditzik does not teach or suggest a shared language model either. However, the rejection asserts that

> it would have been obvious [in view of Ditzik?] . . . to avoid the problems that would arise in attempting to distinguish between differences in vocabularies and errors in recognition.

Respectfully, applicant does not know that such problems are even an issue in message recognition, and is unaware of how recognition errors can be caused by "differences in vocabularies." And, even if accurate in some unrelated context, the rejection fails to show any suggestion or motivation to modify Ditzik to yield a shared language model of any sort, much less one that can be trained in the manner of claim 62. Without such a showing, the rejection cannot stand. Sibia Neurosciences vs. Cadus Pharmaceutical, 55 U.S.P.Q. 2d 1927, 1931 (Fed. Cir. 2000) (Allowing for possibility of obviousness over a single prior art reference but requiring "a showing of a suggestion or motivation to modify the teachings of that reference to the claimed invention in order to support the obviousness conclusion").

Part II of the Rejection

The rejection then goes on to acknowledge (apparently) that sharing functions of a language model may not be clearly disclosed in Ditzik[2] but states that "it is well within the typical design capabilities of the DSP processor . . . to do so." While this statement is perhaps relevant to the claims' allowability under 35 U.S.C. § 112 as enabled by applicant's specification, it clearly does not show any teaching or suggestion in any cited reference that would support a § 103 rejection.

In addition, applicant notes that claim 62 does not merely recite a shared language model *per se*. Other claim limitations are present, and "the claimed invention as a whole must be considered." MPEP 2141.02.

2 Applicant finds the rejection somewhat confusing on this point. It says, "[w]hile Ditzik combines the two processes, *sharing* the functions in a single process may be clearly disclosed although it is well within the typical design capabilities of the *DSP processor* (column 6 lines 25-27) to do so." The only reading of the statement that makes sense to applicant is one in which the word "not" was inadvertently omitted between "may" and "be."

In addition to the shared language model limitation quoted above, claim 62 recites at least two message recognizers. One is

> responsive to the first type of message input to provide text data in accordance with both the shared language model and the first model.

The other message recognizer (and again, there can be more than two) is

> responsive to the second type of message input to provide text data in accordance with both the shared language model and the second model.

The shared language model is

> trainable responsive to user correction of misrecognition by either of the first and second message recognizers, thereby improving accuracy of each of the first and second message recognizers.

By sharing a single language model while also employing their own separate models, the two message recognizers of the invention of claim 62 can both rely on a common, mutually beneficial language model while also facilitating training of that model by user correction of errors they separately make during message recognition. Advantageously, such training improves accuracy of both message recognizers in subsequent message recognition.

An example of this beneficial sharing of a language model may be better understood with reference to FIG. 3B and a descriptive portion of that figure in applicant's specification:

> Local message model 316 includes a language model 350, an acoustic model 356, and a handwriting model 358. . . . Speech recognizer 312 generates text data in accordance with acoustic model 356 and shared language model 350. Advantageously, user training of language model 350 can improve accuracy of both speech recognizer 312 and handwriting recognizer 314. For example, user correction of misrecognition by speech recognizer 312 adapts syntactic model 352 of shared language model 350. Both speech recognizer 312 and handwriting recognizer 314 then operate in accordance with the adapted syntactic model. [P32/L26 - P33/L9]

The claimed arrangement achieves advantageous results that are not provided by its elements in any conventional configuration. One such result is that

> the shared language model may be trained by user correction of any[3] type of erroneous message recognition performed by the message recognizer. [P32/L13]

Another example may provide a still clearer understanding of this point. Consider the case of a user who enters a sequence of words by writing them by hand, corrects a mistake in a handwriting recognizer's attempt to provide text data responsive to the freehand input, and later enters the same sequence of words by dictating them, i.e., with voice input. By correcting the handwriting recognizer's error, the user can refine a syntactic language model to better predict that sequence of words in subsequent handwritten entry of those words.

Significantly, the accuracy improvement does not stop with the handwriting recognizer when things happen in accordance with claim 62. Advantageously, the speech recognizer also benefits from the user correction because it is able to also do a better job on the same sequence of words when the user (in this example) later dictates them. The claimed arrangement makes this improvement possible because it allows the speech recognizer to share the syntactic language model with the handwriting recognizer. The user's correction of the handwriting recognition mistake thus also helps the speech recognizer to better predict the sequence of words in question.

In sum, the clear distinctions between claim 62 (in both its original and amended forms) over Ditzik make the claim and its dependents plainly allowable over that reference.

3 The word "any" indicates a case where the message recognizer performs only message recogntion that can be corrected in a way that trains the shared language model. Exceptions that still fall within the scope of claim 62 are clearly possible, for example where a third type of message recognition is also performed without the possibility of such correction.

THE REJECTION BASED ON DITZIK AND BELLEGARDA

Claims 62-64 were further rejected in the parent application as obvious over Ditzik in view of U.S. Patent 5,502,774 to Bellegarda et al. Applicant discussed that reference in the "Background of the Invention" section of his application as filed:

> U.S. Patent 5,502,774 to Bellegarda discloses a multi-source message recognizer that includes both a speech recognizer and a handwriting recognizer. [Bellegarda] briefly states, at column 4, lines 54-58, that the training of respective source parameters for speech and handwriting recognizers may be done globally using weighted sum formulae of likelihood scores with weighted coefficients. [P5/L6-12, emphasis added]

In citing Bellegarda, however, the rejection asserts that,

> since Bellegarda *et al.* does share processes as cited above [with reference to Ditzik], it would have been obvious . . . to incorporate recognition of both as a means to reduce the overhead of supporting and maintaining separate processes for ostensibly the same function.

This assertion fails to note the significant distinction between Bellegarda's global training using weighted sum formulae (see, e.g., Bellegarda FIG. 1) and the arrangement of claim 62 (as originally filed or as amended) of a shared language model with type-specific message models.

As discussed above, the claimed arrangement allows user correction of one type of message recognition to also improve subsequent accuracy of another type of message recognition. None of the cited references contains any suggestion or motivation for one of ordinary skill in the art to combine the Ditzik and Bellegarda references in a way that would arrive at that claimed arrangement and its advantageous result.

The rejections fail to satisfy a requirement that has been firmly maintained by the Federal Circuit -- to show a suggestion or motivation to combine references in a conclusion of obviousness. In a recent decision overturning a board-affirmed rejection, the Federal Circuit admonished that "the factual inquiry whether to combine references must be thorough and searching," and "must be based on objective evidence of record." In re Sang-Su Lee, 61 U.S.P.Q. 2d 1430 (2002). The court found an examiner's statement

that "[a] motivation would be that the automatic demonstration mode is user friendly and it functions as a tutorial" to "inadequately address the issue of motivation to combine." Id. The court concluded that "[t]his factual question of motivation . . . could not be resolved on subjective belief and unknown authority." Id.

CONCLUSION

Because none of the references of record teach or suggest any modification to Ditzik or Bellegarda -- or suggest any combination of references -- that would meet the limitations of claim 62, applicant respectfully requests allowance of that claim. For similar reasons, applicant solicits allowance of claims 81-82 (which depend on claim 62), method claim 83 and its dependent claims 84-85, and means-plus-function claim 86.

Please feel free to telephone the undersigned (who is also the applicant) if it would in any way advance prosecution of this application.

Respectfully submitted,

Dated: July 30, 2002

By: _____

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

PLEASE AMEND the following claim:

62. A system for generating text responsive to message input of a first type and a second type, the system comprising:

(a) a unified message model including:

(1) a shared language model;

(2) a first model specific to a first type of message recognition; and

(3) a second model specific to a second type of message recognition;

(b) a first message recognizer, responsive to the first type of message input to provide text data in accordance with both the shared language model and the first model; and

(c) a second message recognizer, responsive to the second type of message input to provide text data in accordance with both the shared language model and the second model;

wherein

(d) the shared language model is trainable responsive to user correction of misrecognition by either of the first and second message recognizers, thereby improving accuracy of each of the first and second message recognizers.

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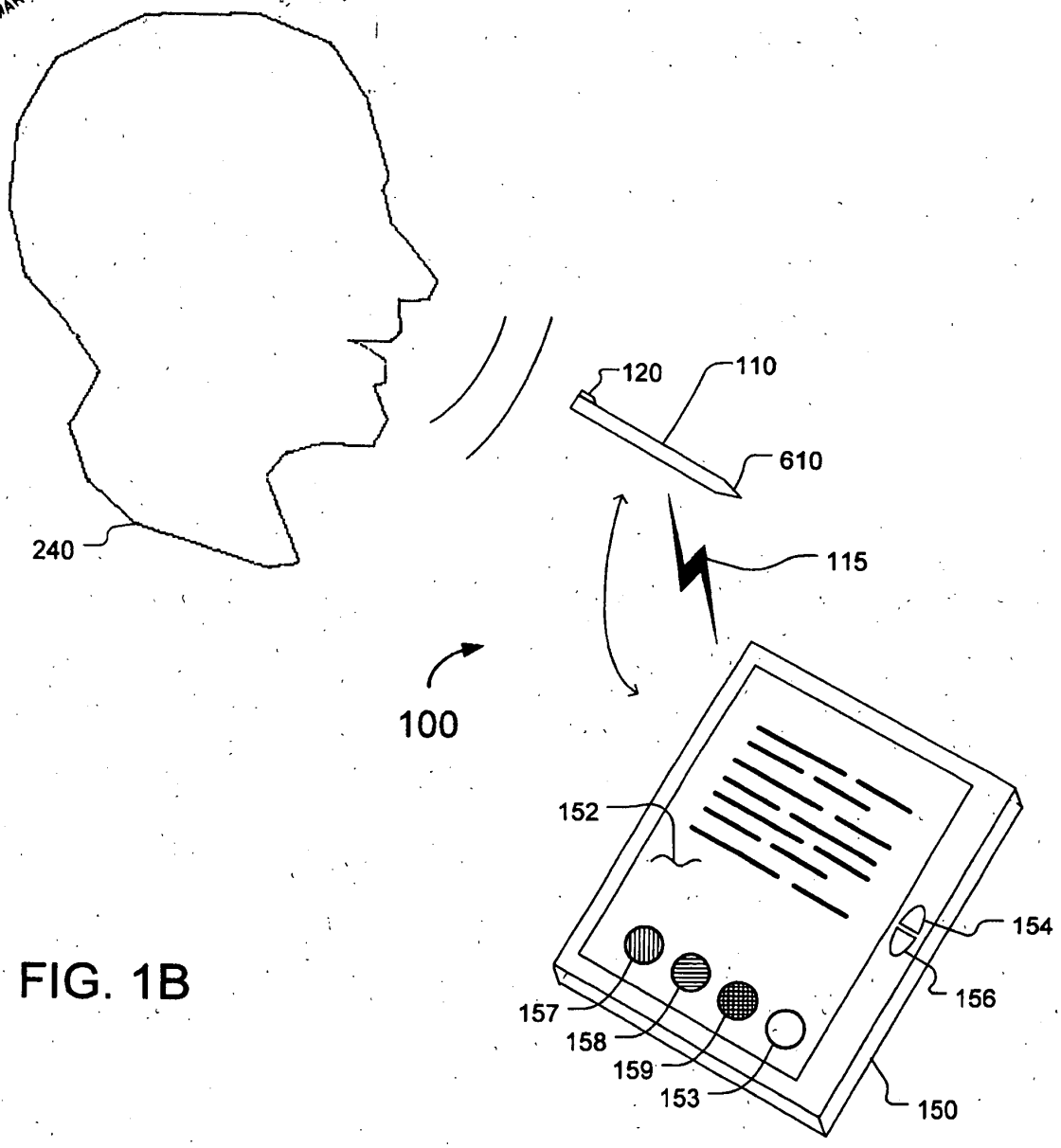


FIG. 1B

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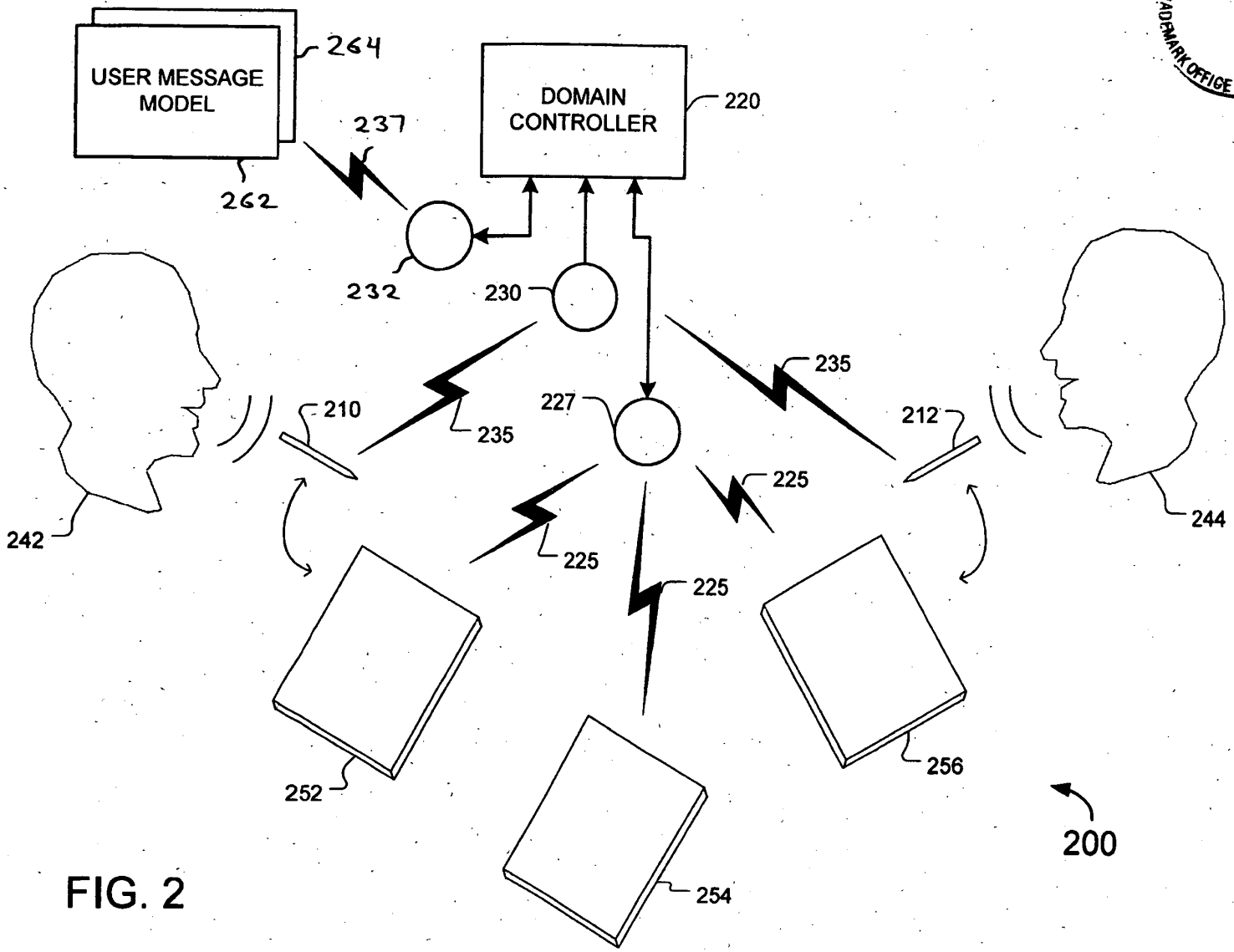
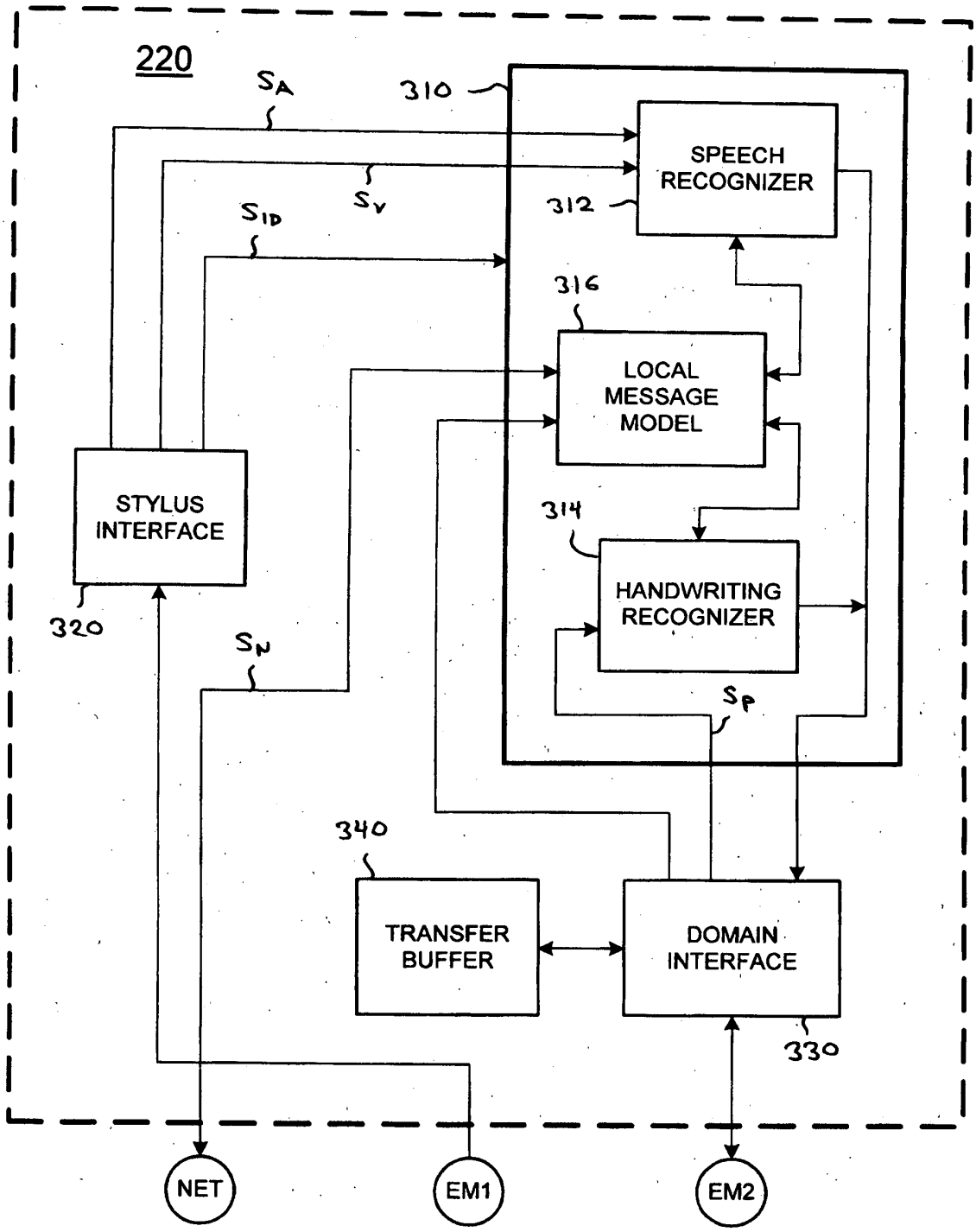


FIG. 2

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FIG. 3A



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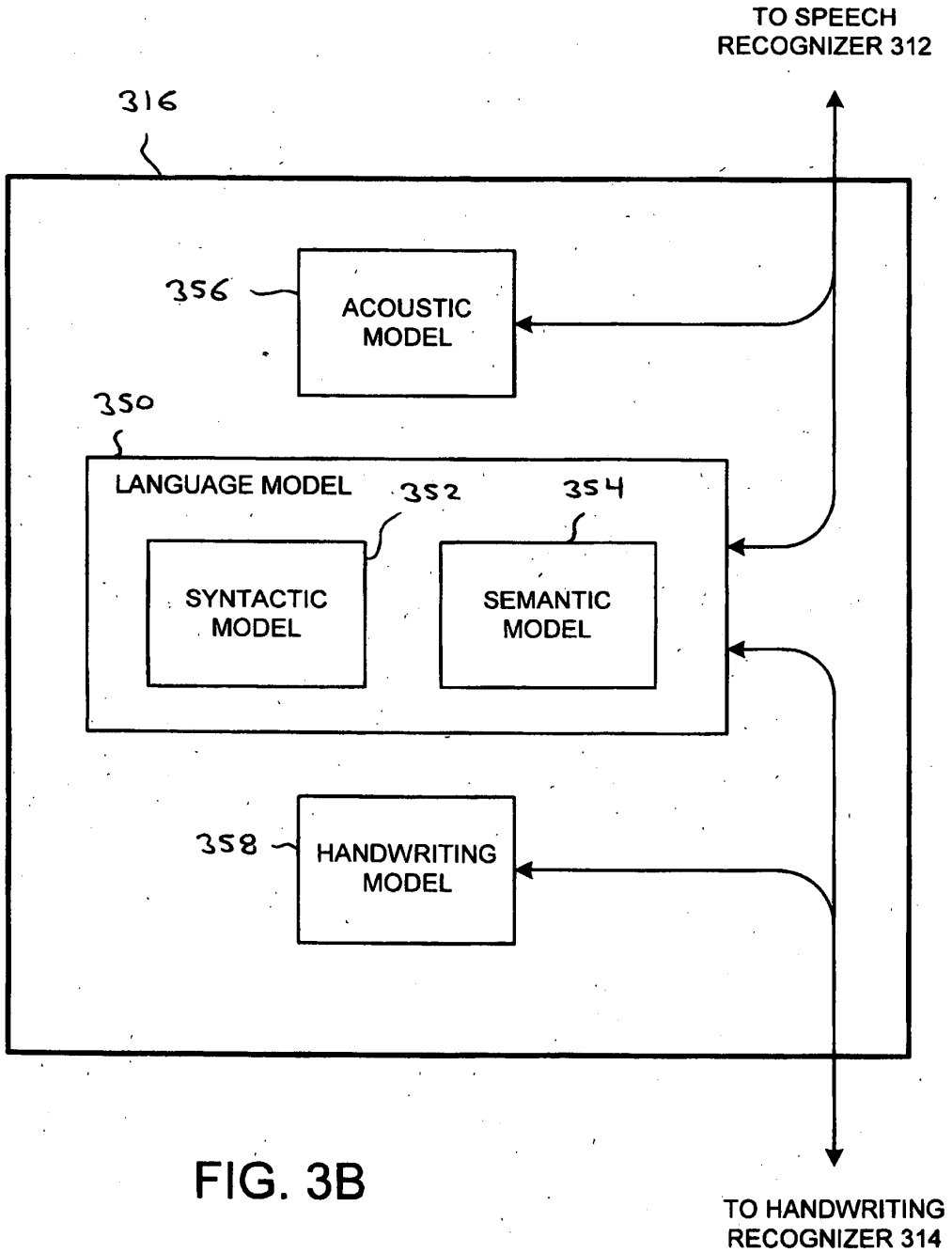


FIG. 3B

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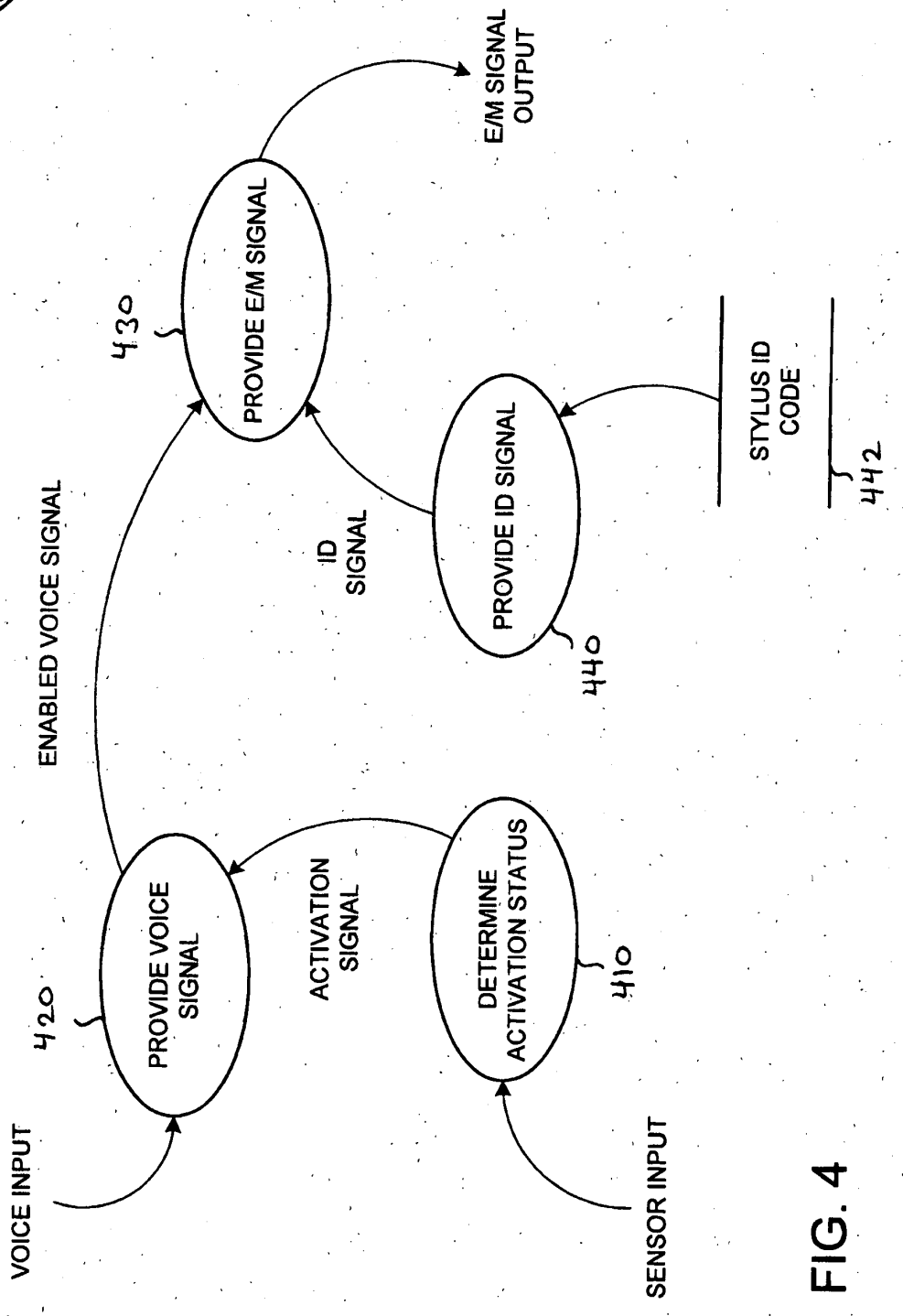
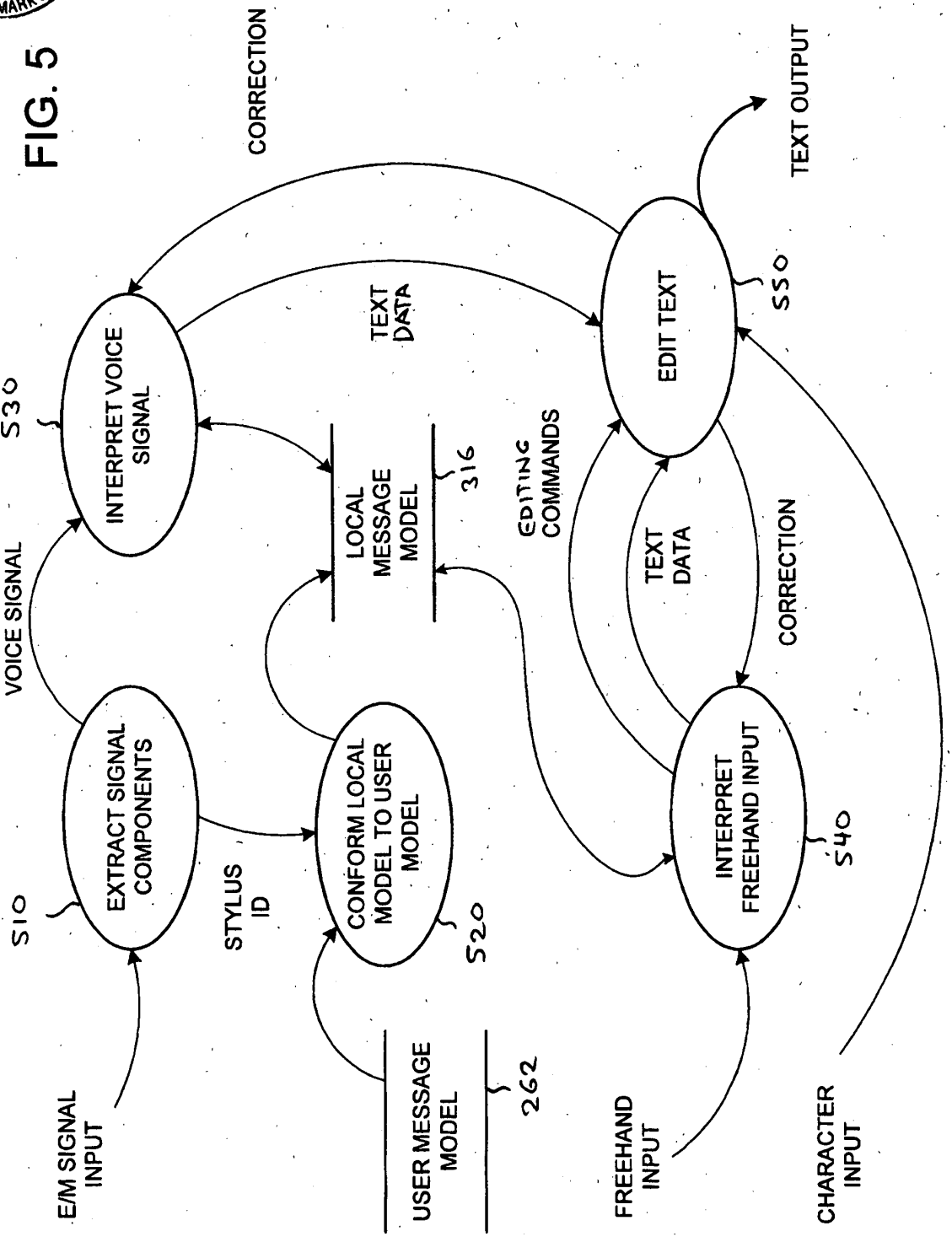


FIG. 4

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FIG. 5



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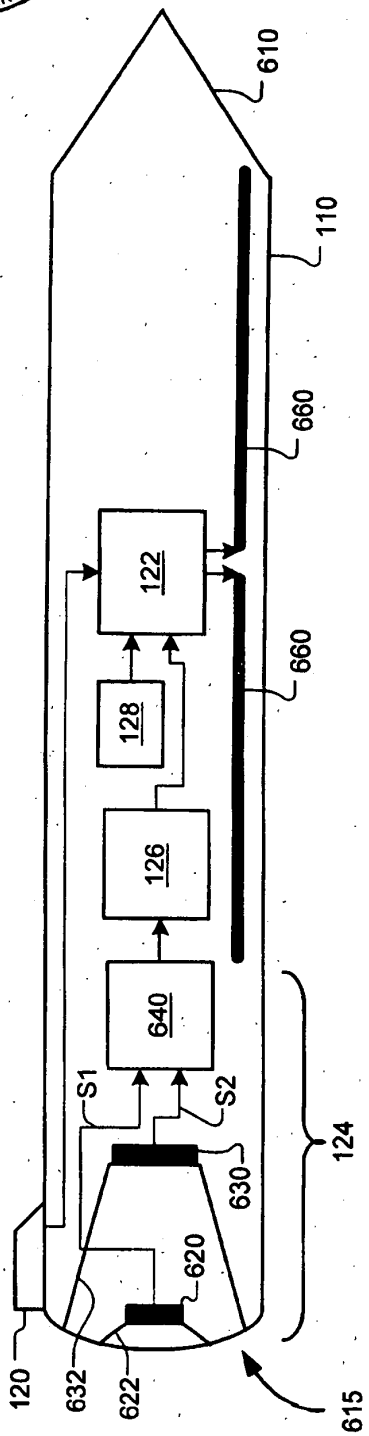


FIG. 6A

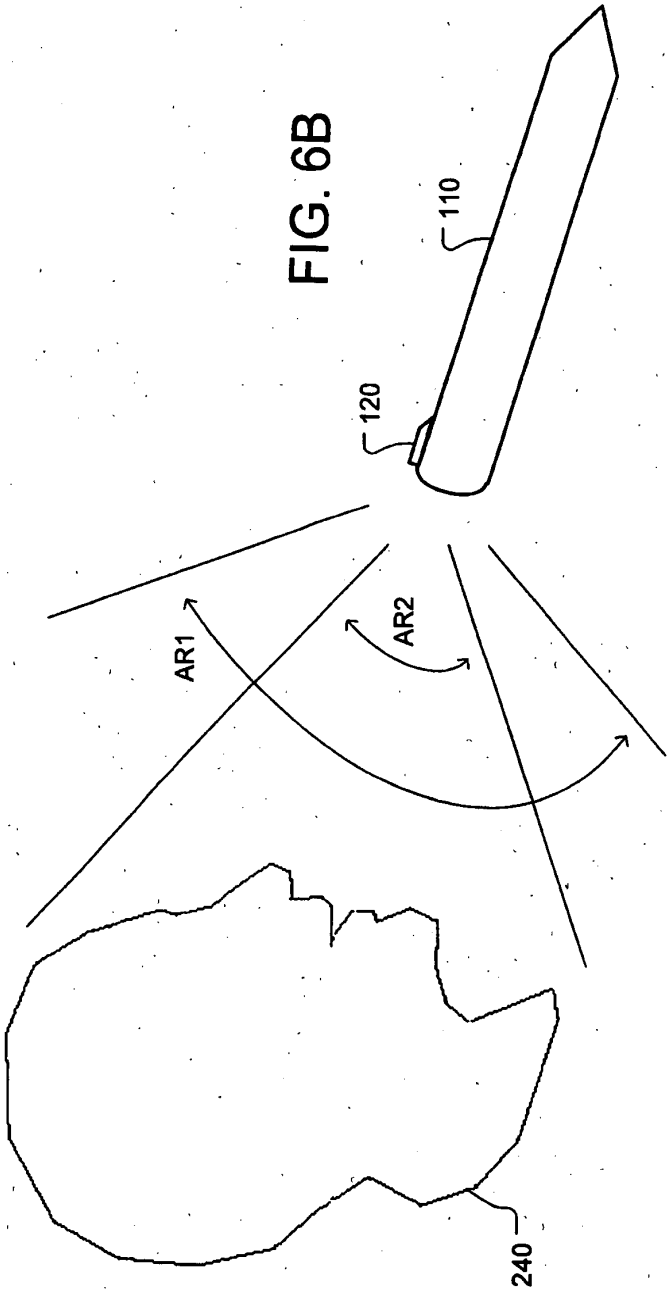


FIG. 6B

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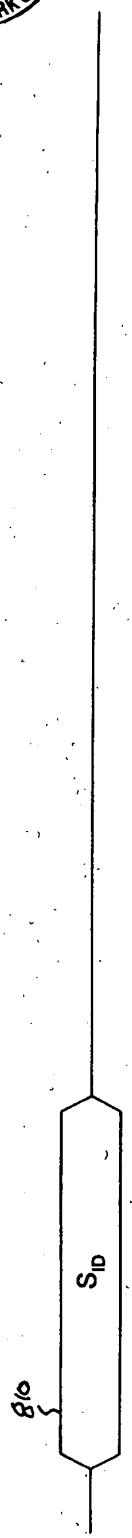


FIG. 8A

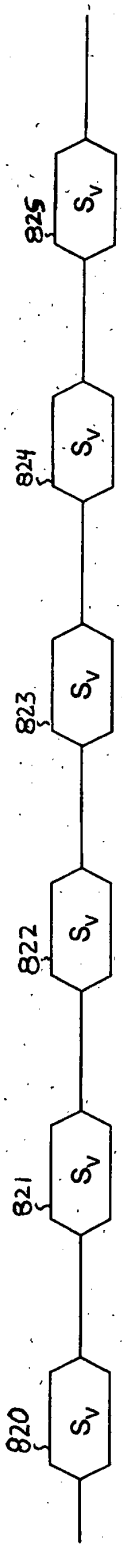


FIG. 8B

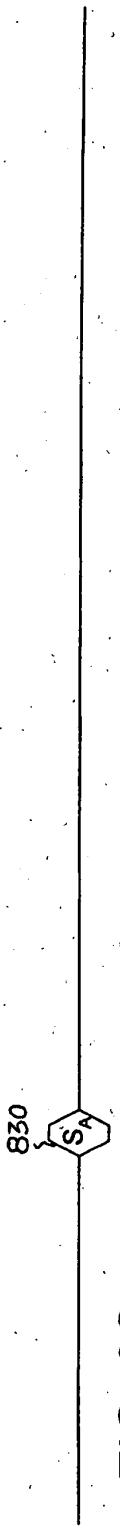


FIG. 8C

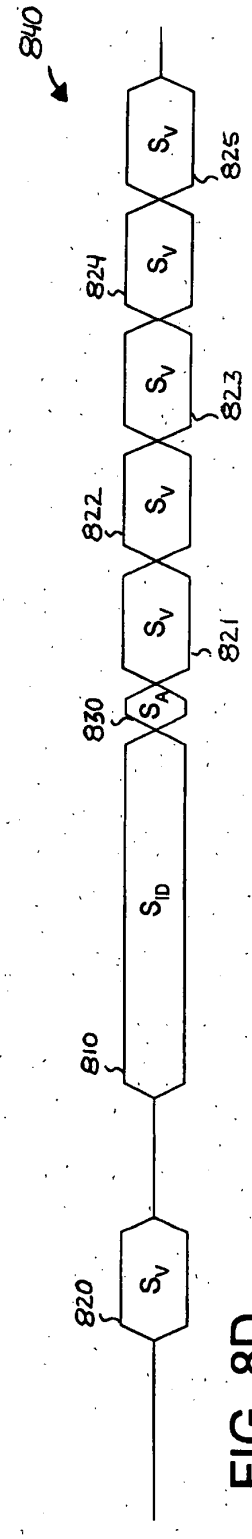
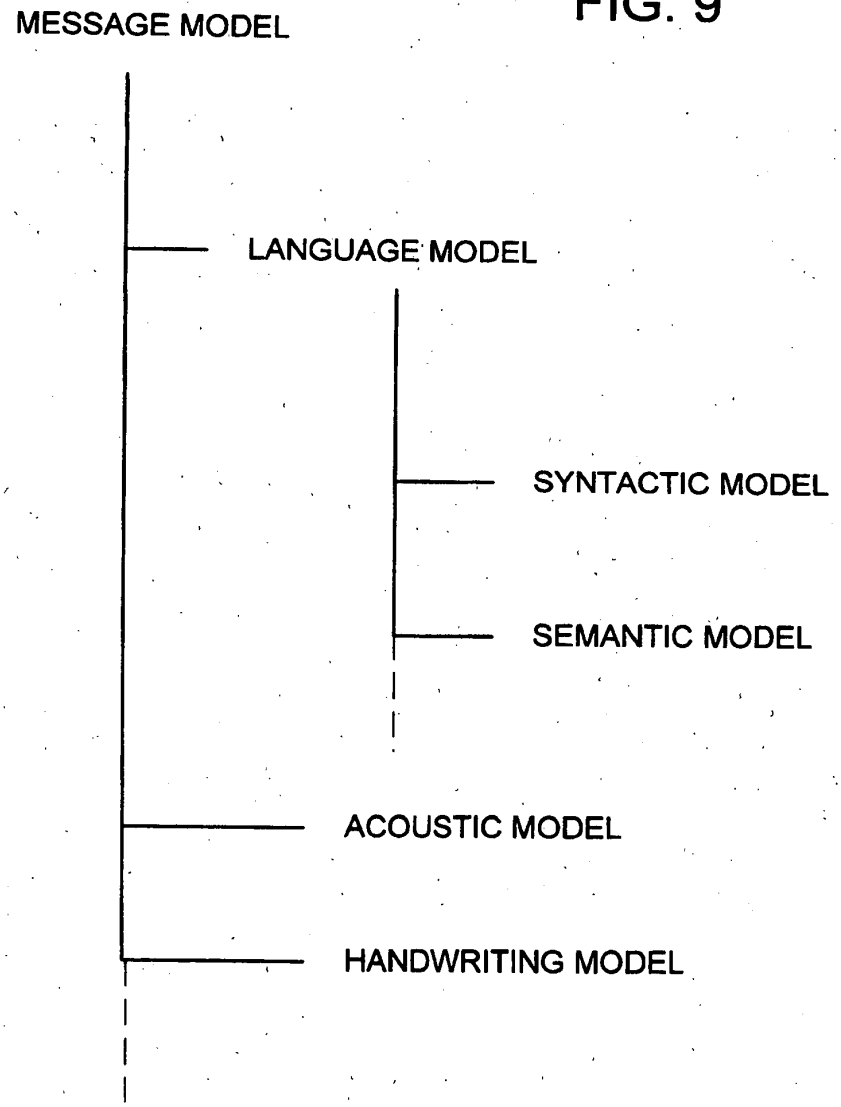


FIG. 8D

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FIG. 9



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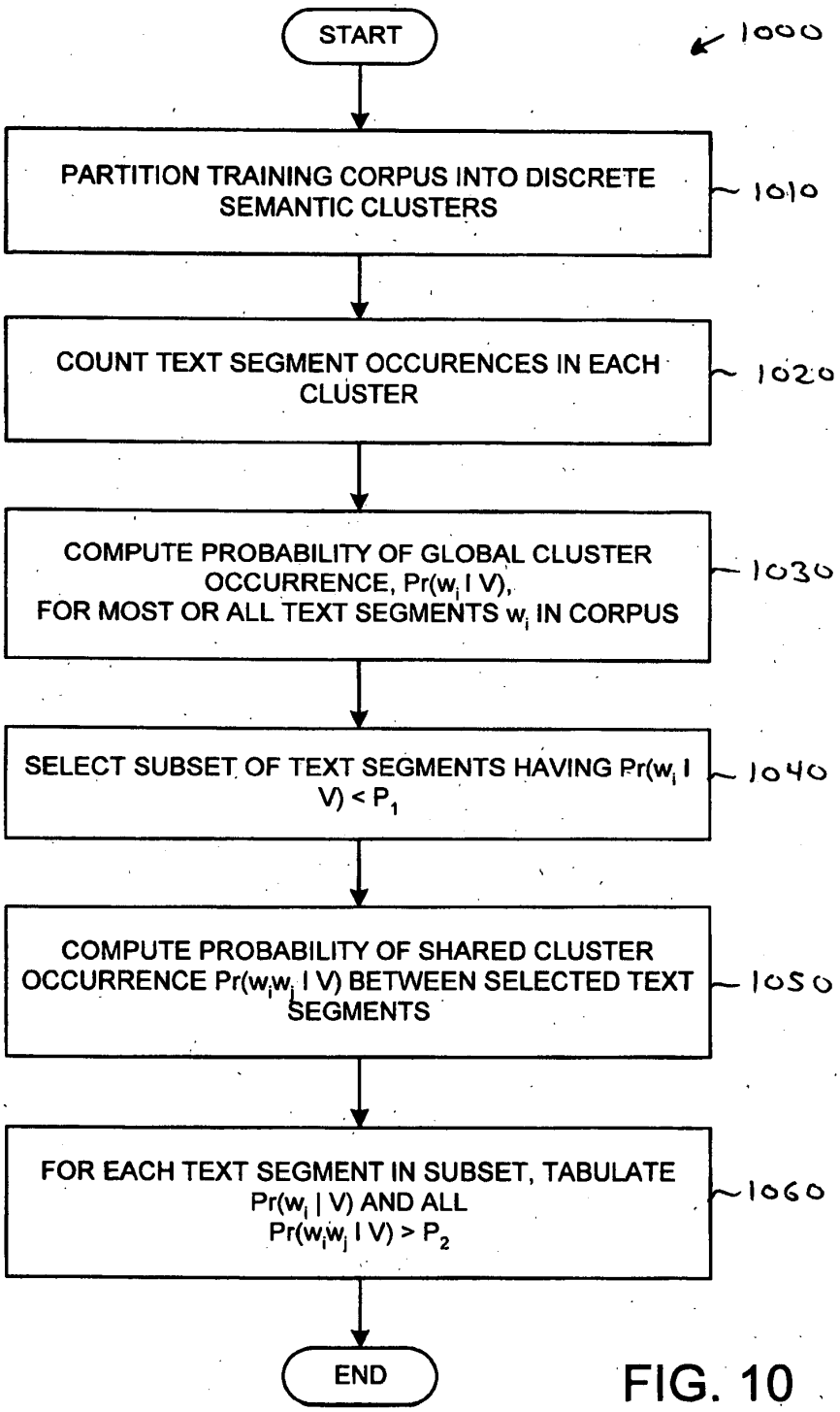


FIG. 10

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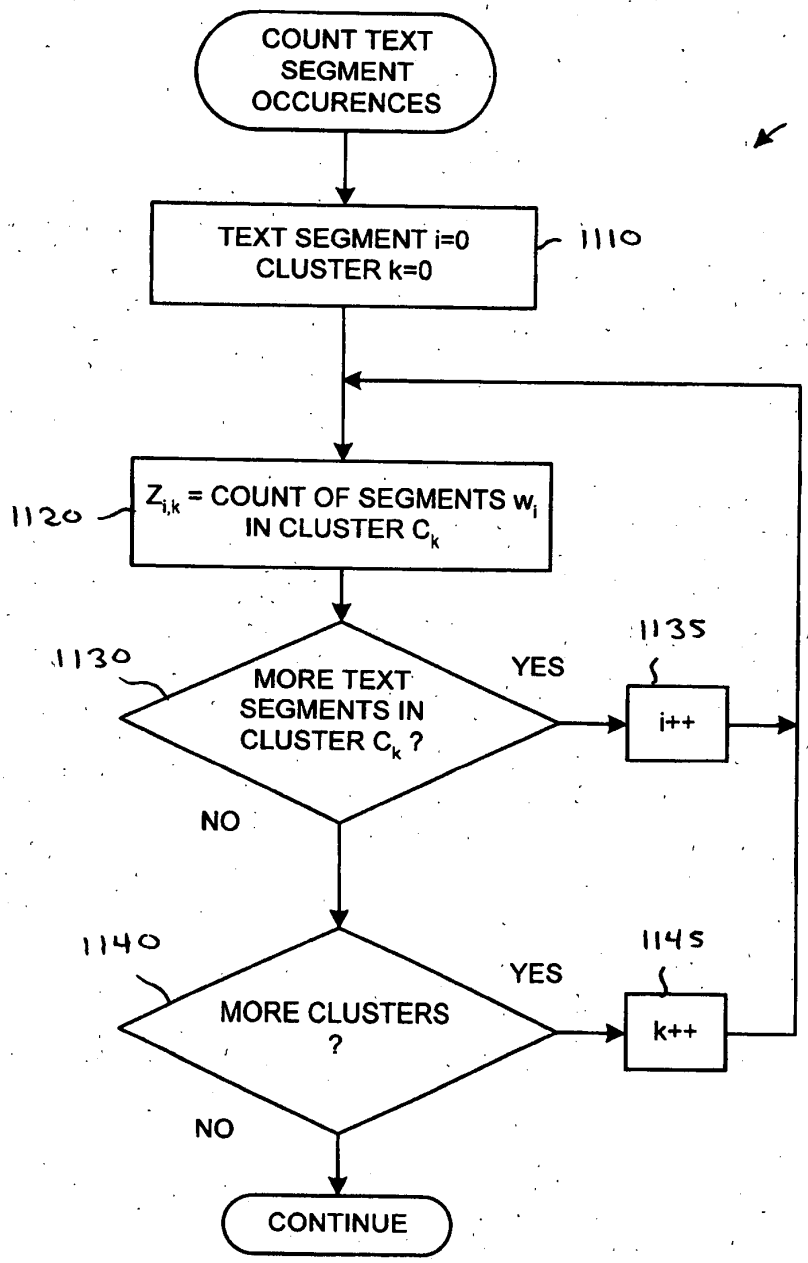


FIG. 11

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W_0 HEADER - "UNCLE", RECORDS = ...
$PR(W_0 \mid V)$ = ...
W_{0A} - AUNT - $PR(W_0W_{0A} \mid V)$ = ...
W_{0B} - NEPHEW - $PR(W_0W_{0B} \mid V)$ = ...
W_{0C} - RELATIVE - $PR(W_0W_{0C} \mid V)$ = ...
W_{0D} - BROTHER - $PR(W_0W_{0D} \mid V)$ = ...
. . .
W_1 HEADER - "COORS", RECORDS = ...
$PR(W_1 \mid V)$ = ...
W_{1A} - BAR - $PR(W_1W_{1A} \mid V)$ = ...
W_{1B} - BEER - $PR(W_1W_{1B} \mid V)$ = ...
W_{1C} - CAN - $PR(W_1W_{1C} \mid V)$ = ...
W_{1D} - BREWING - $PR(W_1W_{1D} \mid V)$ = ...
. . .
W_2 HEADER - "BEACH", RECORDS = ...
$PR(W_2 \mid V)$ = ...
W_{2A} - WATER - $PR(W_2W_{2A} \mid V)$ = ...
W_{2B} - SAND - $PR(W_2W_{2B} \mid V)$ = ...
W_{2C} - OCEAN - $PR(W_2W_{2C} \mid V)$ = ...
W_{2D} - PACIFIC - $PR(W_2W_{2D} \mid V)$ = ...

FIG. 12

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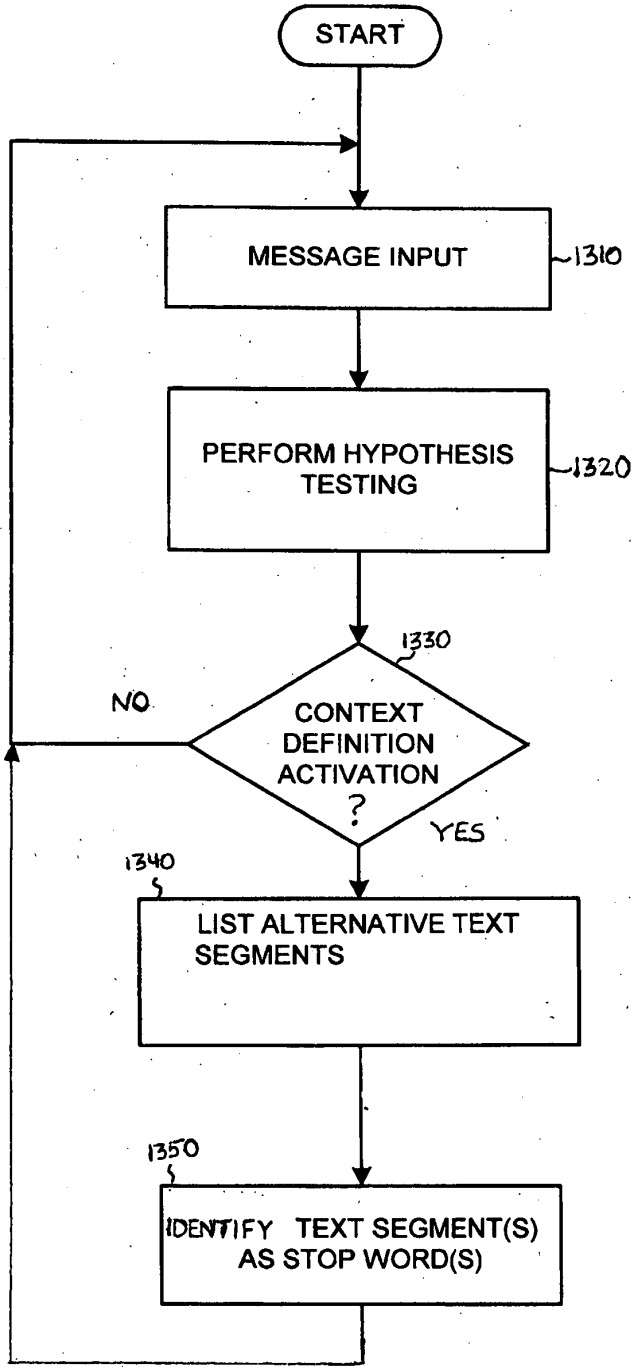


FIG. 13

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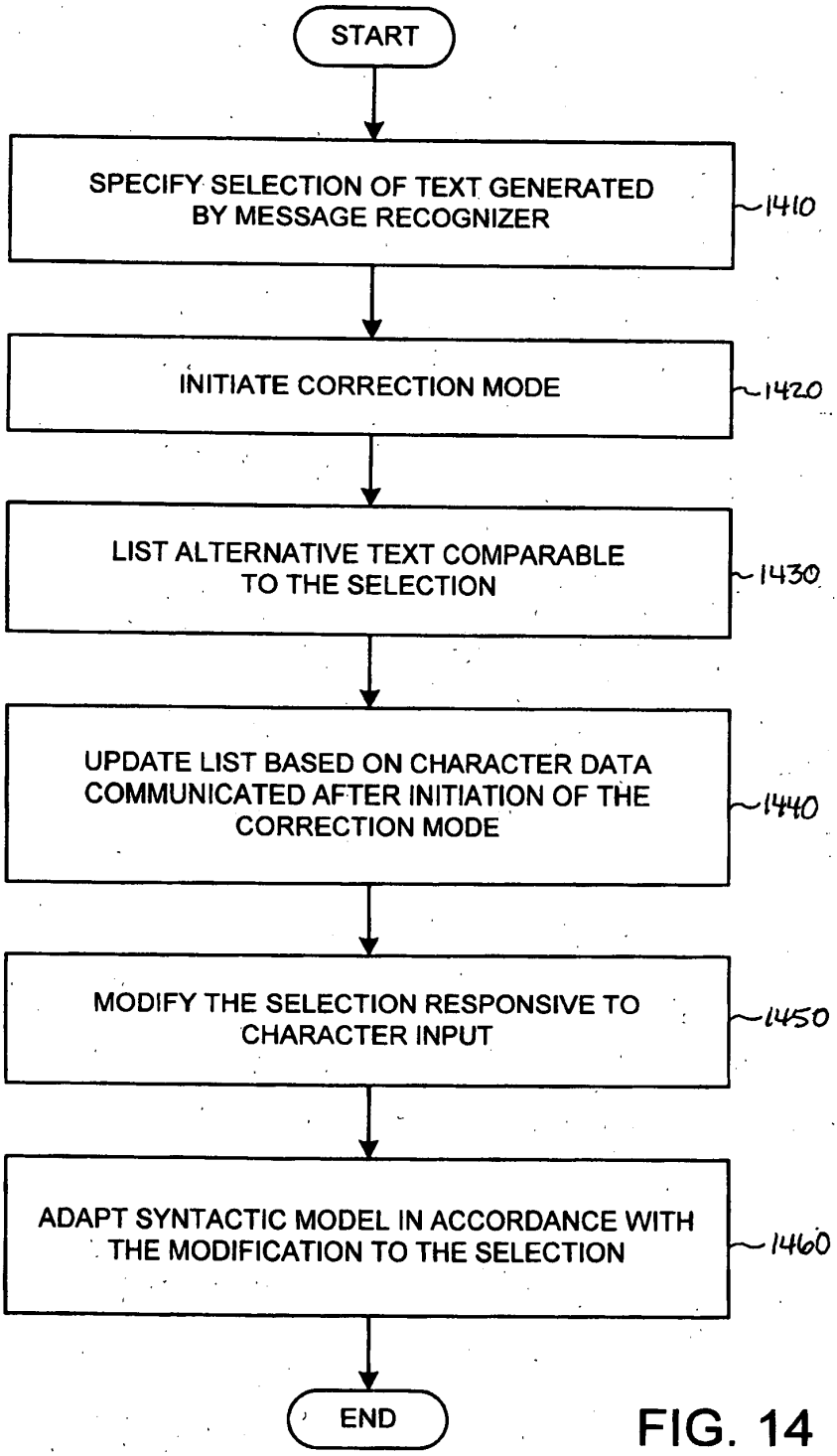


FIG. 14

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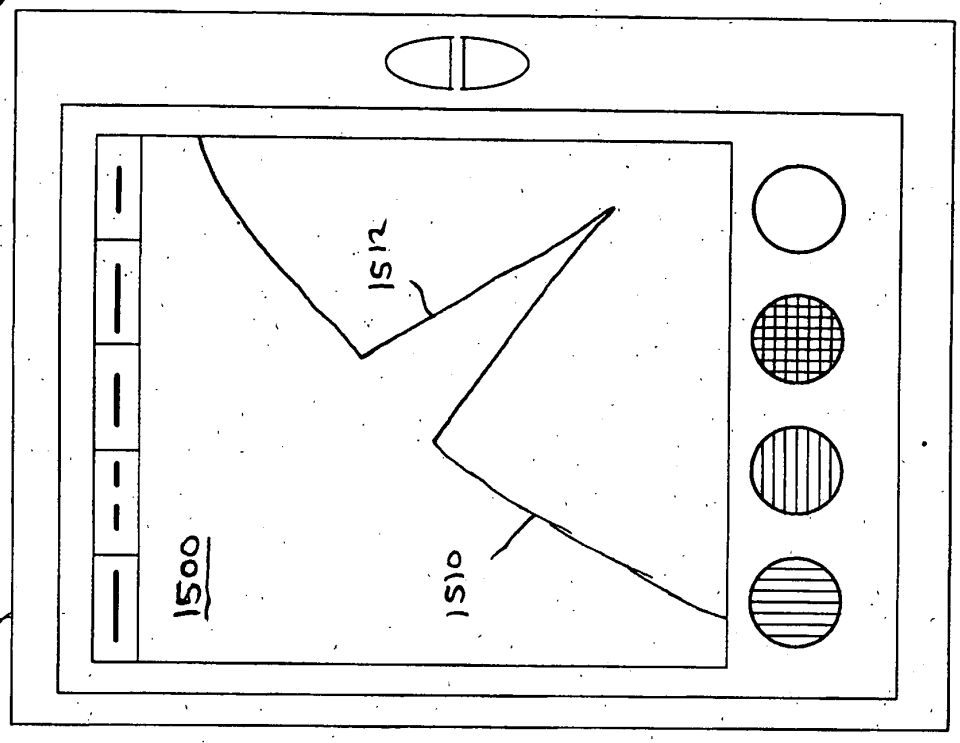


FIG. 15B

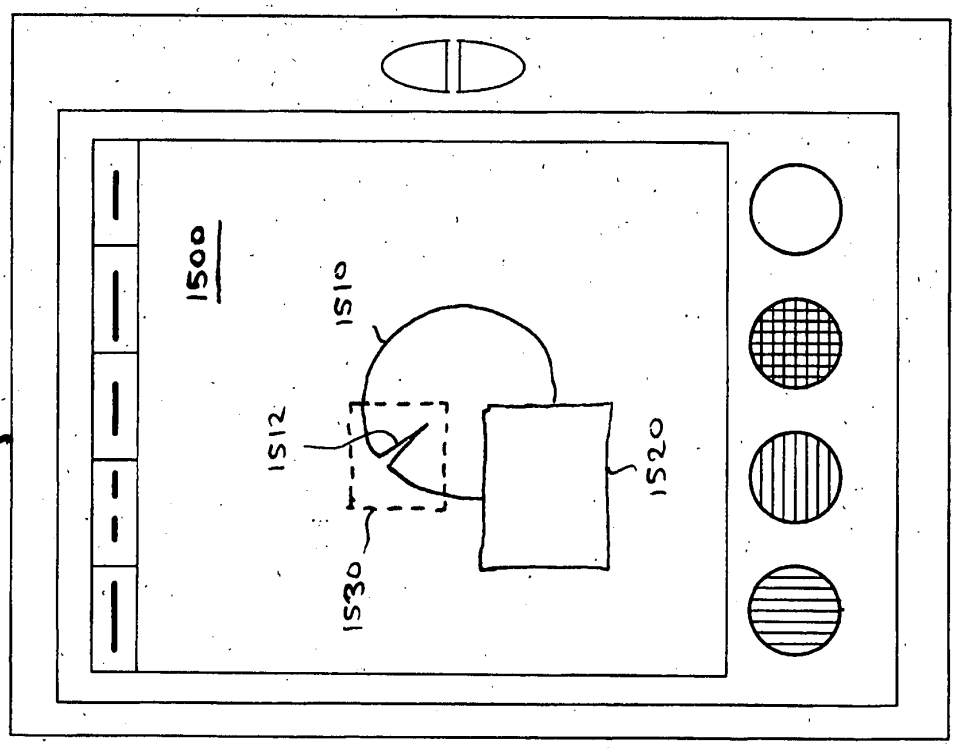


FIG. 15A

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#5



IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant	:	Edwin A. Suominen	Art Unit	:	2641
Serial No.	:	10/061,052	Examiner*	:	Nolan, D.
Filing Date	:	January 28, 2002	* *In parent application*		
Title	:	Text Processing System			

Assistant Commissioner for Patents
Washington, DC 20231

CERTIFICATE OF MAILING UNDER 37 CFR 1.8: I hereby certify that this correspondence is being deposited on July 30, 2002 with the United States Postal Service, with sufficient postage as first class mail in an envelope addressed to: Assistant Commissioner for Patents Washington, DC 20231

by: Edwin A. Suominen
(Name) (Signature)

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Technology Center 2600

INFORMATION DISCLOSURE STATEMENT

Dear Sir:

Applicant discloses the references listed on the attached form PTO-1449 and attaches to this document copies of three references not cited in the parent to this application.

Please feel free to telephone the undersigned (who is also the applicant) if it would in any way advance prosecution of this application.

Respectfully submitted,

Dated: July 30, 2002

By: _____
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(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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09/557,741 25 April 2000 (25.04.2000) US

(71) Applicant: **MICROSOFT CORPORATION** [US/US]; One Microsoft Way, Redmont, WA 98052 (US).

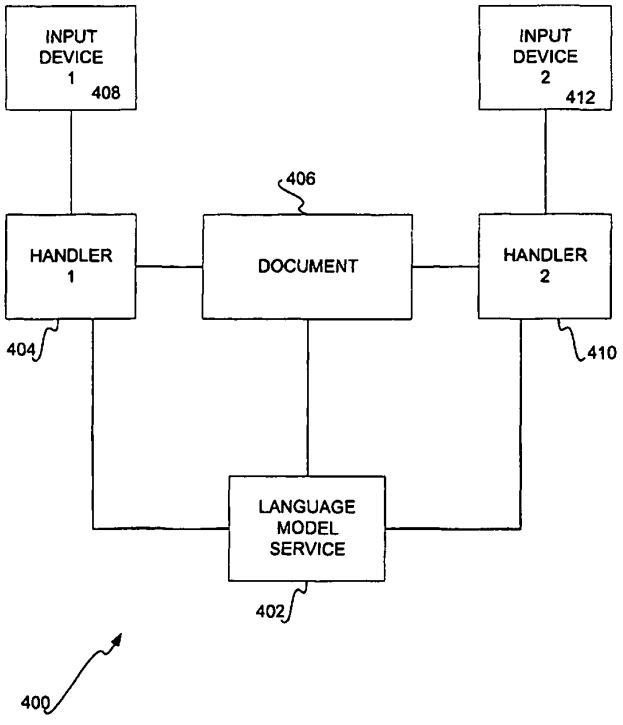
(72) Inventors: **NAKAJIMA, Yutaka**; 14013 180th Avenue NE, Redmond, WA 98052 (US). **SUZUE, Yutaka**; 3845 260th Avenue SE, Issaquah, WA 98029 (US). **GJERSTAD, Kevin, B.**; 2114 North 75th, Seattle, WA 98103 (US). **ZHANG, Dong-Hui**; No.2, Yabao Street, Chaoyang District, Beijing 100020 (CN). **KANOKOGI, Hiroaki**; 243 Oya-Machi Hachioji-City, Tokyo 192-0034 (US). **WESTBROOK, Benjamin, M.**; 4631 148 Avenue #QQ202, Bellevue, WA 98007 (US).

(74) Agent: **DRYJA, Michael A.**; Law Offices of Michael Dryja, 704 228th Avenue NE, PMB 694, Sammamish, WA 98074 (US).

(81) Designated States *(national)*: AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK, DM, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, UZ, VN, YU, ZA, ZW.

[Continued on next page]

(54) Title: LANGUAGE MODEL SHARING



(57) Abstract: The sharing of language models is disclosed. A language model service is provided that is shareable among handlers for input devices. The service includes a pre-processing mode of operation, and a correction mode of operation. In the former, the service is designed to receive a range within a document from a handler for an input device, and in response provide advice regarding text under consideration by the handler to insert within the document at the range, based on the context of the document within the range. In the latter, the service is designed to supervise correction over a range of text within a document, in which a number of different handlers for a number of different input devices were initially responsible for insertion of the text, such that the service solicits suggestions from the handlers, and based thereon determines text corrections. The corrections can then be made.

WO 01/82127 A1



(84) **Designated States** *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published:
— *with international search report*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

LANGUAGE MODEL SHARING

TECHNICAL FIELD

This invention relates generally to language models, such as language models used in conjunction with handwriting and voice recognition, as well as other recognition applications such as East Asian recognition application and other technologies that utilize a statistical language model, and more particularly to the sharing of such language models.

BACKGROUND ART

A common application today is the entering, editing and manipulation of text. Application programs that perform such text operation include word processors, text editors, and even spreadsheets and presentation programs. For example, a word processor allows a user to enter text to prepare documents such as letters, reports, memos, etc.

While the keyboard has historically been the standard input device by which text input is performed into these type of application programs, it is currently being augmented and/or replaced by other types of input devices. For example, touch-sensitive pads can be "written" on with a stylus, such that a handwriting recognition program can be used to input the resulting characters into a program. As another example, voice-recognition programs, which work in conjunction with microphones attached to computers, also are becoming more popular. Especially for non-English language users, these non-keyboard type devices are popular for initially inputting text into programs, such that they can then be edited by the same device, or other devices like the keyboard.

Each of these alternative types of text entry typically has associated with it a language model, which is used to recognize the speech or handwriting input, for example, and translate the input to text. Within the prior art, each different type of input has its own language model. This is usually necessary, because the particularities associated with recognizing speech input, for example, are typically different than the particularities associated with recognizing handwriting input, for example. However, the models can be complementary. As an example, a language model tuned for speech recognition may utilize more contextual information to determine what a user intended to be spoken, while a language model tuned for handwriting recognition may only recognize handwriting on a character-by-character basis. The prior art, however, does not provide for sharing of such different language models.

For this and other reasons, therefore, there is a need for the present invention.

DISCLOSURE OF INVENTION

This invention relates to the sharing of language models. In one embodiment, a language model service is provided that is shareable among handlers (i.e., drivers, processors, or other computer programs) for input devices. The service includes a pre-processing mode of operation, and a correction mode of operation. In the former mode, the language model service is designed to receive a range within a document from a handler for an input device, and in response provide advice regarding text under consideration by the handler to insert within the document at the range, based on the context of the document within the range. In the latter mode, the language model service is designed to supervise correction over a range of text within a document, in which a number of different handlers for a number of different input devices were initially responsible for insertion of the text, such that the service solicits suggestions from the handlers, and based thereon determines text corrections. The corrections can then be made by the handlers themselves, or by the service itself.

Embodiments of the invention provide for advantages not found within the prior art. In the pre-processing mode of operation, for example, a handwriting recognition handler may solicit advice from the language model service regarding the context in which a particular character of text is to be inserted into a document, so that the prediction made by the handler as to the particular character can be better informed, and thus more accurate. In the correction mode of operation, for example, by supervising corrections over a range of text that was initially inserted into the document by different input device handlers, the language model service can coordinate the corrections, and hence provide for better informed and thus more accurate text corrections.

The invention includes computer-implemented methods, machine-readable media, computerized systems, and computers of varying scopes. Other aspects, embodiments and advantages of the invention, beyond those described here, will become apparent by reading the detailed description and with reference to the drawings.

BRIEF DESCRIPTION OF DRAWINGS

FIG. 1 is a diagram of an operating environment in conjunction with which embodiments of the invention can be practiced;

FIG. 2 is a diagram of a system for a pre-processing mode of operation, according to an embodiment of the invention;

FIG. 3 is a flowchart of a method for a pre-processing mode of operation, according to an embodiment of the invention;

FIG. 4 is a diagram of a system for a correction mode of operation, according to an embodiment of the invention;

FIG. 5 is a diagram of an example sentence of text in which a correction mode of operation can be utilized to make corrections thereto, according to an embodiment of the invention;

FIG. 6 is a flowchart of a method for a correction mode of operation, according to an embodiment of the invention; and,

FIG. 7 is a diagram of a system according to an embodiment of the invention.

MODE(S) FOR CARRYING OUT INVENTION

In the following detailed description of exemplary embodiments of the invention, reference is made to the accompanying drawings which form a part hereof, and in which is shown by way of illustration specific exemplary embodiments in which the invention may be practiced. These embodiments are described in sufficient detail to enable those skilled in the art to practice the invention, and it is to be understood that other embodiments may be utilized and that logical, mechanical, electrical and other changes may be made without departing from the spirit or scope of the present invention. The following detailed description is, therefore, not to be taken in a limiting sense, and the scope of the present invention is defined only by the appended claims.

Some portions of the detailed descriptions which follow are presented in terms of algorithms and symbolic representations of operations on data bits within a computer memory. These algorithmic descriptions and representations are the means used by those skilled in the data processing arts to most effectively convey the substance of their work to others skilled in the art. An algorithm is here, and generally, conceived to be a self-consistent sequence of steps leading to a desired result. The steps are those requiring physical manipulations of physical quantities. Usually, though not necessarily, these quantities take the form of electrical or magnetic signals capable of being stored, transferred, combined, compared, and otherwise manipulated.

It has proven convenient at times, principally for reasons of common usage, to refer to these signals as bits, values, elements, symbols, characters, terms, numbers, or the like. It should be borne in mind, however, that all of these and similar terms are to be associated with the appropriate physical quantities and are merely convenient labels applied to these quantities. Unless specifically stated otherwise as apparent from the following discussions, it is appreciated that throughout the present invention, discussions utilizing terms such as

processing or computing or calculating or determining or displaying or the like, refer to the action and processes of a computer system, or similar electronic computing device, that manipulates and transforms data represented as physical (electronic) quantities within the computer system's registers and memories into other data similarly represented as physical quantities within the computer system memories or registers or other such information storage, transmission or display devices.

Operating Environment

Referring to FIG. 1, a diagram of the hardware and operating environment in conjunction with which embodiments of the invention may be practiced is shown. The description of FIG. 1 is intended to provide a brief, general description of suitable computer hardware and a suitable computing environment in conjunction with which the invention may be implemented. Although not required, the invention is described in the general context of computer-executable instructions, such as program modules, being executed by a computer, such as a personal computer. Generally, program modules include routines, programs, objects, components, data structures, etc., that perform particular tasks or implement particular abstract data types.

Moreover, those skilled in the art will appreciate that the invention may be practiced with other computer system configurations, including hand-held devices, multiprocessor systems, microprocessor-based or programmable consumer electronics, network PC's, minicomputers, mainframe computers, and the like. The invention may also be practiced in distributed computing environments where tasks are performed by remote processing devices that are linked through a communications network. In a distributed computing environment, program modules may be located in both local and remote memory storage devices.

The exemplary hardware and operating environment of FIG. 1 for implementing the

The system bus 23 may be any of several types of bus structures including a memory bus or memory controller, a peripheral bus, and a local bus using any of a variety of bus architectures. The system memory may also be referred to as simply the memory, and includes read only memory (ROM) 24 and random access memory (RAM) 25. A basic input/output system (BIOS) 26, containing the basic routines that help to transfer information between elements within the computer 20, such as during start-up, is stored in ROM 24. The computer 20 further includes a hard disk drive 27 for reading from and writing to a hard disk, not shown, a magnetic disk drive 28 for reading from or writing to a removable magnetic disk 29, and an optical disk drive 30 for reading from or writing to a removable optical disk 31 such as a CD ROM or other optical media.

The hard disk drive 27, magnetic disk drive 28, and optical disk drive 30 are connected to the system bus 23 by a hard disk drive interface 32, a magnetic disk drive interface 33, and an optical disk drive interface 34, respectively. The drives and their associated computer-readable media provide nonvolatile storage of computer-readable instructions, data structures, program modules and other data for the computer 20. It should be appreciated by those skilled in the art that any type of computer-readable media which can store data that is accessible by a computer, such as magnetic cassettes, flash memory cards, digital video disks, Bernoulli cartridges, random access memories (RAMs), read only memories (ROMs), and the like, may be used in the exemplary operating environment.

A number of program modules may be stored on the hard disk, magnetic disk 29, optical disk 31, ROM 24, or RAM 25, including an operating system 35, one or more application programs 36, other program modules 37, and program data 38. A user may enter commands and information into the personal computer 20 through input devices such as a keyboard 40 and pointing device 42. Other input devices (not shown) may include a microphone, joystick, game pad, satellite dish, scanner, or the like. These and other input devices are often connected to the processing unit 21 through a serial port interface 46 that is coupled to the system bus, but may be connected by other interfaces, such as a parallel port, game port, or a universal serial bus (USB). A monitor 47 or other type of display device is also connected to the system bus 23 via an interface, such as a video adapter 48. In addition to the monitor, computers typically include other peripheral output devices (not shown), such as speakers and printers.

The computer 20 may operate in a networked environment using logical connections to one or more remote computers, such as remote computer 49. These logical connections are achieved by a communication device coupled to or a part of the computer 20; the invention is

not limited to a particular type of communications device. The remote computer 49 may be another computer, a server, a router, a network PC, a client, a peer device or other common network node, and typically includes many or all of the elements described above relative to the computer 20, although only a memory storage device 50 has been illustrated in FIG. 1. The logical connections depicted in FIG. 1 include a local-area network (LAN) 51 and a wide-area network (WAN) 52. Such networking environments are commonplace in office networks, enterprise-wide computer networks, intranets and the Internal, which are all types of networks.

When used in a LAN-networking environment, the computer 20 is connected to the local network 51 through a network interface or adapter 53, which is one type of communications device. When used in a WAN-networking environment, the computer 20 typically includes a modem 54, a type of communications device, or any other type of communications device for establishing communications over the wide area network 52, such as the Internet. The modem 54, which may be internal or external, is connected to the system bus 23 via the serial port interface 46. In a networked environment, program modules depicted relative to the personal computer 20, or portions thereof, may be stored in the remote memory storage device. It is appreciated that the network connections shown are exemplary and other means of and communications devices for establishing a communications link between the computers may be used.

Pre-Processing Mode

In this section of the detailed description, a pre-processing mode of a language model service, according to an embodiment of the invention, is described. The pre-processing mode is designed to receive a range of text within a document from a handler for an input device, and in response, provide to the handler advice regarding the text under consideration by the handler to insert within the document at the range. The advice is based on the context of the document within the range.

Referring to FIG. 2, a diagram of a system 200 in which a pre-processing mode of operation is accomplished, according to an embodiment of the invention, is shown. The system 200 includes a language model service 202, a handler 204, a document 206, and an input device 208. The handler 204 is a computer program, also referred to as a driver or a processor, for the input device 208, such that it receives the raw data from the input device 208, and based thereon injects text into the document 206. For example, the input device 208 can be a touch-sensitive pad on which a user writes using a stylus, such that the handler 204 recognizes the handwriting as a character of text to be inserted into the document 206. As

another example, the input device 208 can be a microphone into which the user speaks, such that the handler 204 recognizes the speech as a word of text to be inserted into the document 206.

The handler 204 in one embodiment has a resident, or internal, language model, not shown in FIG. 2, which it utilizes to translate the raw data received from the input device 208 to translate into text to inject into the document 206 at the specified range. Such language models are known within the art. For example, in the context of a handwriting recognition handler, the language model can be (but does not have to be) character based, where the language model looks at the user input and translates it into a text character. As another example, in the context of a speech recognition handler, the language model is typically word based, where the language model looks at the user input and translates it into a word of text. To improve the accuracy of the translation, the handler 204 relies on the language model service 202.

The language model service 202 receives a specified range of text within the document 206 from the handler 204, and in response provides advice to the handler 204 regarding proposed text under consideration to input into the document 206 at the range. The language model service 202 in one embodiment encompasses a language model, such as known within the art. For example, the language model can be lattice based, where a lattice is a type of data structure used within language models. In such an embodiment, the language model service 202 provides what is known in the art as a best path through the lattice back to the handler 204 for the handler 204 to have its own language model consider when determining on the text to insert into the document 206.

Thus, the language model service 202 in the case of the pre-processing mode of operation of FIG. 2 is subservient to the handler 204, and does not actually insert text into the document 206 itself. Rather, the handler 204 communicates with the language model service 202, to obtain, for example, a best path through the lattice of the language model of the service 202, and uses this information in conjunction with its own language model to determine what text to insert into the document 206, which it performs itself. By relying on the language model service 202, the handler 204 desirably has improved accuracy as to its recognition of the input received from the input device 208. For example, in the case of handwriting recognition, the handler 204 may have a language model that is character based, while the service 202 has a language model that is word based. The word-based language model of the service 202 thus provides additional information as to the character that the handler 204 is contemplating inserting into the document 206.

As an example, the handler 204 may be inserting text into the document 206 at a range already including the beginning of a word "th". Based on the input from the input device 208, the handler 204 may have determined based on its own character language model that the best match for the input is a letter "z", with 20% probability, and that the second-best match for the input is a letter "r", with 15% probability. Without utilizing the language model service 202, therefore, the handler 204 is likely to enter the letter "z" into the document 206 at the specified range, after the letters "th". However, it is noted that few words in the English language beginning with the letters "thz", so this is likely incorrect.

A further example is described that is word based. The handler 204 may have two candidates, "dog" and "dos" that it passes to the language model service 202. The service 202 can access the document 206 and determine that the range in question is surrounded by "The <target> chased the cat" where <target> will be either "dog" or "dos". Thus, the service 202 can increase the probability that the correct word is "dog" instead of a "dos".

However, in accordance with embodiments of the invention, the handler 204 also requests the language model service 202 to consider the range and also come up with the best character to insert next, based on the specified range. The service 202 examines this range of text within the document, which is "th", and based thereon has a best match "e" with 85% probability, say, and a second best match "r" with 75% probability. It returns this information to the handler 204. The handler 204 may then decide that since its own language model came up with best matches at the significantly lower probabilities of 20% and 15%, it would yield to the matches determined by the service 202. However, the handler 204 may also then determine, since the best match of the service 202, "e" with 85% probability, is not within the best matches provided by its own language model, while the second-best match of the service 202, "r" with 75% probability, is within the best matches provided by its own language model, that the best character to insert into the document 206 is the letter "r".

That is, the handler 204 has a language model in this example that is character based, and thus does not consider the context of the range of the document 206 into which text is to be injected. It may not have an additional language model that is word based for space, performance, or other considerations. However, by relying on the generic language model service 202, it is able to make use of the word-based language model of the service 202, to complement its own word-based character model. Thus, the language model service 202 acts to augment and complement the model of the handler 204 in this embodiment of the invention. As has been noted, however, the service 202 is subservient to the handler 204 – the service 202

only provides advice as requested by handlers such as the handler 204, and does not itself insert text into the document 206.

As shown in FIG. 2, in one embodiment of the invention, interaction with the document 206 is accomplished directly by both the handler 204 and the language model service 202. However, the invention itself is not so limited. For example, in another embodiment of the invention, each of the handler 204 and the language model service 202 interact with the document 206 via a common text framework that provides an abstraction of the document 206 for interaction with the handler 204 and the service 202. Such a common text framework permit applications that own documents such as the document 206, referred herein as owning applications, to expose their documents as abstractions to handlers and services such as the handler 204 and the service 202. In one embodiment, the service 202 can be considered a special type of input device handler, not having an actual input device, but which communicates with the framework as if it were a handler. A common text framework in conjunction with which embodiments of the invention can be implemented is particularly described in the cofiled, copending and coassigned patent application entitled "Common Text Framework" [attorney docket no. 1018.097US1].

Referring next to FIG. 3, a flowchart of a method 300, according to an embodiment of the invention, is shown. The method 300 can in one embodiment be computer-implemented. The computer-implemented method is desirably realized at least in part as one or more programs running on a computer -- that is, as a program executed from a computer-readable medium such as a memory by a processor of a computer. The programs are desirably storable on a machine-readable medium such as a floppy disk or a CD-ROM, for distribution and installation and execution on another computer. The program or programs can be a part of a computer system or a computer, such as that described in conjunction with FIG. 1 in a previous section of the detailed description. The invention is not so limited, however.

As demarcated in FIG. 3 by the dotted-line 302, the parts 304, 306 and 308 of the method 300 are performed by a language model service, while the parts 310 and 312 of the method 300 are performed by an input device handler. In 304, the language model service receives, in a pre-processing mode of operation, a range within a document from the handler. In 306, the language model service generates advice regarding the text under consideration by the handler to insert within the document at the range. In one embodiment, this is accomplished as has been described – for example, the service references the range within the document 206, and generates a best path through a lattice for the specified range. In 308, the

language model service provides the advice back to the handler, such as returning the best path back to the handler.

In 310, the handler then determines the text to insert within the document at the range, based on the advice provided by the language model service, as well as on the raw data it received from the input device. As has been described, for instance, the handler may compare probabilities of the best path received from the language service and the best path it determined itself as to its own language model's lattice. In 312, the handler then inserts the text it determined in 310 into the document at the specified range.

In one embodiment, the method 300 can be implemented in conjunction with a common text framework as has been described. Thus, in 306, the language model service accesses the text within the range of the document via the framework, through an abstraction of the document as exposed by an owning application of the document also via the framework. In 312 as well, the handler inserts the text at the range of the document via the framework, also through the abstraction of the document as exposed by the owning application also via the framework. It is noted that the invention is not so limited to this embodiment, however.

Correction Mode

In this section of the detailed description, a correction mode of a language model service, according to an embodiment of the invention, is described. The correction mode is designed to supervise correction over a range of text within a document, in which a number of different handlers for a number of different input devices were initially responsible for insertion of the text. The language model service solicits suggestions from the different handlers and based thereon determines text corrections, to be made either by the service itself or by the handlers themselves.

Referring to FIG. 4, a diagram of a system 400 in which a correction mode of operation is accomplished, according to an embodiment of the invention, is shown. The system 400 includes a language model service 402, a first handler 404 for a first input device 408, a second handler 410 for a second input device 412, and a document 406. Each of the handlers 404 and 410 are a computer program, also referred to as a driver or a processor, for the input devices 408 and 410, respectively, such that they receive raw data from their respective input devices, and based thereon inject text into the document 206. For example, the first input device 408 may be a touch-sensitive pad on which a user writes using a stylus, such that the handler 404 recognizes the handwriting as a character of text to be inserted into the document 406. As another example, the second input device 412 may be a microphone into which the user

speaks, such that the handler 410 recognizes the speech as a word of text to be inserted into the document 406.

As described in the previous section of the detailed description, the handlers 404 and 410 can in one embodiment each have a resident, or internal, language model, not shown in FIG. 4, that they utilize to translate the raw data received from their respective input devices to translate into text to inject into the document 406. Such language models are known within the art. For example, in the context of a handwriting recognition handler, the language model is typically character based, where the language model looks at the user input and translate it into a text character. As another example, in the context of a speech recognition handler, the language model is typically word based, where the language model looks at the user input and translates it into a word of text.

The language model service 402 can of FIG. 4 be the same language model service 202 of FIG. 2 that was described in the previous section of the detailed description. However, operation in the correction mode of operation is different than the pre-processing mode of operation. In the correction mode of operation, the language model service 402 supervises corrections over a range of text within a document, where the range encompasses text initially inserted by different handlers. The service 402 solicits suggestions from the different handlers as to what corrections should be made, and based on these suggestions, as well as in one embodiment suggestions made by its own language model, determines the corrections that should be made. The service 402 in one embodiment makes these corrections itself, while in another embodiment the service 402 pushes the determined corrections back to the appropriate handlers, requesting them to make the corrections.

Thus, the language model service 402 is a "master" language model as compared to the language models of the handlers 404 and 410. Each of the handlers 404 and 410 typically only makes decisions as to what a given range of text should be based on the raw data its corresponding input device provided, and does not consider, for example, the range of text for which the other handler is responsible. The language model service 402 in the correction mode of operation provides for overseeing these handlers, so that the corrections they make are desirably consistent with those of the other handler. It is noted that the correction mode of operation is desirably performed after initial text has been inserted by various handlers into a document, such as in conjunction with the pre-processing mode described in the previous section of the detailed description. Once text has been so inserted into the document, request for re-conversion of the text can then desirably be handled by the language model service in the correction mode. In one embodiment, the language model service can also provide for a

common correction user interface to govern corrections made by the user, although the invention is not so limited.

An example sentence of text 500, as shown in the diagram of FIG. 5, is considered. The text 500 is the sentence "The DOS ran to the ball.", where the ranges of text 502 and 504, corresponding to the words "The" and "ran to the ball.", were inserted by a handwriting recognition handler, while the range of text 506, corresponding to the word "DOS", was inserted by a speech recognition handler. The user has entered a correction mode, and is requesting that range of text 508, which encompasses the ranges 502, 504 and 506, be re-converted. In the correction mode, the language model service supervises corrections to the text. Thus, the service first requests advice, such as lattice best paths as described in the previous section of the detailed description, for the ranges 502, 504 and 506, from the handwriting recognition and the speech recognition handlers, where the former handler provides advice as to the ranges 502 and 504, and the latter handler provides advice as to the range 506. For sake of this example, it is assumed that the handwriting recognition handler provides a best lattice path of "The" for the range 502 with 95% probability, and a best lattice path of "ran to the ball" for the range 504 also with 95% probability. However, the speech recognition handler provides two best lattice paths for the range 506 – "DOS" (as in the computer-related acronym for "disk operating system") with 25% probability, and "dog" with 20% probability.

Having solicited these suggestions (which in one embodiment are thus paths through lattices of the appropriate handlers), the language model service is then able to run the suggestions against its own language model. Doing so may yield that the path "The DOS ran to the ball." has a significantly lower probability than the path "The dog ran to the ball.". As a result, the language model service is likely to determine that the word "DOS" in the range 506 should be changed to the word "dog", especially since the speech recognition handler had relatively comparable and low probabilities for the words "DOS" and "dog". In one embodiment, the language model service makes this correction to the range 506 itself. However, in another embodiment, the language model service sends the correction back to the speech recognition handler, since it was originally responsible for inserting the word "DOS" in the document.

As described in the previous section of the detailed description, interaction with the document by the handlers and the language model service can be either directly accomplished, through a common text framework, etc.; the invention is not so limited. For example, each of the handlers and the language model service can in one embodiment interact with a document

via a common text framework that provides an abstraction of the document for interaction with the handlers and the service. Such a common text framework, as has been described, permits applications that own documents, referred to as owning applications, to expose their documents as abstractions to handlers and services. Furthermore, as has also been described, in one embodiment the language model service acting as a master in the correction mode of operation is considered a special type of input device handler, not having an actual input device, but communicating with the framework as if it were a handler. A common text framework in conjunction with which embodiments of the invention can be implemented is described in the cofiled, copending and coassigned patent application entitled "Common Text Framework" [attorney docket no. 1018.098US1].

Referring next to FIG. 6, a flowchart of a method 600, according to an embodiment of the invention, is shown. The method 600 can in one embodiment be computer-implemented. The computer-implemented method is desirably realized at least in part as one or more programs running on a computer -- that is, as a program executed from a computer-readable medium such as a memory by a processor of a computer. The programs are desirably storable on a machine-readable medium such as a floppy disk or a CD-ROM, for distribution and installation and execution on another computer. The program or programs can be a part of a computer system or a computer, such as that described in conjunction with FIG. 1 in a previous section of the detailed description. The invention is not so limited, however.

In 602, the language model service, in a correction mode of operation, solicits suggestions over a range of text within a document, where a number of different handlers were initially responsible for insertion of the text within the range (i.e., within a number of ranges within this range). In 604, the language model service receives the suggestions back from the different handlers. In one embodiment, these suggestions are various path(s) through language model lattices of the handlers, with varying degrees of probability of being the actual text intended to be inserted by the user. In 606, the language model service determines any correction(s) to be made to the range of text, based on the suggestions solicited and received from the input device handlers, and also its own internal, or resident, language model.

Finally, in 608, the corrections are made, where in one embodiment the corrections are made by the language model itself, whereas in another embodiment the corrections are sent back to the appropriate input device handlers that were originally responsible for insertion of the text within the range. As has been described, in one embodiment, access to the text of the document, such as the making of corrections thereto, is made via a common text framework,

through an abstraction of the document as exposed by an owning application via the common text framework, although the invention itself is not so limited.

Pre-Processing and Correction Modes of Operation

In this section of the detailed description, embodiments of the invention are presented in which a language model service is operative in both the pre-processing and correction modes, as these modes have been described in previous sections of the detailed description. A particular embodiment is described in which handlers and a language model service interact with documents owned by application programs via a common text framework. This description is made with reference to the diagram of FIG. 7.

The system 700 of FIG. 7 includes a common text framework 702, that provides for interactivity among applications 704a, 704b, . . ., 704n, and input device handlers 708a, 708b, . . ., 708n. Each of the application programs 704a, 704b, . . ., 704n is a program that has a document of primarily text. Such programs include, for example, word processors, text editors, as well as spreadsheets, presentation managers, etc.; the invention is not so limited. Application programs 704a, 704b, . . ., 704n have corresponding documents 706a, 706b, . . ., 706n, and expose their documents to the framework as abstractions to the framework 702, as opposed to, for example, the internal representation of the documents 706a, 706b, . . ., 706n.

Input device handlers 708a, 708b, . . ., 708n are the handlers, also referred to as processors or drivers, for corresponding input devices 710a, 710b, . . ., 710n. Such input devices include, for example, keyboards, touch pads on which text is "written" using a stylus and then handwriting-recognized by their corresponding handlers, microphones into which words are spoken and then voice-recognized by their corresponding handlers, etc.; the invention is not so limited. Input device handlers 708a, 708b, . . ., 708n access the abstractions of the documents and insert additional text into the documents via the framework 702. Each of the handlers desirably has its own language model, as has been described.

Thus, the framework 702 is a mechanism by which application programs and input devices, through their handlers, can interact with one another on a common basis. In one embodiment, the framework 702 is the common text framework described in the copending, coassigned and cofiled patent application entitled "Common Text Framework" [attorney docket no. 1018.097US1]. The invention is not so limited, however. Furthermore, the language model service 712 desirably has a language model, and is shareable among the handlers 708a, 708b, . . ., 708n, and is operable in pre-processing mode, and a correction mode, as has been described in previous sections of the detailed description. In one embodiment, the

service 712 is a computer program, such as may be stored as instructions on a machine-readable medium, such as a memory, a hard disk drive or other fixed storage, a CD-ROM or other removable storage, etc.; the invention is not so limited.

Conclusion

Although specific embodiments have been illustrated and described herein, it will be appreciated by those of ordinary skill in the art that any arrangement which is calculated to achieve the same purpose may be substituted for the specific embodiments shown. This application is intended to cover any adaptations or variations of the present invention. Therefore, it is manifestly intended that this invention be limited only by the claims and equivalents thereof.

We claim:

1. A method characterized by:

receiving by a language model service in a pre-processing mode of operation a range within a document from a handler for an input device (304);

generating by the language model service advice regarding text under consideration by the handler to insert within the document at the range (306);

providing by the language model service the advice to the handler (308).

2. The method of claim 1, further characterized by:

determining by the handler the text under consideration to insert within the document at the range based on the advice provided by the language model service (310); and,

inserting by the handler the text under consideration within the document at the range (312).

3. The method of claim 2, wherein inserting by the handler the text under consideration within the document at the range is characterized by so inserting the text at the range via a common text framework through an abstraction of the document as exposed by an owning application thereof via the common text framework.

4. The method of claim 1, wherein providing by the language model service the advice to the handler is characterized by accessing text within the range of the document via a common text framework through an abstraction of the document as exposed by an owning application thereof via the common text framework.

5. The method of claim 1, wherein the advice provided by the language model service to the handler for the input device in the pre-processing mode of operation is characterized by a best path through a lattice maintained by the language model service.

6. The method of claim 1, further characterized by:

soliciting suggestions over a range of text within a document by a language model service in a correction mode of operation in which a number of different handlers for a number of different input devices were initially responsible for insertion of the text (602);

receiving the suggestions by the language model service from the different handlers (604); and,

determining corrections to the text by the language model service based on the suggestions received from the different handlers (606).

7. The method of claim 6, further characterized by making the corrections by the language model service itself (608).

8. The method of claim 7, wherein the corrections are made by the language model service via a common text framework through an abstraction of the document as exposed by an owning application via the common text framework.

9. The method of claim 6, further characterized by:

receiving the corrections by the different handlers from the language model service; and,

making the corrections by the different handlers themselves.

10. The method of claim 9, wherein the corrections are made by the language model service via a common text framework through an abstraction of the document as exposed by an owning application via the common text framework.

11. The method of claim 6, wherein access to the range of text of the document by the language model service and the different handlers is through an abstraction thereof as exposed by an owning application via a common text framework.

12. The method of claim 6, wherein the suggestions solicited by the language model service from the different handlers is characterized by paths through lattices maintained by the different handlers.

13. A computerized system characterized by:

a plurality of handlers (708), each handler for an input device and able to enter text into a document; and,

a language model service (712) shareable among the plurality of handlers, characterized by:

a pre-processing mode of operation in which the language model service is designed to receive a range within the document from a handler and in response provide to the handler advice regarding text under consideration by the handler to insert within the document at the range, based on the context of the document within the range; and,

a correction mode of operation in which the language model service is designed to supervise correction over a range of text within a document in which more than one of the plurality of handlers were initially responsible for insertion of the text, such that the language model service solicits suggestions from the more than one of the plurality of handlers and based thereon determines text corrections,

such that the text corrections determined by the language model service in the correction mode of operation are made to the text by one of: the language model service and the more than one of the plurality of handlers.

14. The system of claim 13, wherein the plurality of handlers and the language model service interacts with a common text framework to access the document.

15. The system of claim 14, wherein the plurality of handlers and the language model service accesses the document through an abstraction of the document exposed by an owning application via the common text framework.

FIG 1

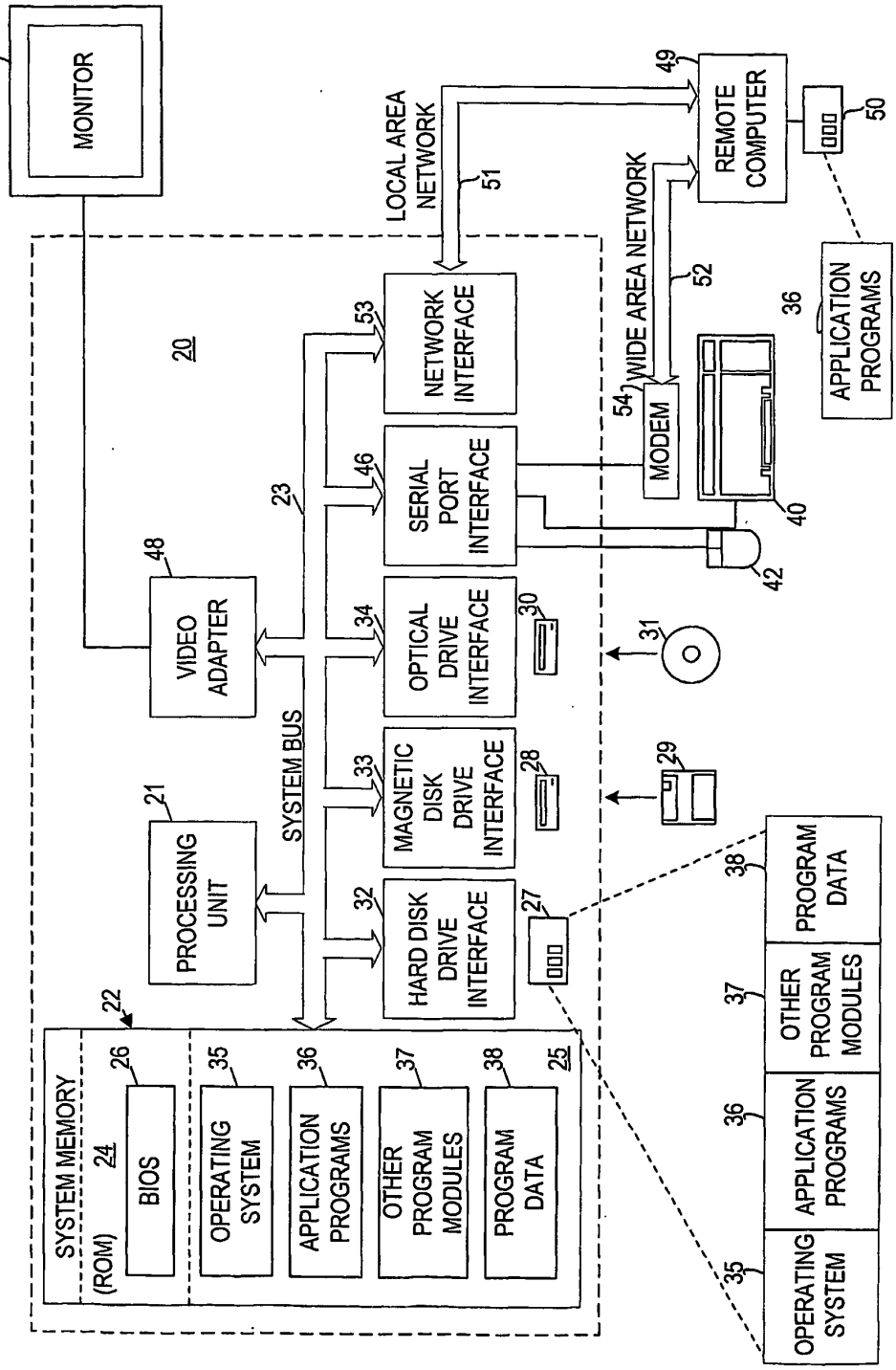

MONITOR
47
20
LOCAL AREA NETWORK
51
49
REMOTE COMPUTER
50
WIDE AREA NETWORK
52
APPLICATION PROGRAMS
36
NETWORK INTERFACE
53
SERIAL PORT INTERFACE
46
MODEM
54
40
42
VIDEO ADAPTER
48
23
SYSTEM BUS
OPTICAL DRIVE INTERFACE
34
30
31
MAGNETIC DISK DRIVE INTERFACE
33
28
29
HARD DISK DRIVE INTERFACE
32
27
PROCESSING UNIT
21
22
SYSTEM MEMORY
(ROM) 24
BIOS
26
OPERATING SYSTEM
35
APPLICATION PROGRAMS
36
OTHER PROGRAM MODULES
37
PROGRAM DATA
38
25
PROGRAM DATA
38
OTHER PROGRAM MODULES
37
APPLICATION PROGRAMS
36
OPERATING SYSTEM
35

FIG 2

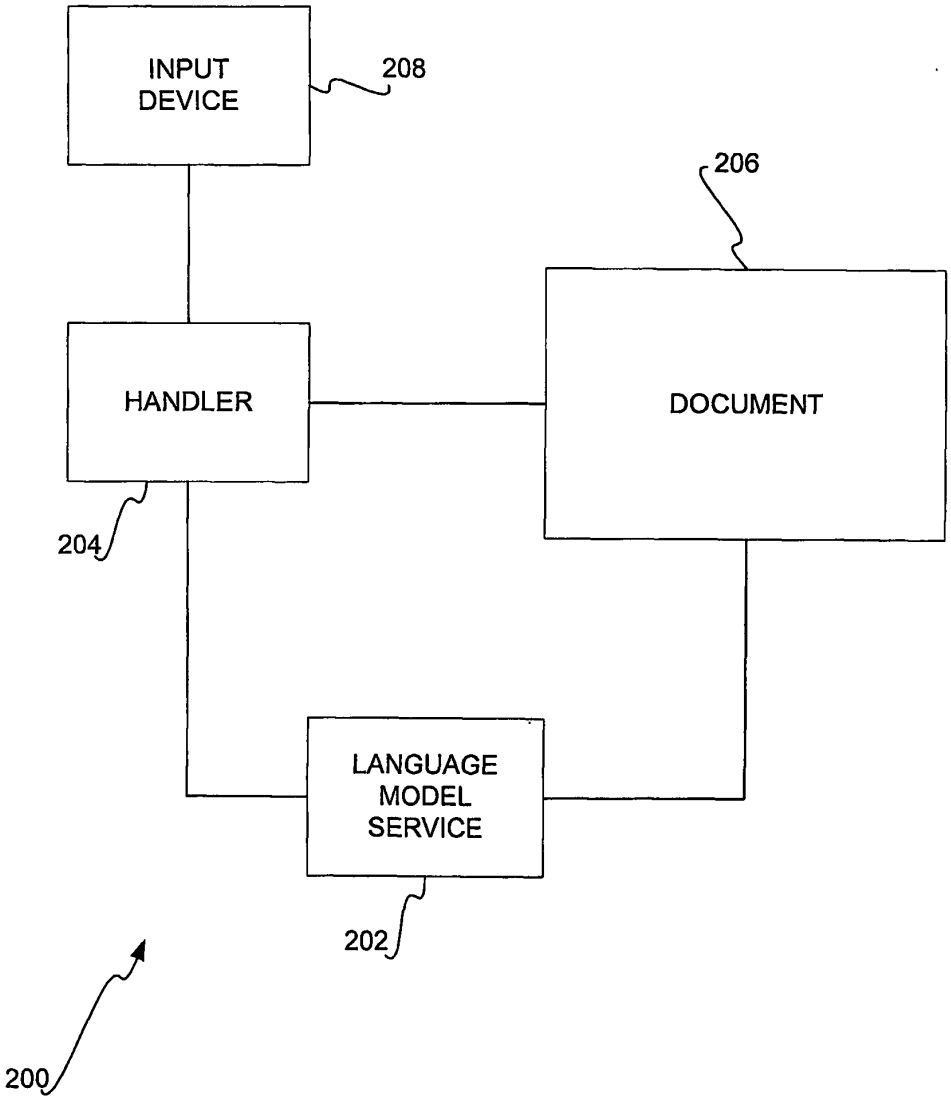

INPUT DEVICE
208
206
HANDLER
DOCUMENT
204
LANGUAGE MODEL SERVICE
202
200

FIG 3

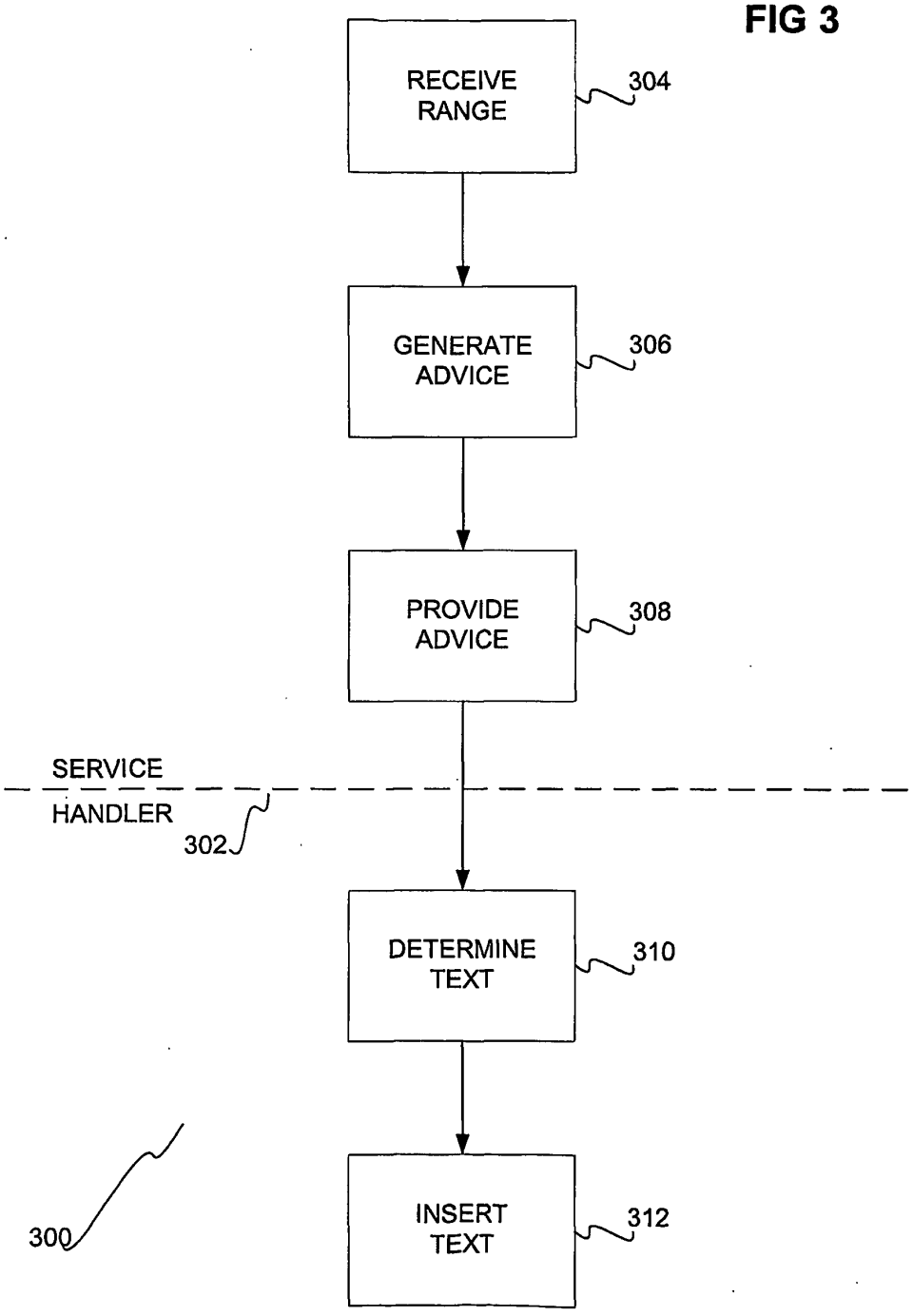

RECEIVE RANGE
304
GENERATE ADVICE
306
PROVIDE ADVICE
308
SERVICE HANDLER
302
DETERMINE TEXT
310
INSERT TEXT
312
300

FIG 4

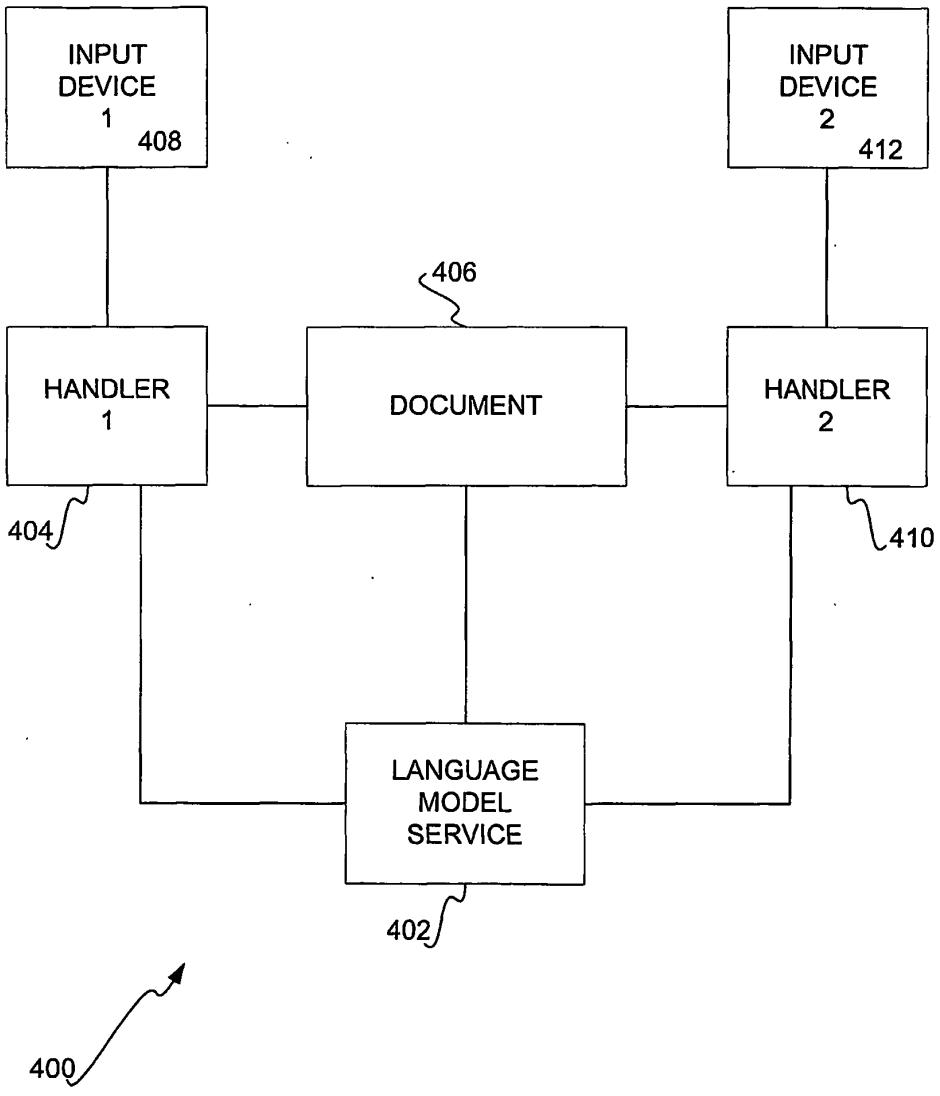

INPUT DEVICE 1
408
INPUT DEVICE 2
412
406
HANDLER 1
DOCUMENT
HANDLER 2
404
410
LANGUAGE MODEL SERVICE
402
400

FIG 5

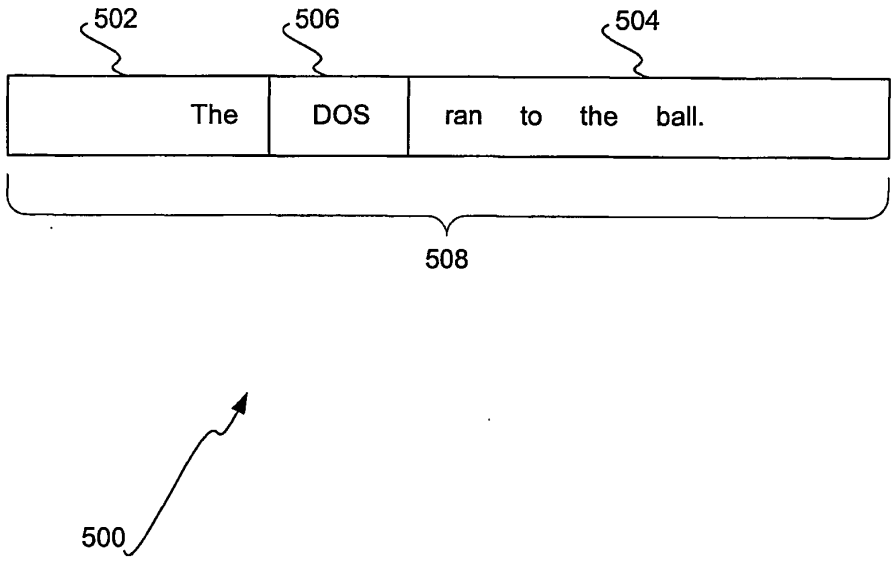


FIG 6

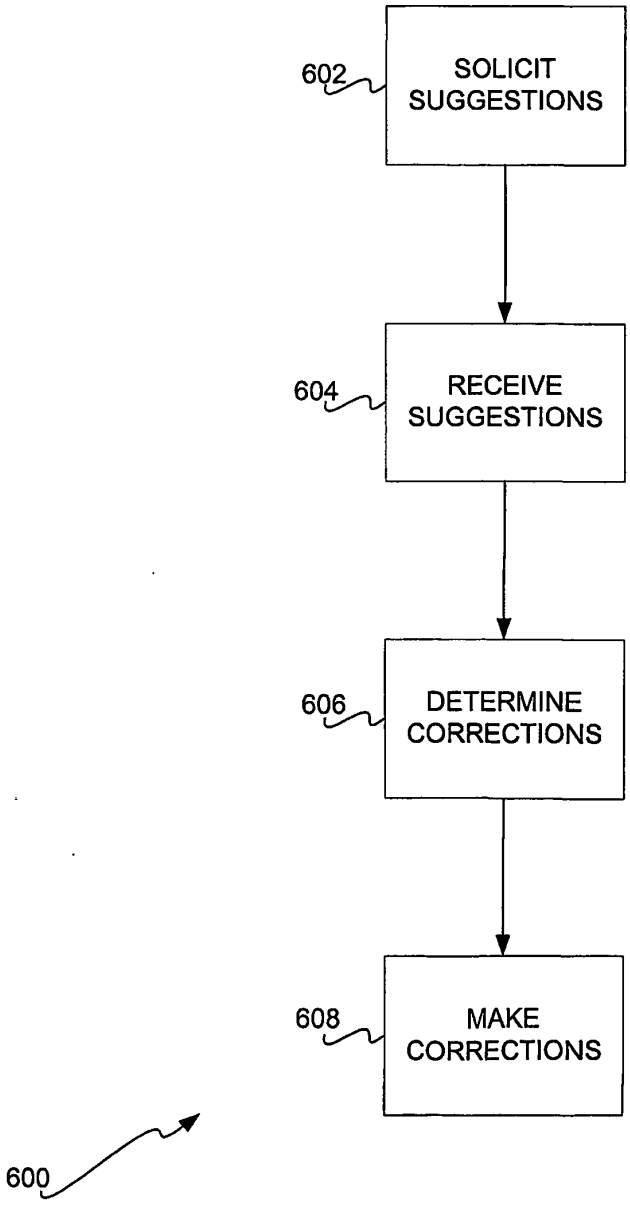
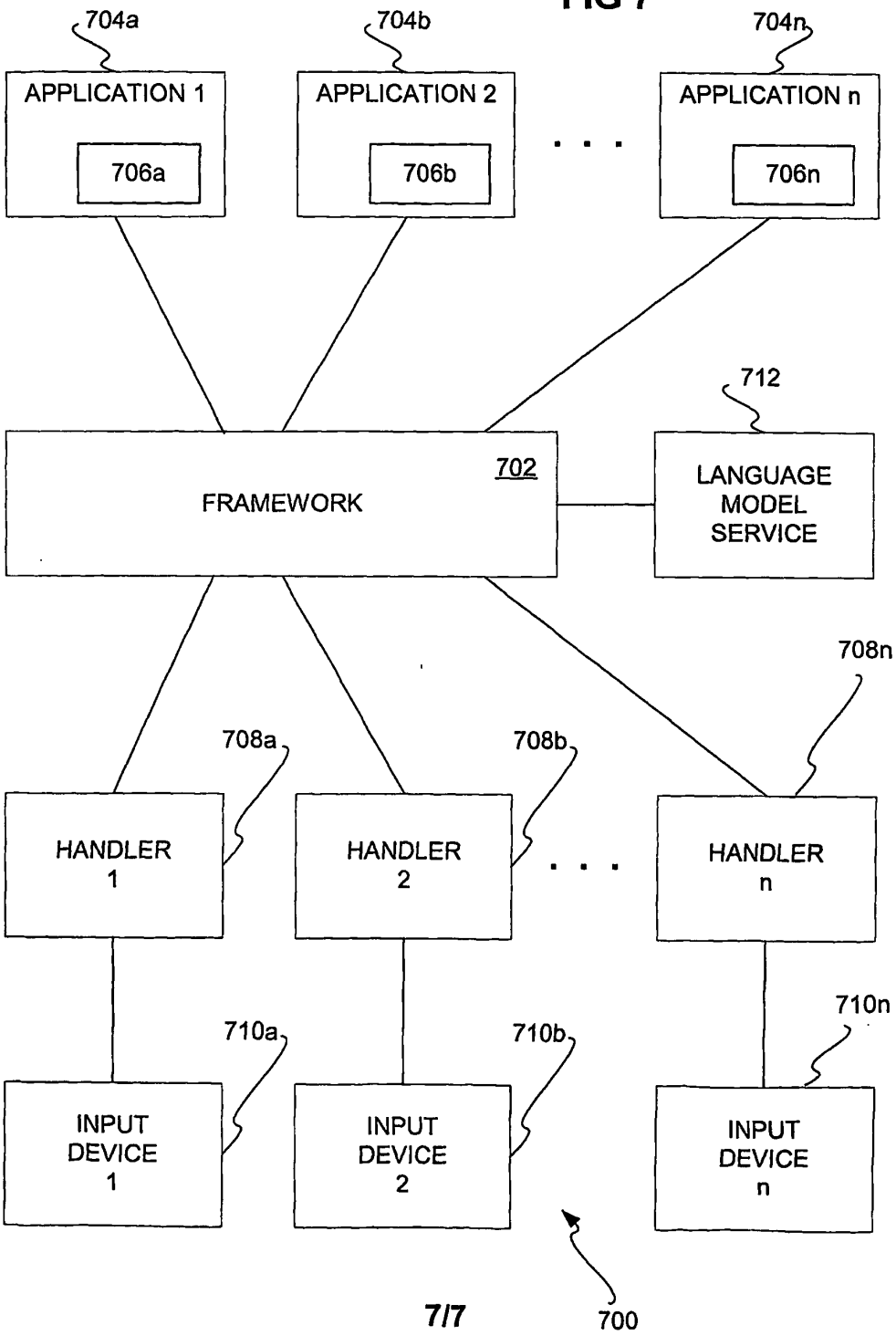

602
SOLICIT SUGGESTIONS
604
RECEIVE SUGGESTIONS
606
DETERMINE CORRECTIONS
608
MAKE CORRECTIONS
600

FIG 7


704a
704b
704n
APPLICATION 1
706a
APPLICATION 2
706b
APPLICATION n
706n
712
FRAMEWORK
702
LANGUAGE MODEL SERVICE
708n
708a
708b
HANDLER 1
HANDLER 2
HANDLER n
710n
710a
710b
INPUT DEVICE 1
INPUT DEVICE 2
INPUT DEVICE n
700

INTERNATIONAL SEARCH REPORT

	ional Application No PCT/US 01/06158

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 G06F17/28

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 G06F

Documentation searched other than minimum documentation 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)
EPO-Internal, INSPEC, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
P,X	WO 00 30070 A (LERNOUT & HAUSPIE SPEECHPROD ;CARUS ALWIN B (US)) 25 May 2000 (2000-05-25) abstract	1,2,13
A	US 6 052 657 A (VAN MULBREGT PAUL A ET AL) 18 April 2000 (2000-04-18) abstract	1,13
A	VAN DEN BOS J: "Abstract interaction tools: a language for user interface management systems" ACM TRANSACTIONS ON PROGRAMMING LANGUAGES AND SYSTEMS, APRIL 1988, USA, vol. 10, no. 2, pages 215-247, XP002169479 ISSN: 0164-0925 the whole document	1,13

☐ Further documents are listed in the continuation of box C. ☒ Patent family members are listed in 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 document 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
13 June 2001	06/07/2001

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	Triest, J

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Information on patent family members

ıtional Application No
PCT/US 01/06158

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 0030070 A	25-05-2000	AU 3789900 A	05-06-2000
US 6052657 A	18-04-2000	EP 1012736 A	28-06-2000
		WO 9913408 A	18-03-1999

Form PCT/ISA/210 (patent family annex) (July 1992)

CIPE
AUG 05 2002
PATENT & TRADEMARK OFFICE

2641/4 #6
1/30/03
DH

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant	:	Edwin A. Suominen	Art Unit	:	2641
Serial No.	:	10/061,052	Examiner*	:	Nolan, D.
Filing Date	:	January 28, 2002	* *In parent application*		
Title	:	Text Processing System			

Assistant Commissioner for Patents
Washington, DC 20231

CERTIFICATE OF MAILING UNDER 37 CFR 1.8: I hereby certify that this correspondence is being deposited on July 30, 2002 with the United States Postal Service, with sufficient postage as first class mail in an envelope addressed to: Assistant Commissioner for Patents Washington, DC 20231

by: Edwin A. Suominen
(Name) (Signature)

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Technology Center 2600

07/30/2002 MAHMED1 00000053 10061052
01 FC:216 200.00 OP

RESPONSE TO NOTICE

Dear Sir:

Responsive to the Notice to File Corrected Application Papers mailed April 1, 2002, applicant submits the following:

- Supplemental Preliminary Amendment that includes the required abstract of the disclosure as well as various amendments and remarks.
- Corrected drawing sheets, as required.
- Information Disclosure Statement with Form PTO-1449 and copies of recently published reference not cited in the parent to this application.
- Check for $200 to cover the small-entity fee for a requested two-month extension of time.

Please feel free to telephone the undersigned (who is also the applicant) if it would in any way advance prosecution of this application.

Respectfully submitted,

Dated: July 30, 2002

By: _____

Edwin A. Suominen
Reg. No. 43,174

14614 North Kierland Boulevard
Suite 300
Scottsdale, Arizona 85254
(480) 948-3295

20020730.2307

UNITED STATES PATENT AND TRADEMARK OFFICE

COMMISSIONER FOR PATENTS
UNITED STATES PATENT AND TRADEMARK OFFICE
WASHINGTON, D.C. 20231
www.uspto.gov

APPLICATION NUMBER	FILING/RECEIPT DATE	FIRST NAMED APPLICANT	ATTORNEY DOCKET NUMBER
10/061,052	01/28/2002	Edwin A. Suominen	

CONFIRMATION NO. 5352

FORMALITIES LETTER

OC000000007758269

Edwin A. Suominen
Suite 300
14614 North Kierland Boulevard
Scottsdale, AR 85254

Date Mailed: 04/01/2002

NOTICE TO FILE CORRECTED APPLICATION PAPERS

Filing Date Granted

This application has been accorded an Application Number and Filing Date. The application, however, is informal since it does not comply with the regulations for the reason(s) indicated below. Applicant is given **TWO MONTHS** from the date of this Notice within which to correct the informalities indicated below. 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 required item(s) identified below must be timely submitted to avoid abandonment:

- Substitute drawings in compliance with 37 CFR 1.84 because:
  - drawing sheets do not have the appropriate margin(s) (see 37 CFR 1.84(g)). Each sheet must include a top margin of at least 2.5 cm. (1 inch), a left side margin of at least 2.5 cm. (1 inch), a right side margin of at least 1.5 cm. (5/8 inch), and a bottom margin of at least 1.0 cm. (3/8 inch);
- An abstract was not provided for this application. An abstract of the technical disclosure is required under 37 CFR 1.72(b).

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

C. J. Harrison

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

jc759 U.S. PTO 01/28/02

OIPE JC35 JAN 28 2002 PATENT & TRADEMARK OFFICE

01-31-01

A

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

j1017 U.S. PTO 10/061052 01/28/02

Applicant	:	Edwin A. Suominen	Art Unit:	:	2641*
Serial No.	:	10/_____	Examiner:	:	Nolan, D.*
Filing Date	:	January 28, 2002	*In parent application*		
Title	:	Text Processing System			

BOX PATENT APPLICATION
Assistant Commissioner for Patents
Washington, DC 20231

Express Mail Label No.: EK739151725US

1006.1052-01500

APPLICATION TRANSMITTAL UNDER 37 C.F.R. 1.53(b)

Dear Sir:

Transmitted herewith is a patent application of Edwin A. Suominen entitled "Text Processing System."

CONTINUATION APPLICATION

The present application is a continuation, filed under 37 C.F.R. 1.53(b), of Application No. 09/616,157, filed on July 14, 2000, naming Edwin A. Suominen as inventor. The present application claims the benefit of that prior, co-pending U.S. application under 35 U.S.C. §120.

A complete copy of the prior application is enclosed, except the declaration, which is replaced by a new one.

PAPERS ENCLOSED WHICH WERE FILED WITH THE PRIOR APPLICATION

- 80 pages of specification, including 23 pages of claims. (Pages 58, 72-74, and 80 include handwritten modifications made by applicant before signing of the declaration in the '157 parent application.)
- 17 formal drawing sheets.

ADDITIONAL PAPERS ENCLOSED

Enclosed also in support of this application are the following papers for the continuation application, for entry once a filing date has been granted:

- Preliminary Amendment.
- New inventor's Declaration, form PTO/SB/01, which replaces the prior application's combined Declaration and Power of Attorney because the application's original Power of Attorney has been revoked.

FEES

Small entity status is claimed. Upon entry of the enclosed preliminary amendment, this application contains 2 independent claims and 2 claims total. A Form PTO-2038 is enclosed authorizing credit card payment of $370 to cover the basic small-entity filing fee.

POWER OF ATTORNEY / AUTHORIZATION OF AGENT

This application is being prosecuted by the applicant (a registered agent) *pro se*. No power of attorney or authorization of agent is being filed.

RELATED PAPERS

Submitted concurrently in the '157 parent application are:

- Petition for Extension of Time with an accompanying Form PTO-2038 authorizing credit card payment of $460 to cover the small-entity extension fee.
- Express Abandonment of the '157 application in favor of the presently filed Continuation Application.

20050210-250Transmit

Please direct all correspondence to the undersigned at the address given below.

Respectfully submitted,

Dated: January 28, 2002

By: _____

Edwin A. Suominen
Reg. No. 43,174

14614 North Kierland Boulevard
Suite 300
Scottsdale, Arizona 85254
(480) 948-3295

2002-0452-005004

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant	:	Edwin A. Suominen	Art Unit:	:	2641*
Serial No.	:	10/_____	Examiner:	:	Nolan, D.*
Filing Date	:	January 28, 2002	* *In parent application*		
Title	:	Text Processing System			

BOX PATENT APPLICATION
Assistant Commissioner for Patents
Washington, DC 20231

Express Mail Label No.: EK739151725US

PRELIMINARY AMENDMENT

Dear Sir:

Applicant submits the following amendments and remarks prior to examination of this Continuation Application. Upon entry of this amendment, claims 58 and 62 are pending in the application, both of which are independent.

Amendments

Beginning on the next page are instructions identifying locations for deletion, replacement, or addition of paragraphs and claims, with clean versions thereof. Marked-up versions of any replacement paragraphs or amended claims are provided at the end of this amendment in a section entitled Version with Markings to Show Changes Made. Please note that the marked-up version does not include any added or deleted claims or paragraphs.

09252005 10076052

NEW OR REPLACEMENT PARAGRAPHS OF SPECIFICATION:

PLEASE INSERT the specification paragraph below immediately below the title:

This application is a continuation of U.S. Patent Application No. 09/616,157, filed July 14, 2000, now abandoned, which claims the benefit of U.S. Provisional Patent Application No. 60/144,481, filed July 17, 1999. Both prior applications are incorporated herein by reference.

PLEASE REPLACE the specification paragraph identified below with the following replacement paragraph:

PAGE 27, PARAGRAPH 2:

Wireless nodes 227 and 230 include any suitable transmitter(s) and/or receiver(s) for establishing respective communications links 225 and 235. Transmitter 122 and receiver 160, discussed above with reference to FIG. 1A, are examples of suitable transmitters and receivers, respectively. Node 227 establishes bi-directional communications between domain controller 220 and each tablet 252, 254, and 256. Because communications link 225 is bi-directional, node 227 includes both a transmitter and receiver. Node 230 establishes unidirectional communications between domain controller 220 and styluses 210 and 212. Typically, only a unidirectional communications link is needed to a stylus, because the stylus typically only sends information.

PAGE 38, PARAGRAPH 3:

The semantic model may be part of a shared language model of the invention. In message recognizer 310, for example, semantic model 354 is part of shared language model 350. A message recognizer may include two or more subordinate message recognizers, each of which may operate in accordance with the semantic model in the shared language model. Advantageously, the accuracy of each subordinate message recognizer sharing a language model that includes a semantic model according to

various aspects of the present invention may be improved by user identification of context.

PAGE 40, PARAGRAPH 3:

A non-technical word that appears in a technical document such as a patent application may be designated as a stop word outside the present context, regardless of the author's overall writing habits. For example, words relating to familial relationships (including the word UNCLE) are not typically used in patent applications. In the "horizontal" example, a user may identify the word UNCLE as being outside the present context (but not the user context) by drawing a single line through it, for example in the first alternative text listing "cores Uncle." Single lines may then appear drawn through each occurrence of the word UNCLE, since the word has been identified as a "present context" stop segment.

PAGE 48, PARAGRAPH 3:

A context definition mode that is initiated automatically can present the user with a list of alternative text segments in addition to the message recognizer's "best guess." Alternatively, the user may be presented with a simple question that may be quickly answered. For example, if the user dictates the sentence "Can you recognize speech?", the message recognizer may determine that the word BEACH could be especially useful for indicating context as a stop segment. If the message recognizer is configured to initiate a context definition mode automatically, the user might be presented with a dialog box containing the statement "You dictated the phrase RECOGNIZE SPEECH. Is the word BEACH of context?" and three "radio buttons" labeled "No," "Yes, this time," and "Always." If the word BEACH is not out of context, the user could select (or say) "No." If the word BEACH is outside the present context, the user could select or say "Yes, this time. " If the word BEACH is outside the user context, the user could select or say "Always."

IN THE CLAIMS:

PLEASE CANCEL claims 1-57, 59-61, and 63-80.

Remarks

The specification is amended to conform with amendments made to the parent application, which the Examiner applied with a resultant withdrawal of objections.

All claims except 58 and 62 are cancelled, without prejudice, to limit excess claim fees.

In the '157 parent application, all pending claims were rejected under 35 U.S.C. § 103 as being obvious over various references. A supplemental preliminary amendment with applicant's response to the rejections and reinstatement of various claims is forthcoming.

Please feel free to telephone the undersigned (who is also the applicant) if it would in any way advance prosecution of this application.

Respectfully submitted,

Dated: January 28, 2002

By: _____

Edwin A. Suominen
Reg. No. 43,174

14614 North Kierland Boulevard
Suite 300
Scottsdale, Arizona 85254
(480) 948-3295

MARKED-UP COPY OF AMENDED PARAGRAPHS AND CLAIMS

PAGE 27, PARAGRAPH 2:

Wireless nodes 227 and 230 include any suitable transmitter(s) and/or receiver(s) for establishing respective communications links 225 and 235. Transmitter 122 and receiver 160, discussed above with reference to FIG. 1A, are examples of suitable transmitters and receivers, respectively. Node 227 establishes [*bidirectional*] bi-directional communications between domain controller 220 and each tablet 252, 254, and 256. Because communications link 225 is [*bidirectional*] bi-directional, node 227 includes both a transmitter and receiver. Node 230 establishes unidirectional communications between domain controller 220 and styluses 210 and 212. Typically, only a unidirectional communications link is needed to a stylus, because the stylus typically only sends information.

PAGE 38, PARAGRAPH 3:

The semantic model may be part of a shared language model of the invention. In message recognizer 310, for example, semantic model 354 is part of shared language model 350. A message recognizer may include two or more subordinate message recognizers, each of which may operate in accordance with the semantic model in the shared language model. Advantageously, the accuracy of each subordinate message recognizer sharing a language model that includes a semantic model [*model*] according to various aspects of the present invention may be improved by user identification of context.

PAGE 40, PARAGRAPH 3:

A [*nontechnical*] non-technical word that appears in a technical document such as a patent application may be designated as a stop word outside the present context, regardless of the author's overall writing habits. For example, words relating to familial relationships (including the word UNCLE) are not typically used in patent applications. In the "horizontal" example, a user may identify the word UNCLE as being outside the

present context (but not the user context) by drawing a single line through it, for example in the first alternative text listing "cores Uncle." [*Double*] Single lines may then appear drawn through each occurrence of the word UNCLE, since the word has been identified as a "present context" stop segment.

PAGE 48, PARAGRAPH 3:

A context definition mode that is initiated automatically [*a*] can present the user with a list of alternative text segments in addition to the message recognizer's "best guess." Alternatively, the user may be [*present*] presented with a simple question that may be quickly answered. For example, if the user dictates the sentence "Can you recognize speech?", the message recognizer may determine that the word BEACH could be especially useful for indicating context as a stop segment. If the message recognizer is configured to initiate a context definition mode automatically, the user might be presented with a dialog box containing the statement "You dictated the phrase RECOGNIZE SPEECH. Is the word BEACH of context?" and three "radio buttons" labeled "No," "Yes, this time," and "Always." If the word BEACH is not out of context, the user could select (or say) "No." If the word BEACH is outside the present context, the user could select or say "Yes, this time. " If the word BEACH is outside the user context, the user could select or say "Always."

Petitioner's Exhibit 1004

TEXT PROCESSING SYSTEM

Inventor: Edwin A. Suominen

BACKGROUND OF THE INVENTION

Conventional computer workstations use a "desktop" interface to organize information on a single display screen. Users of such workstations may work with multiple documents on the desktop interface. However, many users find it more desirable to organize multiple documents on a work surface than to focus attention to multiple windows on a fixed display screen. A physical work surface is usually much larger than the screen display, and multiple documents may be placed on the surface for quick access and review. For many users, it is more natural and convenient to look for a desired document by visual inspection in a physical workspace than to click on one of a number of windows on a display screen. Because it is desirable to shift positions throughout a long workday, many users also prefer to physically pick up a document and review it in a reclining position instead of remaining in a fixed, upright seated position to review the document on a fixed display screen.

In an article entitled "The Computer for the 21st Century," which appeared in the September 1991 issue of *Scientific American*, Mark Weiser has proposed "electronic pads" that may be spread around on a desk like conventional paper documents. These pads are intended to be "scrap computers", analogous to scrap paper and having no individualized identity or importance. The pads can be picked up and used anywhere in the work environment to display an electronic document and receive freehand input with a stylus.

An article in the September 17, 1993 issue of *Science* included a further description of Weiser's ideas. In the article, electronic pads are characterized as thin note pads with a flat screen on top that a user could scribble on. The pads are intended to be as easy to use as paper. Instead of constantly opening and closing applications in the on-screen windows of a single desktop machine, a user could stack the pads around an office like paper and have all of them in use for various tasks at the same time.

The need has long been felt to generate text data (*e.g.*, character codes in a word processor) by voice input, and to integrate voice input with pen-based computers. An article headlined "Pen

Apple v. Eolas
IPR2015-01280

EK739151725 US

and Voice Unite" in the October 1993 issue of *Byte Magazine*, for example, describes a system for responding to alternating spoken and written input. In the system described, the use of pen and voice alternates as the user either speaks or writes to the system. The article states that using a pen to correct misrecognitions as they occur could make an otherwise tedious dictation system acceptable. According to the article, misrecognized words could be simply crossed out. The article suggests, however, that a system in which the use of pen and voice alternates as the user either speaks or writes to the system is less interesting than possibilities that could arise from simultaneous speech and writing.

The effectiveness and convenience of generating text data by voice input is directly proportional to the accuracy of the speech recognizer. Frequent misrecognitions make generation of text data tedious and slow. To minimize the frequency of misrecognitions, it is desirable to provide voice input of relatively high acoustic quality to the speech recognizer. A signal with high acoustic quality has relatively consistent reverberation and amplitude, and a high signal-to-noise ratio. Such quality is conventionally obtained by receiving voice input via a headset microphone. By being mounted on a headset, a microphone may be mounted at a close, fixed proximity to the mouth of a person dictating voice input and thus receive voice input of relatively high acoustic quality.

Head mounted headsets have long been viewed with disfavor for use with speech recognition systems, however. In a 1993 article entitled "From Desktop Audio to Mobile Access: Opportunities for Voice in Computing," Christopher Schmandt of MIT's Media Laboratory concludes that "obtaining high-quality speech recognition without encumbering the user with head mounted microphones is an open challenge which must be met before recognition will be accepted for widespread use." In the November 7, 1994 issue of *Government Computer News,* an IBM marketing executive in charge of IBM speech and pen products is quoted as saying that, *inter alia*, a way must be found to eliminate head-mounted microphones before natural-language computers become pervasive. The executive is further quoted as saying that the headset is one of the biggest inhibitors to the acceptance of voice input.

Being tethered to a headset is especially inconvenient when the user needs to frequently walk away from the computer. Even a cordless headset can be inconvenient. Users may feel self-conscious about wearing such a headset while performing tasks away from the computer.

The long felt need for a system incorporating speech recognition capability with pen-based computers has remained largely unfulfilled. Such a system presents conflicting requirements for high acoustic quality and freedom of movement. Pen-based computers are often used in collaborative environments having high ambient noise and extraneous speech. In such environments, the user may be an engaging in dialogue and gesturing in addition to dictation. Although a headset-mounted microphone would maintain acoustic quality in such situations, the headset is inconsistent with the freedom of movement desired by users of pen-based computers.

It has long been known to incorporate a microphone into a stylus for the acquisition of high-quality speech in a pen-based computer system. For example, the June 1992 edition of IBM's *Technical Disclosure Bulletin* discloses such a system, stating that speech is a way of getting information into a computer, either for controlling the computer or for storing and/or transmitting the speech in digitized form. However, the *Bulletin* states that such a system is not intended for applications where speech and pen input are required simultaneously or in rapid alteration.

IBM's European patent application EP 622724, published in 1994, discloses a microphone in a stylus for providing speech data to a pen-based computer system, which can be recognized by suitable voice recognition programs, to produce operational data and control information to the application programs running in the computer system. *See*, for example, column 18, lines 35-40 of EP 622724. Speech data output from the microphone and received at the disclosed pen-based computer system can be converted into operational data and control information by a suitable voice recognition program in the system.

To provide an example of a "suitable voice recognition program," the EP 622724 application refers to U.S. Patent Application 07/968,097, which matured into U.S. patent 5,425,129 to Garman. At column 1, lines 54-56, the '129 patent states the object of providing a speech recognition system with word spotting capability, which allows the detection of indicated words or phrases in the presence of unrelated phonetic data.

Due to the shortcomings of available references such as the aforementioned June 1992 IBM *Technical Disclosure Bulletin*, EP 622724 European application, and 07/968,097 U.S. application, the need remains to integrate high-quality voice input for dictation with pen-based computers. This need is especially unfulfilled for a system that includes voice dictation capability with a number of electronic pads. Such a system would need to maintain acoustic

EXHIBIT 2052 - 0129

quality while providing voice input to a desired one of the pads, which are spread out on a work surface, possibly in a noisy collaborative environment, at varying distances from the source of voice input.

The need also remains for a speech recognizer that may be automatically activated when voice input is desired. U.S. patent 5,857,172 to Rozak, for example, identifies a difficulty encountered with conventional speech recognizers in that such speech recognizers are either always listening and processing input or not listening. When such a speech recognizer is active and listening, all audio input is processed, even undesired audio input in the form of background noise and inadvertent comments by a speaker. As discussed above, such undesired audio input may be expected to be especially problematic in collaborative environments where pen-based computers are often used. The '172 patent discloses a manual activation system having a designated hot region on a video display for activating the speech recognizer. Using this manual system, the user activates the speech recognizer by positioning a cursor within the hot region. It would be desirable however, for a speech recognizer to be automatically activated without the need for a specific selection action by the user.

Speech recognition may be viewed as one possible subset of message recognition. As defined in Merriam-Webster's *WWWebster Dictionary* (Internet edition), a message is "a communication in writing, in speech, or by signals." U.S. Patent 5,502,774, issued March 26, 1996 to Bellegarda discloses a "message recognition system" using both speech and handwriting as complementary sources of information. Speech recognizers and handwriting recognizers are both examples of message recognizers.

A need remains for message recognition with high accuracy. Misrecognitions by conventional message recognizers, when frequent, make generation of text data tedious and slow. Conventional language, acoustic, and handwriting models respond to user training (*e.g.*, corrections of misrecognized words) to adapt and improve recognition with continued use.

In conventional message recognition systems, user training is tied to a specific computer system (*e.g.*, hardware and software). Such training adapts language, acoustic, and/or handwriting models that reside in data storage of the specific computer system. The adapted models may be manually transferred to a separate computer system, for example, by copying files to a magnetic storage medium. The inconvenience of such a manual operation limits the

portability of models in a conventional speech recognition system. Consequently, a user of a second computer system is often forced to duplicate training that was performed on a first computer system. In addition, rapid obsolescence of computer hardware and software often renders adapts language, acoustic, and/or handwriting models unusable after the user has invested a significant amount of time to adapt those models.

Conventionally, user training is also tied to a specific type of message recognizer. Correction of misrecognized words typically improves only the accuracy of the particular type of message recognizer being corrected. U.S. Patent 5,502,774 to Bellegarda discloses a multi-source message recognizer that includes both a speech recognizer and a handwriting recognizer. The '774 patent briefly states, at column 4, lines 54-58, that the training of respective source parameters for speech and handwriting recognizers may be done globally using weighted sum formulae of likelihood scores with weighted coefficients. However, the need remains for a multi-source message recognizer that can apply user correction to appropriately perform training for multiple types of recognition, by applying the correction of a message misrecognition only to those models employed in the type of message recognition to which the training is directly relevant.

Conventional message recognition systems include a language model and a type-specific model (*e.g.*, acoustic or handwriting). As discussed in U.S. patent 5,839,106, issued November 17, 1998 to Bellegarda, conventional language models rely upon the classic N-gram paradigm to define the probability of occurrence, within a spoken vocabulary, of all possible sequences of N words. Given a language model consisting of a set of *a priori* N-gram probabilities, a conventional speech recognition system can define a "most likely" linguistic output message based on acoustic input signal. As the '106 patent points out, however, the N-gram paradigm does not contemplate word meaning, and limits on available processing and memory resources preclude the use of models in which N is made large enough to incorporate global language constraints. Accordingly, models based purely on the N-gram paradigm can utilize only limited information about the context of words to enhance recognition accuracy.

Semantic approaches to language modeling have been disclosed. Generally speaking, such techniques attempt to capture meaningful word associations within a more global language context. For example, U.S. patent 5,828,999, issued October 27, 1998 to Bellegarda *et al.*

discloses a large-span semantic language model which maps words from a vocabulary into a vector space. After the words are mapped into the space, vectors representing the words are clustered into a set of clusters, where each cluster represents a semantic event. After clustering the vectors, a first probability that a first word will occur (given a history of prior words) is computed. The probability is computed by calculating a second probability that the vector representing the first word belongs to each of the clusters; calculating a third probability of each cluster occurring in a history of prior words; and weighting the second probability by the third probability.

The '106 patent discloses a hybrid language model that is developed using an integrated paradigm in which latent semantic analysis is combined with, and subordinated to, a conventional N-gram paradigm. The integrated paradigm provides an estimate of the likelihood that a word, chosen from an underlying vocabulary, will occur given a prevailing contextual history.

A prevailing contextual history may be a useful guide for performing general semantic analysis based on a user's general writing style. However, a specific context of a particular document may be determined only after enough words have been generated in that document to create a specific contextual history for the document. In addition, the characterization of a contextual history by a machine may itself be inaccurate. For effective semantic analysis, the need remains for accurate and early identification of context.

Attorney Docket No. 42390.P8052

BRIEF DESCRIPTION OF THE DRAWING

Embodiments of the present invention are described below with reference to the drawing, wherein like designations denote like elements, and:

FIGS. 1A and 1B are, respectively, a functional block diagram and simplified pictorial view of a single-tablet system responsive to freehand input and voice input, according to various aspects of the present invention;

FIG. 2 is a combination block diagram and simplified pictorial view of a multiple-tablet system responsive to freehand input and voice input, according to various aspects of the present invention;

FIG. 3A is a functional block diagram of a domain controller in the system of FIG. 2;

FIG. 3B is a functional block diagram of a message model in the domain controller of FIG. 3A;

FIG. 4 is a data flow diagram of the operation of a stylus according to various aspects of the present invention;

FIG. 5 is a data flow diagram of the operation of the domain controller of FIG. 3A in cooperation with the stylus of FIG. 4;

FIG. 6A is a functional and simplified schematic block diagram of a stylus that includes an activation circuit having an infrared radiation sensor responsive to infrared field radiation according to various aspects of the present invention;

FIG. 6B is a simplified pictorial view illustrating operation of the activation circuit in the stylus of FIG. 6A;

FIG. 7A is a functional and simplified schematic block diagram of a stylus that includes an activation circuit having an acoustic radiation sensor and ultrasonic transmitter according to various aspects of the present invention;

FIG. 7B is a simplified pictorial view illustrating operation of the activation circuit in the stylus of FIG. 7A;

FIG. 8, including FIGS. 8A through 8D, is a timing diagram of signals provided by a stylus according to various aspects of the present invention;

FIG. 9 is a diagram of relationships among various models of a message model according to various aspects of the present invention;

FIG. 10 is a flow diagram of a method for the identification of semantic clusters according to various aspects of the present invention;

FIG. 11 is a flow diagram of a process for analyzing semantic clusters of a training corpus according to various aspects of the present invention;

FIG. 12 illustrates a partial example of a data structure tabulating probabilities computed in the method of FIG. 10;

FIG. 13 is a flow diagram of a method for adapting a semantic model by user identification of context according to various aspects of the present invention;

FIG. 14 is a flow diagram of a method for adapting a syntactic model by user correction of misrecognition according to various aspects of the present invention; and

FIGS. 15A and 15B are planar views of respective tablets displaying respective views of a document according to various aspects of the present invention.

DESCRIPTION OF PREFERRED EXEMPLARY EMBODIMENTS

A text processing system according to various aspects of the present invention may be responsive to both voice input and freehand input to generate and edit text data. Text data is any indicia of text that may be stored and conveyed numerically. For example, text data may be numerical codes used in a computer to represent individual units (*e.g.*, characters, words, kanji) of text. Voice input may be used primarily to generate text data, while freehand input may be used primarily to edit text data generated by voice input. For example, system 100 of FIG. 1 (including FIGS. 1A and 1B) suitably includes a stylus 110 responsive to voice input and a tablet 150 responsive to freehand input, coupled together via a communications link 115.

A tablet according to various aspects of the present invention includes any suitable hardware and/or software for performing functions of, *inter alia*, a speech recognizer and an editor. Tablet 150, for example, may include a conventional CPU and memory (not shown) having indicia of suitable software instructions for the CPU to implement tablet interface 164, speech recognizer 162, and editor 168. Tablet 150 may further include suitable conventional hardware (*e.g.*, "glue logic," display driving circuitry, battery power supply, etc.) and/or software (*e.g.*, operating system, handwriting recognition engine, etc.).

Tablet 150 may be an "electronic book" type of portable computer having a tablet surface and a display integrated into the tablet surface. Such a computer may include hardware and software of the type disclosed in U.S. Patent 5,602,516, issued September 1, 1998 to Shwarts *et al.*, and U.S. Patent 5,903,668, issued May 11, 1999 to Beernink. The detailed description portion (including referenced drawing figures) of each of these two aforementioned patents is incorporated herein by reference. Further, the detailed description portion (including referenced drawing figures) of any U.S. patent or U.S. patent application incorporated by reference into either of these two aforementioned patents is also specifically incorporated herein by reference.

Functional blocks implemented by hardware and/or software in tablet 150 include: tablet interface 164 for receiving freehand input communicated via pointer 610 of stylus 110; receiver 160 for receiving (indirectly) voice input communicated via microphone 120 of stylus 110; speech recognizer 162 for generating text data responsive to the voice input; and editor 168. In FIG. 2 and also in FIGS. 3A and 3B (discussed below), interconnection between functional blocks is depicted by single lines. Such lines represent transfer of data by any suitable hardware or software interconnection, including, for example, the transfer of memory contents between software objects instantiated in a single processing environment.

Microphone 120 couples voice input from stylus 110 to speech recognizer 162 via transmitter 122 and receiver 160. Transmitter 122 is coupled to receiver 160 via communications link 115. Speech recognizer 162 generates text data responsive to voice input from user 240 and provides the text data to editor 168. Tablet interface 164 interprets editing commands responsive to freehand input and provides indicia of the editing commands to editor 168. Editor 168 performs any modifications to the text data that are suitably specified by the editing commands. Speech recognizer 162, tablet interface 164, and editor 168 are described in greater detail below.

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According to various aspects of the present invention, a communications link may employ any suitable medium, modulation format, and/or communications protocol to convey information from transmitter in a stylus to a receiver in, for example, a table. A communications link may use a wired (*i.e.*, physical) connection, or a wireless connection through modulated field radiation. Field radiation includes acoustic radiation and electromagnetic radiation in the radio, infrared, or visible light spectrum. For example, communications link 115 uses modulated radio transmission to convey information from transmitter 122 to receiver 160.

A transmitter according to various aspects of present invention includes any suitable hardware and/or software for transmitting voice input via a communications link 115. When a simple wired connection is utilized for a communications link, no transmitter may be needed. When a wireless connection is utilized, a transmitter may include appropriate conversion, modulation, and/or transmission circuitry. For example, transmitter 122 in stylus 110 includes a conventional analog-to-digital converter for converting voice input into digital samples, and a conventional modulator/transmitter for converting the digital samples into an analog signal

having a desired modulation format (*e.g.*, FSK, QPSK). A transmitter may be coupled to a radiating device for converting the analog signal into a desired form of field radiation (*e.g.*, an RF signal in the 1-5 GHz range). For example, transmitter 122 couples an RF signal to a conventional dipole antenna having elements 660, which are oriented parallel to a longitudinal axis of stylus 110. As a further example, infrared transmitter 760 in stylus 710 couples digital modulation to a conventional solid state infrared emitter 770. Emitter 770 produces modulated infrared radiation, which passes out of stylus 710 through transparent aperture 775.

A receiver according to various aspects of present invention includes any suitable hardware and/or software for receiving information from a transmitter via a communications link. When a simple wired connection is utilized for a communications link, a receiver may consist of a circuit for amplifying and/or filtering the signal from a microphone. When a wireless connection is utilized, a receiver may include appropriate receiving, demodulation, and conversion circuitry, generally complementary to circuitry in a cooperating transmitter. For example, receiver 160 of tablet 150 includes a conventional receiver/demodulator for converting an analog signal transmitted by transmitter 122 and picked up by a suitable sensing device (*e.g.*, an antenna, not shown).

In a variation, a communications link may be of the type disclosed in U.S. Patent 4,969,180 issued November 6, 1990 to Watterson *et al.*, The disclosure found from column 5, line 19 through column 14, line 55 of the aforementioned patent, including drawing figures referenced therein, is incorporated herein by reference. In such a variation, an analog ultrasonic signal is employed in a communications link.

A stylus according to various aspects of the present invention includes any device having a pointer for conveying freehand input to a tablet interface. A pointer may be a portion of one end of a stylus that is suitably narrow for a user to convey freehand input (*e.g.*, gestures, editing commands, and handwriting). Typically, a pointer is a tapered portion toward the distal (*i.e.*, downward, in operation) end of a stylus. As may be better understood with reference to FIG. 6A, for example, stylus 110 includes a tapered pointer 610, which a user 240 may manually manipulate on or near surface 152 of tablet 150 to convey freehand input. As may be better understood with reference to FIG. 1A, exemplary stylus 110 further includes: a microphone 120; a proximity sensor 124; an activation circuit 126; an identification circuit 128; a transmitter 122;

control circuitry (not shown) such as a programmable logic device and/or a microcontroller; and suitable supporting hardware (*e.g.*, battery power supply).

By permitting alternating speech and pen input using stylus 110, text processing system 100 provides speech recognition with improved accuracy and editing convenience. To generate text by dictation, user 240 moves stylus 110 toward his or her mouth and begins speaking into microphone 120. To edit text, user 240 moves stylus 110 to tablet surface 152 and manually manipulates pointer 610 on surface 152. User 240 need not be tethered to a head-mounted microphone; he or she already has microphone 120 in hand when grasping stylus 110. When positioned near the mouth of user 240, microphone 120 is typically able to receive high quality voice input comparable to that received by a head-mounted microphone.

When employed for generating an editing an electronic document, tablet 150 may be used as an alternative to a paper document and can be expected to be positioned near the head of user 240. When tablet 150 is positioned for comfortable use, for example resting on the thigh portion of a crossed leg of user 240, the distance between tablet surface 152 and the head of user 240 may be only about twice the length of stylus 110. In such a configuration, alternating speech and freehand input using stylus 110 can be expected to be natural and intuitive. User 240 may find it natural and intuitive to move stylus 110 away from tablet surface 152, and toward his or her mouth, while reviewing displayed text and preparing to generate additional text by dictation. No significant change in the orientation of stylus 110 is necessary because microphone 120 typically remains aimed toward the mouth of user 240. User 240 may also find it natural and intuitive to edit the text he or she has generated, or to correct misrecognized dictation, by simply moving stylus 110 toward and onto tablet surface 152 to manipulate pointer 610 on surface 152.

Preferably, microphone 120 is disposed toward the proximal (*i.e.*, upward in operation) end of stylus 110 and is at least somewhat directional to improve quality of voice input when pointed toward the mouth of user 240. When directional, microphone 120 is responsive to sound impinging on stylus 110 from the direction of its proximal end with a greater sensitivity than from its distal end.

A stylus may include a proximity sensor and an activation circuit for activating a speech recognizer when the stylus is proximate a human head. A stylus may also include (alternatively or additionally) an identification circuit for identifying the owner of the stylus, for example to

permit selection of an appropriate user message model, as described below. Exemplary stylus 110 further includes: proximity sensor 124; activation circuit 126; and identification circuit 128.

An activation circuit according to various aspects of the present invention includes any circuit housed in a stylus for activating speech recognition when the stylus is situated to receive voice input. Such a circuit may determine that the stylus is situated to receive voice input by sensing one or more conditions. Such conditions include, for example, the amplitude or angle of impingement of sound waves from the voice input and the proximity (*i.e.*, displacement and/or orientation) of the stylus with respect to the head of a user providing the voice input.

An activation circuit may employ any conventional selection or control system to activate speech recognition. In system 100, for example, activation circuit 126 provides a binary activation signal S_A to transmitter 122 while microphone 120 provides transmitter 122 an analog voice signal S_V. Transmitter 122 continuously conveys both activation signal S_A and voice signal S_V to receiver 160. Activation signal S_A includes an activation bit that is set to a true state by activation circuit 126 to activate speech recognition. Receiver 160 may be configured to convey voice signal S_V to speech recognizer 162 only when the activation bit is set to a true state. In a variation, speech recognizer 162 may be configured to generate text responsive to voice input only when the activation bit is in a true state. In another possible variation, activation signal S_A may selectively control the transmission of voice signal S_V by transmitter 122.

An activation circuit that senses angle of impingement of sound waves as a condition for activation may include a plurality (*e.g.*, two) of sound sensors that are responsive to sound impinging on the stylus from a plurality of respective angular ranges. Such a circuit also includes a comparator for comparing the amplitudes of sound from the sound sensors. When the relative amplitude indicates that the voice input is impinging on the stylus from within a predetermined angular range, the comparator makes a positive determination that causes activation of speech recognition.

When such an activation circuit is used, the function of a microphone may be easily incorporated into one of the sound sensors. Consequently, it may not be necessary for a stylus employing such an activation circuit to include a separate microphone. The activation circuit may include circuitry of the type disclosed in U.S. Patent 4,489,442, issued December 18, 1984 to Anderson *et al.* The disclosure found from column 2, line 42 through column 11, line 29 of

Exhibit 2002.012.002

this aforementioned patent, including drawing figures referenced therein, is incorporated herein by reference.

As may be better understood with reference to FIGS. 1A and 6A, activation circuit 126 is a preferred example of an activation circuit that senses proximity of stylus 110 with respect to the head of a user 240 providing voice input. Activation circuit 126 includes a proximity sensor 124.

A proximity sensor includes any device positioned proximate a microphone in a stylus, according to various aspects of the present invention, such that is able to sense proximity of a human head to the microphone. A proximity sensor may include a radiation sensor responsive to field radiation impinging on the stylus from a human head. For example, proximity sensor 124 includes radiation sensor 615. Alternatively, a proximity sensor may be a capacitive proximity sensor of the type disclosed in U.S. Patent 5,337,353, issued August 9, 1994 to Boie *et al.* The detailed description portion (including referenced drawing figures) of this aforementioned patent is incorporated herein by reference.

A radiation sensor according to various aspects of the present invention includes any device responsive to field radiation impinging on the stylus. As discussed above, field radiation includes acoustic radiation and electromagnetic radiation in the radio, infrared, or visible light spectrum. For example, radiation sensor 615 includes two infrared sensors 620 and 630. Sensors 620 and 630 provide respective sensing signals S1 and S2 with amplitudes proportional to the respective amounts of infrared field radiation sensed. Sensor 620 is positioned at the end of a wide aperture cone 622 such that it is responsive to infrared radiation impinging on stylus 110 within a wide angular range AR1. Sensor 630 is positioned at the end of a narrow aperture cone 632, behind sensor 620, such that it is responsive to infrared radiation impinging on stylus 110 within a narrow angular range AR2.

Proximity sensor 124 further includes a comparator 640 for comparing sensing signals S1 and S2. A comparator according various aspects of the present invention includes any circuit for making a determination that a stylus is situated to receive voice input based on one or more suitable conditions of signals provided by sensors. A comparator may perform mathematical functions on such signals, as well as any time-domain processing of the signals that may be desired to establish that the stylus has been properly situated for a given period of time. For example, comparator 640 performs subtraction and division operations to compute a residual

portion SR of signal S1 that is uniquely attributable to sensor 620. Comparator 640 also performs comparisons of residual portion SR and signal S2 to two predetermined thresholds T_1 and T_2, respectively. Comparator 640 thus makes a determination that stylus 110 is situated to receive voice input based on two conditions, which may be mathematically expressed as follows:

$$Condition\ \ A:\ \ S2 \geq T_1$$

$$Condition\ \ B:\ \ \frac{S2}{S2-S1} \geq T_2$$

When microphone 120 is at a desired proximity to the head of user 240, infrared radiation from the head of user 240 occupies most of angular range AR2. Sensor 630 collects a predetermined amount of infrared radiation, which causes the amplitude of signal S2 to reach the first predetermined threshold (condition A). At the desired proximity, infrared radiation from the head of user 240 occupies only that part of angular range AR1 also occupied by range AR2. The residual portion of signal S1 is thus relatively small, which causes the ratio between signal S2 and the residual portion to reach the second predetermined threshold (condition B).

It is possible for stylus 110 to be situated such that microphone 120 is displaced from the head of user 240 within a desired separation range but oriented away from the head (*i.e.*, having an orientation outside the desired angular range). When stylus 110 is so situated, sensor 630 may be close enough to the head to permit the amplitude of signal S2 to reach the first predetermined threshold (condition A) even though infrared radiation from the head only occupies a portion of angular range AR2. However, the residual portion of signal S1 will then be relatively large because a significant portion of the infrared radiation falls within angular range AR1 but outside range AR2. Consequently, the ratio between signal S1 and the residual portion will fall short of the second predetermined threshold and condition B will not be met.

In a variation, an infrared proximity sensor may be suitably adapted from the disclosure of U.S. Patent 5,330,226 issued July 19, 1994 to Gentry *et al.* The detailed description portion (including referenced drawing figures) of this aforementioned patent is incorporated herein by reference.

A proximity sensor according various aspects of a present invention may include a radiation sensor that is responsive to acoustic field radiation. For example, stylus 710 of FIG. 7A includes

a microphone 720 and an ultrasonic activation circuit 725, which suitably includes: an ultrasonic radiation transmitter/sensor 740; a signal processor 745; and a comparator 750. Transmitter/sensor 740 emits an ultrasonic (*e.g.*, having a center frequency of 50 kHz) pulse of acoustic field radiation from piezoelectric transducer 730. The radiation travels toward the head of user 780 and multiple echoes (depicted as E1, E2, and E3 for illustrative purposes) of the radiation reflect from its surface. Portions of the echoes return to transducer 730 where they are sensed over an interval to form a time-varying signal that is coupled to transmitter/sensor 740.

Transmitter/sensor 740 converts the time-varying signal to a suitable form (*e.g.*, Nyquist filtered discrete-time samples) and conveys the converted signal to signal processor 745. Signal processor 745 provides a distance profile of the sensed acoustic field radiation.

A distance profile is a characterization of the respective distances between an ultrasonic transducer and a scattering object that reflects echoes back to the transducer. For example, a distance profile may be a mathematical curve characterizing a sequential series of discrete-time samples. Each sample may represent amplitude of echoes received at a specific point within a time interval. Such a curve may be characterized by a width of the most prominent peak in the curve and a "center of mass" of the curve T_{cm}, which may be calculated as follows:

$$T_{cm} = \frac{\int_0^T t\, f(t)dt}{\int_0^T f(t)dt}$$

The center of mass of a distance profile curve moves to the left (*i.e.*, closer to $t = 0$) as the scattering object moves closer to the transducer, and to the right as the scattering object moves away. Such a curve has a pronounced peak if the scattering object is relatively flat (*e.g.*, a wall), because all echoes are received at about the same time. Scattering objects having irregular surfaces provide distance profile curves that are relatively distributed and irregular because echoes from different portions of the surface are received at different times and with varying amplitudes. A scattering object having a distinct surface shape (*e.g.*, a human face) can be expected to provide a distinct distance profile curve.

Comparator 750 compares the distance profile from signal processor 745 to an expected profile. The expected profile corresponds to acoustic field radiation expected to impinge on

transducer 730 of stylus 710 when microphone 720 is at a predetermined proximity to the head of user 780. The expected profile may be a curve formed from a sequential series of predetermined data values, each representing the expected amplitude of echoes received at a specific point within a time interval. Alternatively, the expected profile may simply be a collection of statistics (*e.g.*, center of mass and peak width) characterizing the expected distance profile when microphone 720 is at a predetermined proximity to the head of user 780. The distance profile may be compared to the expected profile by any suitable signal processing technique (*e.g.*, comparison of statistics or cross-correlation of data points).

A suitable expected profile may be generated by situating stylus 710 such that microphone 720 is at a desired proximity to the head of user 780. Then a programming mode may be entered by suitable user control (*e.g.*, depressing a button on the body of stylus 710) at which point the distance profile is recorded or statistically characterized. The recorded or characterized distance profile then becomes the expected profile, which may be employed for subsequent operation of stylus 710. A single expected profile (or a statistical aggregate using heads of multiple people as scattering objects) may be pre-programmed into multiple production copies of stylus 710.

In a variation, an ultrasonic proximity sensor may be suitably adapted from the disclosure of U.S. Patent 5,848,802 issued December 15, 1998 to Breed *et al.* The detailed description portion (including referenced drawing figures) of this aforementioned patent is incorporated herein by reference.

An identification circuit according to various aspects of the present invention includes any circuit housed in a stylus for identifying the stylus. Such a circuit may provide an identification signal that identifies an owner of the stylus by any suitable descriptive or uniquely characteristic content (*e.g.*, a digital code). A few examples of suitable identification circuits and identification signals that may be provided by such circuits are provided in TABLE I below.

TABLE I

Identification Circuit	Corresponding Identification Signal For Identifying Stylus
Microcontroller (possibly shared with transmitter and/or activation circuit)	Numeric or alphanumeric code, provided either periodically or upon request.
Dedicated non-volatile memory device (*e.g.*, 4-pin serial PROM)	Binary code (*e.g.*, 48-bit serial bitstream) provided upon request of control circuitry or transmitter.
Programmable logic device (possibly shared with transmitter and/or activation circuit)	Binary code (*e.g.*, 48-bit serial bitstream) provided either periodically or upon request.
Analog periodic signal source	Periodic modulation of signal from transmitter (*e.g.*, with one or more subcarriers containing characteristic periodic behavior or digitally modulated identification)

In system 100 (FIG. 1A), identification circuit 128 is a four-pin serial PROM that identifies stylus 110 by providing, upon request by suitable controlling circuitry (not shown), identification signal S_{ID} as a 48-bit serial word to transmitter 122. Transmitter 122 incorporates identification signal S_{ID} with voice signal S_V from microphone 120 and transmits the combined signals to receiver 160 via communications link 115.

Depending on the type of identification circuit employed, a predetermined identification signal may be assigned during or after device fabrication. For example, identification circuit 128 is programmed to provide a 48-bit serial identification signal before being soldered to a printed circuit board along with other components of stylus 110. When a microcontroller is employed for control circuitry in stylus 110, the function of identification circuit 128 may be performed by the microcontroller. Dedicated circuitry for identification circuit 128 is not necessary in such a configuration. A microcontroller-based identification circuit may be programmed after device fabrication as desired, possibly many times. Conventional interface circuitry (*e.g.*, magnetic

sensor and cooperating receiver, miniature 3-pin connector and serial port) may be provided to facilitate such programming.

When personalized with an identification circuit, a stylus may be carried about by a user and treated as a personal accessory. For example, a stylus may be shaped and dimensioned to have a look and feel similar to that of a high quality pen. If desired, such a stylus and pen may be packaged and carried about by a user as a complementary set. A personalized stylus may include personalizing indicia on its outer surface such as a monogram or logo.

By facilitating identification, stylus 110 may be used in particularly advantageous applications. In system 200, for example, stylus 110 may be owned by a particular user and used with a tablet that is shared with a number of users. (The structure and operation of system 200 is discussed in greater detail below with reference to FIGS. 2-5.) As exemplified in system 200, a speech recognizer and/or handwriting recognizer may be responsive to identifying signal S_{ID} to select a particular user message model to use when generating text responsive to voice input conveyed via stylus 110. In a collaborative environment, an identification circuit may also enable text data generated by a particular user to be "stamped" with the user's identity. Text may be "stamped," for example, by displaying the text data in a particular color or with a hidden identifier that may be displayed upon user selection.

A user message model is a message model that is specific to a particular user. As discussed in greater detail below, a message model is a model used in recognition of a message. A message is any communication in writing, in speech, or by signals. A message model may include a language model as well as an acoustic and/or handwriting model.

A stylus having an identification circuit may be associated with a user by a suitable registration system. For example, a user may select an identification signal to program into the identification circuit. Alternatively, a registration system may assign an identification signal to the user, and an associate the user with that predetermined identification signal. When stylus 110 is assigned (*e.g.*, sold, loaned by an employer, etc.) to a user, for example, the user may register personal information for association with the predetermined identification signal. Such personal information may include the user's name and security authorizations, and the location (*e.g.*, Internet address) of the appropriate user message model on a wide area network.

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Transmission of voice signal S_V, identification signal S_{ID}, and activation signal S_A from stylus 110 to tablet 150 may be better understood with reference to FIG 8 (including FIGS. 8A-8D). In system 100, these signals are transmitted via communications link 115 as bursts of serial data. Each burst includes header bits and data bits. The header bits of any given bursts identify that burst as a portion of either signal S_V, S_{ID}, or S_A. In system 100, two header bits are used to distinguish the three signals. The data bits convey signals S_V, S_{ID}, or S_A as serial data. In system 100, voice signal S_V is conveyed with bursts of 16 data bits and identification signal S_{ID} is conveyed with bursts of 48 data bits. Activation signal S_A of system 100 is conveyed with a single data bit that indicates either an "activate" command or an "inactivate" command. Alternately, a standard number of data bits may be used, with unused bits left unspecified or in a default state.

In the time span depicted in FIG. 8, identification signal S_{ID} is asserted one time in burst 810. Signal S_{ID} may be asserted at a relatively low rate of repetition (*e.g.*, once every second), just often enough to be able to signal a newly used tablet of the identity of stylus 110 without perceptible delay by the user. In a variation, receiving circuitry (not shown) may be included in stylus 110 so that a new tablet may indicate its presence to stylus 110 and signal the need for a new assertion (*i.e.*, serial burst) of identification signal S_{ID}. In system 100, signal S_{ID} is conveyed with a large data word length (48 bits) to permit a large number (*e.g.*, 2^{32}) of pre-certified identification signals to be asserted with an even larger number (*e.g.*, $2^{48} - 2^{32}$) of invalid identification signals possible using random bit sequences. Consequently, stylus 110 may use signal S_{ID} to validate secured access to tablet 150. Signal S_{ID} may also be used as an encryption key, for example to facilitate secured transmission of a user message model on a wide area network. In identification circuits where security is not a concern, shorter word lengths (*e.g.*, 24 bits) may be used for an identification signal.

Voice signal S_V is asserted at regular intervals, for example in periodic bursts 820-825 of FIG. 8B. Signal S_V is comprised of periodic samples, which may be provided by a conventional A/D converter (not shown) at any desired point in the signal path from microphone 120 through transmitter 122. The A/D converter may be preceded by a suitable anti-aliasing filter (also not shown). If a delta-sigma A/D converter is used, only a single-pole RC anti-aliasing filter is needed. In system 100, signal S_V is a serial bitstream having bursts 820, 821, 822, 823, 824, and 825 of 16-bit samples, which are provided at a 8 kHz sample rate.

Activation signal S_A is asserted once, as burst 830, in the time span depicted in FIG. 8. Signal S_A may be asserted, with appropriate coding, whenever a change in the activation of speech recognition is desired. Signal S_A may be asserted with an "activate" code when stylus 110 initially becomes situated to receive voice input. For example, activation circuit 126 may so assert signal S_A when user 240 brings stylus 110 toward his or her mouth to begin generating text by voice input. Signal S_A may be again asserted (this time with an "inactivate" code) when stylus 110 is no longer situated to receive voice input. For example, activation circuit 126 may so assert signal S_A when user 240 moves stylus 110 away from his or her mouth and toward tablet 150 to begin editing text by freehand input. In system 100, signal S_A is a serial bitstream with bursts 830 having a single data bit, plus the two header bits.

Signals S_V, S_{ID}, and S_A are combined into a single signal 840. As may be better understood with reference to FIG. 8D, data bursts in signal 840 do not have identical timing to corresponding bursts in originating signals S_V, S_{ID}, and S_A. Bursts 820-825 from signal S_V do not need to be transmitted at constant intervals. Bursts 820-825 are merely numeric representations of signal samples that have been acquired and digitized at constant intervals. Bursts 820-825 need only to be transmitted at the same mean rate as the rate at which the signal samples were acquired. Speech recognizer 162 may process a series of digital samples (each conveyed by a respective data burst) for processing without concern for exactly when the samples were transmitted in digital form. In the event that timing of the digital samples is a concern, sample buffering (*e.g.*, using a FIFO) may be incorporated in receiver 160 to ensure that samples are passed along to speech recognizer 162 at substantially constant intervals.

Burst 810 from signal S_{ID} is passed on signal 840 as soon as it has been completed. Activation signal S_A takes high priority because it determines whether or not bursts from voice signal S_V are responded to. Consequently, burst 830 from signal S_A is passed on signal 840 immediately after burst 810, even though two bursts 821 and 822 of voice signal S_V are ready to be passed on as well. Bursts 821 and 822 are sent immediately after bursts 830, followed immediately by additional bursts 823, 824, and 825 from signal S_V.

In system 100, signal 840 is modulated into an electromagnetic signal suitable for transmission by transmitter 122. Receiver 160 demodulates the signal to provide signals

corresponding to signals S_V, S_{ID}, and S_A to speech recognizer 162. Receiver 160 may also provide some or all of these signals to other portions of tablet 150, as desired.

A tablet interface according to various aspects of the present invention (*e.g.*, tablet interface 164) includes (1) any tablet surface on which a stylus pointer may be manually manipulated and (2) suitable cooperating hardware (*e.g.*, stylus position indicator) and/or software (*e.g.*, for implementing handwriting recognition) that is responsive to freehand input communicated via the pointer. Any conventional tablet surface may be used, including, for example, a position sensitive membrane or an array of ultrasonic receivers for triangulating the position of a stylus pointer having a cooperating ultrasonic transmitter.

A tablet interface and stylus may include cooperating circuitry of the type disclosed in U.S. Patent 5,007,085, issued April 9, 1991 to Greanias *et al.* The detailed description portion (including referenced drawing figures) of this aforementioned patent is incorporated herein by reference. Further, the detailed description portion (including referenced drawing figures) of any U.S. patent or U.S. patent application incorporated by reference into this aforementioned patent is also specifically incorporated herein by reference.

Preferably, a conventional flat-panel display is integrated into the tablet surface. Such an integrated configuration is advantageous because, *inter alia*, visible "ink" may be displayed to show freehand input as if the stylus pointer were the actual tip of a pen. A display according to various aspects of the present invention may employ any conventional technology such as LCD. It is contemplated that newer display technologies such as IBM's "Roentgen," using aluminum and copper display materials, and "reversible paper" (*e.g.*, Xerox's "Gyricon") may also be integrated into a tablet surface in accordance with the invention.

In a variation, "reversible paper" may be overlaid on a tablet surface such that freehand input may be conveyed to the tablet surface through the "paper." In such a variation, the stylus may include an erasable writing marking medium to provide visible indicia of such freehand input on the "paper." Text generated, for example by voice input, may be displayed on a conventional display (*e.g.*, LCD, CRT, etc.) separate from the tablet surface. Color displays permits visible "ink" of different colors to be displayed. However, monochromatic displays may also be used, for example to save costs when incorporated into a number of tablets that are used as "scrap computers."

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A tablet interface interprets editing commands responsive to freehand input and provides indicia of the editing commands to an editor. The tablet interface may also interpret handwriting responsive to freehand input and provide text data to the editor. Handwriting may be distinguished from editing commands by a subsystem of the type disclosed in U.S. Patent 5,862,256, issued Jan. 19, 1999 to Zetts *et al.* The detailed description portion (including referenced drawing figures) of this aforementioned patent is incorporated herein by reference. Further, the detailed description portion (including referenced drawing figures) of any U.S. patent or U.S. patent application incorporated by reference into this aforementioned patent is also specifically incorporated herein by reference. Tablet interface 164 of system 100, for example, suitably includes: tablet surface 152 having an integrated LCD display; conventional hardware (not shown) for determining the position of a stylus on surface 152; and a conventional CPU and memory (also not shown) having indicia of suitable software instructions for the CPU to implement, *inter alia*, handwriting and/or gesture recognition.

Editing commands include any commands for modifying text data that may be communicated by freehand input. A set of particularly advantageous editing commands is provided in TABLE II below.

TABLE II

Editing Command	**Corresponding Freehand Input**
Delete Text	Straight horizontal line through displayed text; or diagonal or wavy line through block of displayed text.
Underline Text	Straight horizontal line immediately below displayed text.
Capitalize Text	Two straight horizontal lines immediately below displayed text.
Lowercase character	Diagonal line through displayed character.
Bold Text	Straight horizontal lines immediately above and below displayed text.
Italicize Text	Diagonal slashes immediately before and after displayed text.

Editing Command	Corresponding Freehand Input
Correct Misrecognition of Text	Straight horizontal line through displayed text followed immediately by stylus tap somewhere on the text; or closed curve around block of displayed text followed immediately by stylus tap somewhere within the curve.
Indicate Text out of Present Context (without going through correction dialog)	Straight horizontal line through displayed text followed immediately by double stylus tap somewhere on the text
Indicate Text out of User Context (without going through correction dialog)	Straight horizontal line through displayed text followed immediately by another straight horizontal line back through the text, then by double stylus tap somewhere on the text, or
Copy Text	Closed curve around block of displayed text.
Paste Text	Double tap at desired insertion point on display of destination tablet (same or different from source tablet).
Move Insertion Point	Single tap at new insertion point on display of desired tablet (same or different from tablet having old insertion point).
Find Text	Question mark (?) drawn in isolated white space (e.g., margin) of display. Dictate text to find into provided text input dialog box.
Find Other Occurrences of Displayed Text	Closed curve around block of displayed text, immediately followed by question mark (?) drawn in isolated white space (e.g., margin) of display.

In a variation of tablet 150, tablet interface 164 includes a conventional handwriting recognizer that responds to freehand input to generate text data in addition to, or as an alternative to, text data generated by voice input. In such a variation, tablet 150 performs two types of message recognition: speech recognition and handwriting recognition. As discussed below with reference to FIGS. 2, 3, and 5, an alternative system 200 includes a multi-input message recognizer 310. Message recognizer 310 performs both types of message recognition (speech and handwriting) in accordance with a unified message model. As discussed below, a unified message model according to various aspects of the present invention provides particular advantages.

A tablet according to various aspects of the present invention may include user controls for convenient navigation in an electronic document. For example, tablet 150 includes a "Page Up"

button 154 and a "Page Down" button 156 conveniently positioned together near the edge of tablet 150. User 240 may navigate through an electronic document using tablet 150 via depressing buttons 154 and 156 with his or her right thumb. When tablet 150 is positioned for comfortable use, for example resting on the thigh portion of a crossed leg of user 240, only one hand is needed for support and control of tablet 150. Typically, user 240 may then use an opposite hand to manipulate stylus 110 on surface 152 of tablet 150. If user 240 is right-handed, he or she may flip tablet 150 upside-down from the orientation shown in FIG. 1B to support and control tablet 150 with his or her left hand while manipulating stylus 110 with the right hand. If user 240 is one-handed, he or she may prefer to rest tablet 150 on a supporting surface and use stylus 110 for both freehand input and for depressing buttons 154 and 156.

Tablet surface 152 includes an integrated display for displaying an electronic document and any additional user controls that may be desired. Preferably, the display is configured to preserve clarity at a wide range of viewing angles and under varied lighting conditions. When tablet surface 152 is integrated with a color display, additional user controls may include a displayed group of software-based mode controls ("inkwells") at the bottom of tablet surface 152 for changing the behavior of freehand input. For example, user 240 may "dip" pointer 610 of stylus 110 in a red inkwell 157 to begin modifying text data using editing commands such as those in TABLE II. A yellow inkwell 158 may be provided to initiate highlighting and/or annotating of text data, a black inkwell 159 may be provided to initiate freehand input of new text data, and a white inkwell 153 may be provided to initiate erasure (*i.e.*, deletion) of text data. In a variation, touch-sensitive pads (each responsive to contact with pointer 610) may be provided below tablet surface 152 in red, yellow, black, and/or white colors to serve as such "inkwells."

An editor (*e.g.*, editor 168) according to various aspects of the present invention includes any suitable hardware and/or software for modifying text data as specified by editing commands. Examples of suitable editing commands are provided in TABLE II above. As discussed above, text data is any indicia of text that may be stored in conveyed numerically, including numerical codes representing individual units of text.

In one computing model, text data may be considered to be generated by a source other than an editor. In such a model, text data may be stored in a global memory segment that is

accessible to both a speech recognizer and an editor. In another computing model, text data may be considered to be generated by an editor that is responsive to external sources of text input. For example, text data may be stored in a local memory segment that is controlled by an editor. External sources of text (*e.g.*, a keyboard interface or speech/handwriting recognizer) may have access to such a local memory segment only through the editor that controls it. In either computing model, an editor has access to text data to both read and modify the text data. For example, editor 168 of tablet 150 (FIG. 1A) performs any desired modifications to text data generated by speech recognizer 162 in accordance with editing commands communicated by freehand input and interpreted by tablet interface 164.

A stylus according to various aspects of the present invention may be advantageously used with a tablet interface and editor of the type disclosed in U.S. Patent 5,855,000, issued December 29, 1998 to Waibel *et al.* The detailed description portion (including referenced drawing figures) of this aforementioned patent is incorporated herein by reference. Further, the detailed description portion (including referenced drawing figures) of any U.S. patent or U.S. patent application incorporated by reference into this aforementioned patent is also specifically incorporated herein by reference. For example, stylus 110 may be used to convey freehand input (*e.g.*, cursive handwriting, gestures) and voice input via the input device (*e.g.*, a tablet surface) and microphone, respectively, that are disclosed in U.S. Patent 5,855,000 to Waibel *et al.*

When suitably constructed (*e.g.*, with miniaturized electronics, lightweight materials, a thin, flat form factor, etc.), a tablet according to various aspects of a present invention may be made to have the look and feel of an "electronic notepad," which may be stacked and laid on a desk like a conventional paper document. When so constructed, a tablet such as tablets 150, 252, 254, and/or 256 may be used as a "scrap computer," analogous to scrap paper and having limited individualized identity and importance. Several such tablets may be used together in a network (preferably wireless) such that any one may be picked up and used anywhere in a work environment to display an electronic document and receive freehand input with a stylus. Instead of constantly opening and closing applications in the on-screen windows of a single desktop computer, a user may stack the tablets around an office and have several of them in use for various tasks at the same time.

A networked text processing system according to various aspects of the present invention includes any plurality of tablets networked together to permit exchange of data between them. Such networking provides particular advantages. For example, text data may be transferred between tablets. A document may be displayed in multiple views on displays of multiple tablets. A stylus including a microphone and identification circuit according to various aspects of the present invention may be used to generate text data in accordance with a message model associated with a particular owner of the stylus. Tablets may be networked together through a domain controller, or by peer-to-peer communication.

A network of tablets may be of the type disclosed in U.S. Patent 5,812,865, issued September 22, 1998 to Theimer *et al.* The detailed description portion (including referenced drawing figures) of this aforementioned patent is incorporated herein by reference. Further, the detailed description portion (including referenced drawing figures) of any U.S. patent or U.S. patent application incorporated by reference into this aforementioned patent is also specifically incorporated herein by reference.

A preferred example of a text processing system including a network of tablets may be better understood with reference to FIGS. 2-5. Networked text processing system 200 suitably includes: a domain controller 220; a plurality (*e.g.*, three) of tablets 252, 254, and 256, each linked via wireless communications links 225 to domain controller 220; a first stylus 210 for conveying message input from a first user 242; and a second stylus 212 for conveying message input from a second user 244. Styluses 210 and 212 are linked to domain controller 220 via wireless communications links 235. System 200 further includes suitable wireless nodes 227 and 230 for establishing communications links 225 and 235, respectively.

A networked text processing system according to various aspects of the present invention may include only a single stylus. When multiple styluses are included, they need not be of the same type so long as they are all compatible with the system. For example, stylus 210 and stylus 212 may both be of the type of stylus 110 (FIGS. 1A, 1B, 6A, 6B). Alternatively, stylus 210 and stylus 212 may be of different types. For example, stylus 210 may be of the type of stylus 110 and stylus 212 may be of the type of stylus 710 (FIGS. 7A and 7B). In variations where the benefit of styluses having microphones is not required, conventional styluses without microphones may be used.

A networked text processing system according to various aspects of the present invention may include a node to a wide area network (*e.g.*, the Internet). A network connection permits one or more local message models that are internal to the system to be initialized to be in conformance with one or more user message models that are remote from the system (and possibly from each other). For example, system 200 includes a network node 232 for establishing a network connection link 237 between a plurality (*e.g.*, two) of user message models 264 and 262. When link 237 is established, local message model 316 may be initialized to be in conformance with message model 264 and/or message model 262, as discussed below.

Wireless nodes 227 and 230 include any suitable transmitter(s) and/or receiver(s) for establishing respective communications links 225 and 235. Transmitter 122 and receiver 160, discussed above with reference to FIG. 1A, are examples of suitable transmitters and receivers, respectively. Node 227 establishes bidirectional communications between domain controller 220 and each tablet 252, 254, and 256. Because communications link 225 is bidirectional, node 227 includes both a transmitter and receiver. Node 230 establishes unidirectional communications between domain controller 220 and styluses 210 and 212. Typically, only a unidirectional communications link is needed to a stylus, because the stylus typically only sends information.

Particular types of communications may be employed in communications links 225 and 235 in particular situations. For example, when tablets 252, 254, and 256 are in close proximity to each other and to domain controller 220 (*e.g.*, on a single work surface in a room), wired connections or infrared field radiation may be employed. When tablets 252, 254, and 256 are located in separate rooms from each other and/or from domain controller 220, suitable RF field radiation (*e.g.*, 1 GHz carrier frequency) may be employed.

A domain controller according to various aspects of the present invention includes any suitable hardware and/or software for controlling the interconnection of networked tablets to each other and to any styluses being used with the tablets. Advantageously, a domain controller may centrally implement functions of a message recognizer so that individual message recognizers are not needed in the networked tablets. In variations where the benefits of a domain controller are not required, networked tablets may each include a message recognizer and a receiver for establishing a communication link with one or more styluses.

As discussed in greater detail with reference to FIG. 3, exemplary domain controller 220 implements functional blocks including: message recognizer 310; stylus interface 320; and domain interface 330, which is coupled to message recognizer 310 as well as to a transfer buffer 340. As discussed above, interconnection between functional blocks may include hardware connections (*e.g.*, analog connections, digital signals, etc.) and/or software connections (*e.g.*, passing of pointers to functions, conventional object-oriented techniques, etc.). This interconnection is depicted in FIGS. 3A and 3B by signal lines for clarity.

Stylus interface 320 receives electromagnetic signals from one or more styluses (*e.g.*, styluses 210 and 212) and, responsive to the electromagnetic signal(s), couples one or more sets of signals to message recognizer 310. Each set includes a respective activation signal S_A, identification signal S_{ID}, and voice signal S_V.

Respective activation signals S_A activate message recognizer 310 (particularly speech recognizer 312) to provide text data responsive to voice input provided by a user of one particular stylus (*e.g.*, user 242 of stylus 210). In the event that activation signals from multiple styluses are received at once (indicating simultaneous voice input from multiple users), message recognizer 310 may provide respective portions of text data responsive to each voice input, for example by multitasking. Each portion of text may be conveyed to a different tablet for display. For example, text data provided responsive to voice (or handwriting) input from users 242 and 244 may be displayed separately (*e.g.*, as alphanumeric characters, kanji, etc.) on respective tablets 252 and 256. Alternatively, a hierarchy of styluses may be established such that message input conveyed by a low-ranking stylus may be preempted by message input conveyed by a high-ranking stylus. When multiple styluses are in wireless communication with a domain controller, electromagnetic signals from two or more styluses may be multiplexed by any suitable multiple access scheme (*e.g.*, spread spectrum, FDMA, TDMA, etc.).

Respective identification signals S_{ID} permit message recognizer 310 to associate message input conveyed by a particular stylus with a user message model of the user of a stylus. An identification signal according to various aspects of the present invention may include an encryption key to permit message recognizer 310 to interpret a user message model that has been encrypted for secure transmission across a wide area network. Message recognition in accordance with a user message model is described in greater detail below.

Domain interface 330 couples message recognizer 310 to tablets 252, 254, and 256 through wireless node 227 using any suitable multiple access and/or control protocol. Domain interface 330 conveys text data provided by speech recognizer 312 or handwriting recognizer 314 to a desired one of tablets 252, 254, and 256. Domain interface 330 also conveys respective stylus position signals S_P from tablet interfaces of tablets 252, 254, and 256 to handwriting recognizer 314.

Stylus position signal S_P communicates freehand input (conveyed to a tablet interface by a stylus) to handwriting recognizer 314 via domain interface 330. A stylus position signal conveys indicia of the position of the stylus on a tablet surface in any suitable format (*e.g.*, multiplexed binary words representing X, Y coordinates). When a stylus is aimed at, but does not contact, a particular point on a surface, a stylus position signal may convey indicia of the particular point aimed at.

An editor according to various aspects of the present invention may be implemented as part of a domain interface. For example, domain interface 330 may perform the same functions for networked tablets 252, 254, and 256 that editor 168 performs for tablet 150. When a domain controller performs functions of a message recognizer and editor for a plurality of networked tablets, hardware and/or software in the networked tablets may be simplified.

A domain controller may include a transfer buffer (*e.g.*, a portion of memory) to facilitate transmission of data from one networked tablet to another. For example, user 242 may cause text data to be copied from tablet 252 into transfer buffer 340 through domain interface 330. With an editing command from the set provided in TABLE II above, for example, the user may cause a block of displayed text data to be copied by using stylus 210 to draw a closed curve around the block. User 242 may then caused text data to be pasted from transfer buffer 340 to tablet 252. Again using an editing command from the set provided in TABLE II, the user may cause a block of displayed text data to be pasted by using stylus 210 to double-tap at the desired insertion point on the display of tablet 254. When tablets are interconnected in a peer-to-peer network (omitting a domain controller), text data that is copied from the display of a tablet may be stored in a transfer buffer in the tablet until the text data is pasted at a desired insertion point.

A domain controller may include a housing, supporting and/or control circuitry (*e.g.*, power supply, operator controls, etc.), and a conventional CPU and memory (not shown) having indicia

of suitable software instructions for the CPU to implement, *inter alia*, functional blocks of FIG. 3. A "desktop" domain controller may be placed on a work surface as a semi-permanent fixture in a work area. Suitable variations of domain controllers include, for example, unobtrusive (perhaps hidden for aesthetic reasons) wall panels and electronic "white boards" (*e.g.* "Boards" of the type disclosed in U.S. Patent 5,812,865 to Theimer et al., incorporated by reference above). A domain controller may also be incorporated into one tablet of a plurality of networked tablets.

A message recognizer according to various aspects of present invention includes any suitable hardware and/or software for recognizing a message of at least one type to provide text data. A message includes any communication in writing, in speech, or by signals. As may be better understood with reference to TABLE III below, examples of types of messages to be recognized include voice input (for speech recognition), freehand input (for handwriting recognition), and visual input (for optical character recognition).

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TABLE III

Type of Message Recognizer	**Associated Type(s) of Message Input**	**Associated Type(s) of Message Model**
Generic: Message Recognizer	Generic: any communication in writing, in speech, or by signals	Generic: Message Model
Speech recognizer	Voice input (speech)	Acoustic model, language model
Handwriting recognizer	Freehand input (handwriting)	Handwriting model, language model
Visual character recognizer	Visual input (printed or handwritten characters that are scanned for OCR)	Character model, language model
Sign language recognizer	Visual input (CCD image of signing hands) or tactile input (glove with sensors)	Gesture model, language model

A message recognizer may include multiple subordinate message recognizers of different types within it. A message recognizer may include, for example, a speech recognizer or a handwriting recognizer, or both. A speech recognizer according to various aspects of the present invention includes any suitable hardware and software for providing text data responsive to voice

input. A concise summary of the operation of a conventional speech recognizer is provided in U.S. Patent 5,839,106 to Bellegarda (incorporated by reference below), particularly from column 3, line 46 through column 4, line 43. A handwriting recognizer according to various aspects of the present invention includes any suitable hardware and software for providing text data responsive to freehand input. A handwriting recognizer may be of the type disclosed in U.S. Patent 5,903,668, issued May 11, 1999 to Beernink, incorporated by reference above.

A message recognizer may include a visual handwriting recognizer for generating text data from scanned handwriting, which may be of the type disclosed in U.S. Patent 5,862,251, issued Jan. 19, 1999 to Al-Karmi *et al.* The detailed description portion (including referenced drawing figures) of this aforementioned patent is incorporated herein by reference. Further, the detailed description portion (including referenced drawing figures) of any U.S. patent or U.S. patent application incorporated by reference into this aforementioned patent is also specifically incorporated herein by reference.

A message recognizer including both a speech and handwriting recognizer may be adapted from the disclosure of U.S. Patent 5,502,774, issued March 26, 1996 to Bellegarda. The detailed description portion (including referenced drawing figures) of this aforementioned patent is incorporated herein by reference. This aforementioned patent cites a number of technical papers that may be reviewed for further guidance on the structure, training, and operation of conventional speech recognizers and handwriting recognizers. In a variation, a message recognizer may include a speech recognizer and handwriting recognizer of the type disclosed in U.S. Patent 5,855,000, issued December 29, 1998 to Waibel *et al.*, incorporated above by reference. In domain controller 220, message recognizer 310 includes both a speech recognizer 312 and handwriting recognizer 314 for recognizing voice and handwriting types of message input, respectively.

A message model according to various aspects of present invention includes any model (*e.g.*, algorithm, mathematical expression, set of rules, etc.) for defining operation of a message recognizer to provide text data responsive to message input. Conventionally, a message model includes a language model and a model specific to one type of message recognition. For example, a conventional speech recognizer operates in accordance with a type-specific message model consisting of a language model and an acoustic model. As a further example, a

conventional handwriting recognizer operates in accordance with its own type-specific message model that consists of a language model and a handwriting model.

A unified message model according to various aspects of the present invention provides particular advantages over a conventional message model. A unified message model is a message model that includes a shared language model and models specific to at least two types of message recognition. As may be better understood with reference to FIG. 9, a unified message model may suitably include, *inter alia*, a language model, an acoustic model, and/or a handwriting model.

A message recognizer may include two or more types of subordinate message recognizers, each of which may operate in accordance with a shared language model. Advantageously, the accuracy of each subordinate message recognizer may be improved by user correction of misrecognition by any of the message recognizers. For example, the syntactic language model in a shared language model may be trained by user correction of any type of erroneous message recognition performed by the message recognizer. An exemplary correction process 1400 is described below with reference to FIG. 14.

A shared language model according to various aspects of the present invention is any language model that may be shared between two types of subordinate message recognizers included within a message recognizer. A message recognizer of a first type may provide text data responsive to a first type of message input (*e.g.*, voice input) in accordance with the shared language model and a first type-specific model (*e.g.*, an acoustic model). A message recognizer of a second type may provide text data responsive to a second type of message input (*e.g.*, freehand input) in accordance with the shared language model and a first type-specific model (*e.g.*, a handwriting model). A language model may be of a conventional type, for example consisting of an N-gram syntactic model.

An example of a unified message model may be better understood with reference to FIG. 3B. Local message model 316 includes a language model 350, an acoustic model 356, and a handwriting model 358. An acoustic model is any model that may be used to determine basic units of speech (*e.g.*, phonemes, allophones, etc.) responsive to suitably transformed voice input (*e.g.*, by a conventional acoustic feature extractor). A handwriting model is any model that may be used to determine basic units of handwriting conveyed by freehand input (*e.g.*, strokes of

printed characters or cursive words) responsive to suitably transformed freehand input, for example as disclosed in U.S. Patent 5,903,668 to Beernink (incorporated by reference above).

Speech recognizer 312 generates text data in accordance with acoustic model 356 and shared language model 350. Handwriting recognizer 314 generates text data in accordance with handwriting model 358 and shared language model 350. Advantageously, user training of language model 350 can improve accuracy of both speech recognizer 312 and handwriting recognizer 314. For example, user correction of misrecognition by speech recognizer 312 adapts syntactic model 352 of shared language model 350. Both speech recognizer 312 and handwriting recognizer 314 then operate in accordance with the adapted syntactic model.

A local message model according to various aspects of the present invention is any message model that is local to a message recognizer operating in accordance with the message model. A message model is said to be local to a message recognizer when the message recognizer may operate in accordance with the message model without the necessity of communications outside its local processing environment. For example, a message model implemented in the same memory space, virtual machine, or CPU as a message recognizer is said to be local to the message recognizer.

A user message model according to various aspects of the present invention is any message model that is specific to a particular user. In variations where the benefits of a unified message model are not required, a user message model may be of a conventional type. A message model is said to be specific to a particular user when the message model may be adapted by training input from the user. Such adaptation provides improved recognition.

Training input includes corrections of misrecognized message input by any suitable form of user input. For example, a tablet (*e.g.*, tablet 252) according to various aspects of the present invention may include a character interface for user correction of misrecognition. A character interface is any user interface (*e.g.*, conventional keyboard or software user interface simulating a keyboard on a display) that is responsive to character input. Character input is a selection of specific characters using a character interface, for example by using a stylus to depress keys on a miniature keyboard or to tap areas of a display that represent keys of a simulated keyboard.

When a character interface (not shown) is provided (*e.g.*, on a display of tablet 252), a language model according to various aspects of the present invention may be adapted by a

correction process using (at least in part) character input. An exemplary correction process 1400 may be better understood with reference to FIG. 14. Process 1400 begins at step 1410 with a user specifying, typically by freehand input, a selection of text that has been generated (erroneously) by a message recognizer. At step 1420, a correction mode is initiated for modifying the selection.

A user may specify text and initiate a correction mode by communicating any appropriate editing command (*e.g.*, with freehand input, voice input, etc.). With an editing command from the set provided in TABLE II above, for example, the user may cause steps 1410 and 1420 to be carried out by using a stylus to draw a straight horizontal line through a displayed text segment, then immediately tapping the stylus somewhere on the text segment. As alternatively specified in TABLE II, a user may also specify a selection of text by drawing a closed curve around a block of displayed text (*e.g.*, a phrase of several words), then immediately tapping the stylus somewhere within the curve.

At step 1430, a list of alternative text comparable to the selection is provided. The list includes text segments that each received a high score (but not the maximum score) during hypothesis testing of the message recognizer. Two lists of alternative text of the type that may be produced at step 1430 are shown by way of example in TABLE IV and TABLE V below. As discussed below, the lists of TABLE IV and TABLE V were displayed in a correction mode of a conventional computer configured as a speech recognizer by executing conventional speech recognition software, marketed as NATURALLY SPEAKING, Preferred Edition, version 3.01, by Dragon Systems, Inc.

At step 1440, the list of alternative text is updated, based on character data communicated after initiation of the correction mode. In a conventional speech recognizer such as a computer executing the NATURALLY SPEAKING software, the displayed list of alternative text changes as different characters are entered by a user using character input.

At step 1450, the selected text segment is modified responsive to the character input. Step 1450 is carried out when the user indicates that the text segment as modified accurately reflects the message input provided by the user. In a conventional speech recognizer such as a computer executing the NATURALLY SPEAKING software, the modifications to the selected text segment are entered when the user selects an "OK" control of a displayed user interface dialog.

At step 1460, the syntactic model is conventionally adapted in accordance with the user's modification to the selected text segment.

When a language model includes a semantic model according to various aspects of the present invention, training input also includes user identification of a present context or a user context. User identification of context may be performed in addition to, or alternatively to, correction of misrecognized message input.

Local message model 316 may be initialized to be in conformance with one or more user message models (*e.g.*, user message model 262 or 264). A local model is said to be in conformance with a user model when a message recognizer operating in accordance with the local model behaves substantially as if it were actually operating in accordance with the user message model.

Initialization of a model entails creation of a new model or modification of a model from a previous configuration to a new configuration. A local model may be initialized by any suitable hardware and/or software technique. For example, a local model may be initialized by programming of blank memory space with digital indicia of a user model that the local model is to conform with. Alternatively, a local model may be initialized by overriding of memory space containing digital indicia of a previous configuration with indicia of digital indicia of a new configuration. The previous configuration of the local model is in conformance with a previous local model (*i.e.*, of a previous user). The new configuration is in conformance with a new local model (*i.e.*, of a new user).

In system 200, local message model 316 may be initialized to be in conformance with, for example, user message model 262. During this initialization, digital indicia of user message model 262 is transferred to the local processing environment of message recognizer 310 via network connection 237 and digital signal S_N.

Message recognizer 310 may retrieve a selected user message model from a remote database via, for example, an Internet connection. Identifying signal S_{ID} may specify an Internet address (*e.g.*, URL) from which the stylus owner's model may be retrieved. Local message model 316 may then be initialized to conform to the remotely located user model. When security is a concern, the user message model may be transmitted in an encrypted format, to be decrypted in accordance with a key that may be provided, for example, in identifying signal S_{ID}.

After a message recognition session, a local message model may have been adapted by user training, preferably including both correction of misrecognition and user identification of a user context. Advantageously, a user message model may be initialized to be in conformance with an adapted local message model. For example, message recognizer 310 may transfer digital indicia of local message model 316 (after user training) from its local processing environment to a remote database where user message model 262 is stored. User message model 262 may thus be initialized to be in conformance with adapted local message model 316. Accordingly, in message recognizer according to various aspects of the present invention provides a user with the opportunity to adapt and modify his or her user message model over time, regardless of the particular system in which he or she employs it for message recognition. A user of such a message recognizer may develop a highly adapted message model by, and for, use of the model in many different message recognition systems.

User training may include adaptation of an acoustic model in the message model. Advantageously, the acoustic model may be adapted over time using a single stylus-mounted microphone. Use of the same stylus for user training provides acoustic consistency, even when the stylus is used with many different message recognition systems.

In variations where the benefits of a user message model are not required, a message recognizer may operate in accordance with a number of generic local message models, each generally tailored to portions of an expected user population. When so configured, domain controller 220 may include a local database in non-volatile memory (not shown) for storing such models.

As discussed above, a message recognizer according to various aspects of the present invention may be responsive to message input from a plurality of users to provide respective portions of text data. Such a message recognizer may operate in accordance with a plurality of respective local message models. Each respective local message model may be initialized to be in conformance with a user message model of a particular user. For example, message recognizer 310 may operate at times in accordance with a second local message model (not shown). This second model may be initialized to be in conformance with a second user message model, for example user message model 264.

A language model is any model that may be used to determine units of language responsive to input sequences of text segments. Such input sequences may be derived, for example, from voice input and/or freehand input in accordance with a respective acoustic model or handwriting model. In message recognizer 310, for example, speech recognizer 312 first derives units of speech responsive to feature vectors (which are conventionally derived from voice signal S_V) in accordance with acoustic model 356. (Acoustic model 356 is part of unified message model 316.) Speech recognizer 312 then derives units of language (here, strings of text data) from the units of speech in accordance with language model 350. Speech recognizer 312 provides the derived units of language as text data to domain interface 330. Handwriting recognizer 314 first derives units of handwriting responsive to feature vectors (which are conventionally derived from stylus position signal S_P) in accordance with handwriting model 358. Handwriting recognizer 314 then derives units of language (again, strings of text data) from the units of handwriting in accordance with language model 350. Handwriting recognizer 314 provides the derived units of language as text data to domain interface 330. Handwriting recognizer 314 also provides (to domain interface 330 and ultimately to an editor) indicia of any editing commands conveyed by freehand input, as communicated by stylus position signal S_P.

Language model 350 includes a syntactic model 352 and a semantic model 354. Syntactic model 352 provides a set of *a priori* probabilities based on a local word context, and may be a conventional N-gram model. Semantic model 354 provides probabilities based on semantic relationships without regard to the particular syntax used to express those semantic relationships. As described below, semantic model 354 may be adapted according to various aspects of the present invention for accurate identification of a present context or a user context. In a variation where the benefits of user context identification are not required, semantic model 354 may be of the type disclosed in U.S. patent 5,828,999 to Bellegarda et al. (incorporated by reference below). In a further variation where the benefits of semantic analysis are not required, language model 350 may omit semantic model 354.

As discussed above, a language model may include a syntactic model, a semantic model having a plurality of semantic clusters, or both. For example, a language model may be of the type disclosed in U.S. patent 5,839,106, issued November 17, 1998 to Bellegarda and U.S. patent 5,828,999, issued October 27, 1998 to Bellegarda *et al.* The detailed description portion (including referenced drawing figures) of each of these two aforementioned patents is

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incorporated herein by reference. Further, the detailed description portion (including referenced drawing figures) of any U.S. patent or U.S. patent application incorporated by reference into either of these two aforementioned patents is also specifically incorporated herein by reference.

A semantic model may be adapted, according to various aspects of the present invention, for accurate identification of a present context, *i.e.*, the context of text currently being presently generated or a user context, *i.e.*, the type of text that may be expected to be generated by the user. A system and method according to various aspects of the invention provides the user with an opportunity to identify text segments that are not expected to occur in the present context of the text currently being generated, or in the user context. Such text segments are referred to herein as "stop segments," and may include more or less text than a single word. Semantic clusters associated with user-identified stop segments may be expected, in accordance with the inventive semantic model, to be outside the present context.

The semantic model may be part of a shared language model of the invention. In message recognizer 310, for example, semantic model 354 is part of shared language model 350. A message recognizer may include two or more subordinate message recognizers, each of which may operate in accordance with the semantic model in the shared language model. Advantageously, the accuracy of each subordinate message recognizer sharing a language model that includes a semantic model model according to various aspects of the present invention may be improved by user identification of context.

A message recognizer (*e.g.*, speech recognizer 162 of system 100 or message recognizer 310 of system 200) may perform a context-sensitive hypothesis test of text segments against message input in accordance with an adapted semantic model. In cooperation with the message recognizer, the adapted semantic model biases against those tested segments that have a high probability of occurrence in clusters considered to be outside the present context. Advantageously, the model may cause such biasing by simply applying a negative bias against those text segments having a high probability of shared cluster occurrence with stop segments. A semantic model is said to bias against a tested segment when a message recognizer scores the tested segment less favorably in a hypothesis test due to the operation of the semantic model.

In the discussion below of semantic models according to the invention, two examples of semantic model operation are provided to illustrate the benefit of user context identification in

particular situations. The first of these two examples illustrates how certain text segments can be expected to be especially useful for indicating context as stop segments. The second example illustrates how certain text segments are less useful for indicating context.

The first example of semantic model operation is referred to herein as the "Coors Uncle" example. In the "Coors Uncle" example, the phrase "straight *horizontal* line through" was dictated (*i.e.*, communicated by voice input) to a conventional speech recognizer, which was a computer executing the NATURALLY SPEAKING software discussed above. The speech recognizer provided the text data "straight *Coors Uncle* line through" in response to the voice input. The dictated phrase and the speech recognizer's alternative text segments are listed below in TABLE IV.

TABLE IV

Dictated Phrase: Straight [Coors Uncle] horizontal line through	
Ranking	**Alternative Text**
1	Coors Uncle
2	cores Uncle
3	core is Uncle
4	Coors uncle
5	Cora's uncle
6	core his uncle
7	or his uncle
8	core as Uncle
9	corps is Uncle
10	quarters Uncle

The phrase "straight horizontal line through" was dictated by the Applicant during preparation of the present patent application. The text data "straight *Coors Uncle* line through," generated by the conventional speech recognizer (a computer executing the NATURALLY SPEAKING software) in response, was clearly out of the context of such a document. Because it would be very unusual for the Applicant to write a document relating to the consumption of alcoholic beverages, words relating to alcohol consumption (e.g., beer, brewing, etc.) are

unlikely to appear in any document the Applicant generates. If a message recognizer operating in accordance with the semantic model of the invention were used, the word COORS (a registered trademark of the Coors Brewing Company) would likely have been designated as a stop word outside the user context.

As discussed below, a user may identify stop segments by any suitable system or method. In the "Coors Uncle" example, the user may identify the word COORS as being outside the user context by drawing a double line through it, for example in the first alternative text listing "Coors Uncle." Double lines may then appear drawn through each occurrence of the word COORS, since the word has been identified as a "user context" stop segment.

A nontechnical word that appears in a technical document such as a patent application may be designated as a stop word outside the present context, regardless of the author's overall writing habits. For example, words relating to familial relationships (including the word UNCLE) are not typically used in patent applications. In the "horizontal" example, a user may identify the word UNCLE as being outside the present context (but not the user context) by drawing a single line through it, for example in the first alternative text listing "cores Uncle." Double lines may then appear drawn through each occurrence of the word UNCLE, since the word has been identified as a "present context" stop segment.

A user context is the context of all documents generated by a particular user. A user context may also be viewed as a context of all documents generated by a group of users, such as members of a particular collaborative group. Examples of collaborative groups include project teams, institutions, corporations, and departments. Members of a collaborative group may share a common pool of stop segments. A stop segment designated by any member of the group as being outside his or her user context is then considered to be outside the user context of each group member. In one variation, a leader of the group may review a list of pooled stop segments and edit the list. In another variation, each group member may remove pooled user stop segments (at least from operation of message recognition responsive to his or her message input) that the member considers to be inside his or her particular user context.

Advantageously, a user context may exclude words not consistent with the writing style of a particular user (or collaborative group). For example, a user who writes only technical documents may appreciate the opportunity to designate profanities and slang terms as being

outside the user context. The designation of a profanity or slang term as a stop word outside the user context may cause a semantic model of the invention to bias against other profanities or slang terms. Alternatively, a fiction writer may appreciate the opportunity to designate technical terms as being outside the user context.

The second example of semantic model operation is referred to herein as the "words on" example. In the "words on" example, the phrase "straight *horizontal* line through" was again dictated (*i.e.*, communicated by voice input) to a conventional speech recognizer, which was again a computer executing the NATURALLY SPEAKING software. The speech recognizer provided the text data "straight *words on a* line through" in response to the voice input. The dictated phrase and the speech recognizer's alternative text segments are listed below in TABLE V.

TABLE V

Dictated Phrase: Straight [words on a] horizontal line	
Ranking	**Alternative Text**
1	words on a
2	words on
3	for his all

The phrase "straight horizontal line through" was dictated the second time by the Applicant during preparation of the present patent application. The text data "straight *words on a* line through," generated by the conventional speech recognizer (a computer executing the NATURALLY SPEAKING software) in response, was not clearly out of the context of such a document. The text segments "words," "on," and "a" are common words that appear frequently in many different types of documents including the present patent application. If a message recognizer operating in accordance with the semantic model of the invention were used, none of the alternative text segments listed in TABLE V would be useful to designate as stop segments.

A semantic cluster includes any semantic association of text in a language model. In a first exemplary semantic model of the present invention, a semantic cluster is of a first type. The first type of semantic cluster is a mathematically derived group of vectors representing text segments (*e.g.*, words). The vectors may lie in a word-document vector space defined by a word-

document matrix, which tabulates the number of times each word of a suitable training corpus occurs in each of a plurality of documents (or paragraphs, sections, chapters, etc.) in the corpus. The vectors may be clustered, for example, based on a distance measure between the word vectors in the vector space after a singular value decomposition of the word-document matrix. Such a technique is taught in U.S. patent 5,828,999 to Bellegarda *et al.*, incorporated by reference above. The disclosure found from column 4, lines 8-54; from column 5, line 35 through column 7, line 35; and column 8, lines 3-24 of the aforementioned patent is considered particularly instructive for the identification of semantic clusters of this first type.

In a second exemplary semantic model of the present invention, a semantic cluster is of a second type. The second type of semantic cluster is a discrete grouping of text that may be expected to have a particular context, *e.g.*, discussing a particular topic. Examples of semantic clusters of this type include documents within a document collection (*e.g.*, an article within the standard Wall Street Journal training corpus), paragraphs within a document, and sections of text separated by headings in a document.

Additional types of semantic clusters include, for example, a third type of semantic cluster, which is defined with respect to an individual reference word that is considered to be indicative of a particular context. For example, a semantic cluster of this type may include all words found within a given number (*e.g.*, 50) of a particular reference word in a training corpus. Such a semantic cluster may be given indefinite boundaries by applying words further from the reference word may given a lower semantic association than text close to the reference point.

A method 1000 for the identification of semantic clusters of the second type (for the second exemplary semantic model) may be better understood with reference to FIG. 10. Method 1000 begins with a suitable training corpus, which is partitioned into discrete semantic clusters at step 1010. Discrete semantic clusters are semantic clusters of the second type discussed above. A commonly used corpus is the standard Wall Street Journal corpus. Another corpus, referred to as TDT-2, is available from Linguistic Data Consortium (LDC). The TDT-2 corpus consists of about 60,000 stories collected over a six-month period from both newswire and audio sources. When the TDT-2 corpus is employed in process 1000, each story is preferably partitioned into a discrete semantic cluster at step 1010.

At step 1020, each semantic cluster is analyzed. Text segments occurring in each cluster are counted and tabulated into a two-dimensional matrix Z. This matrix is used at steps 1030 and 1050 to compute probabilities of global and shared cluster occurrence, respectively.

An exemplary process 1100 for carrying out step 1020 may be better understood with reference to FIG. 11. At step 1110, process 1100 begins by setting pointers i and k both to zero for counting of the first text segment w_0 in the first cluster C_0. At step 1120, a count is made of the number of occurrences of one text segment w_i of the corpus in one cluster C_k of the corpus. When step 1120 is first carried out after step 1110, the count is made of the number of occurrences of the first text segment w_0 in the first cluster C_0. Each count is tabulated in a respective element $Z_{i,k}$ of matrix Z, starting with element $Z_{0,0}$.

After each occurrence of step 1120, a determination is made at decision step 1130 as to whether or text segments of the corpus are still to be counted in the present cluster. If so, pointer i is incremented at step 1135 and step 1120 is repeated to count the number of occurrences of the next text segment of the corpus in the present cluster. If no text segments remain to be counted in the present cluster, process 1100 continues at decision step 1140.

At decision step 1140, a determination is made as to whether or semantic clusters of the corpus are still to be analyzed. If so, pointer k is incremented at step 1145 and step 1120 is repeated to count the number of occurrences of the first text segment of the corpus in the next cluster. If no clusters remain to be analyzed, process 1100 is complete and method 1000 continues at 1030 (FIG. 10).

At step 1030, the probability of global cluster occurrence is computed for most (or all) text segments in the corpus. In the second exemplary semantic model, the probability of global cluster occurrence may be expressed as $Pr(w_i|V)$. "V" indicates "given the entire vocabulary (*i.e.*, corpus)." $Pr(w_i|V)$ is the probability that a given text segment w_i of the corpus will appear in a random sample (adjusting for sample size) of text segments chosen from the corpus. $Pr(w_i|V)$ may also be viewed as the probability that a randomly chosen text segment of the corpus (globally, *i.e.*, without regard to any particular semantic cluster) will be a given text segment w_i. The more times a given text segment w_i appears in the corpus, no matter how distributed, the higher probability $Pr(w_i|V)$ will be.

Probability $Pr(w_i|V)$ may be computed (at least as an estimate) by any suitable statistical technique. For example, probability $Pr(w_i|V)$ may be computed for a given text segment wi based on the total number of occurrence of segment wi in matrix Z, divided by the total number of occurrences of all segments in matrix Z. Determination of probability $Pr(w_i|V)$ may be expressed by the following equation:

$$\Pr(w_i|V) \cong \frac{\sum_{k=0}^{N} Z_{i,k}}{\sum_{j=0}^{L}\sum_{k=0}^{M} Z_{j,k}}$$

At step 1040, a subset of text segments is selected for further analysis. The subset excludes text segments having a very high probability of global cluster occurrence. In the second exemplary semantic model, text segments that appear often are less likely to receive a negative bias, even though they may appear often in the same semantic clusters as stop words. The expectation is that commonly occurring text segments can be expected to occur in many different contexts, and that the present context is less likely to exclude such text segments.

By selecting text segments having a probability of global cluster occurrence $Pr(w_i|V) < P_1$, where P_1 is a predetermined upper limit of "commonness," words likely to be biased against may be omitted from consideration in the second exemplary semantic model. In the "Coors Uncle" example, the word BAR may be expected to appear in semantic clusters where consumption of alcohol may be discussed and could thus receive some negative bias when the word COORS is identified as a stop segment. However, the word BAR also has many synonymous meanings (e.g., "sand bar," "metal bar," "patent bar," etc.) and would have relatively high probability of global cluster occurrence in most corpora, thus limiting the negative bias. By omitting words such as BAR that are likely to be biased against less severely, the second exemplary semantic model may be simplified.

At step 1050, the probability of shared cluster occurrence is computed for the selected text segments. In the second exemplary semantic model, the probability of shared cluster occurrence may be expressed as $Pr(w_i w_j|V)$. $Pr(w_i w_j|V)$ is the probability that two given text segments w_i and w_j of the corpus will appear together in a random sample (adjusting for sample size) of text

segments chosen from the corpus. The more times two given text segments w_i and w_j appear together in semantic clusters of the corpus, the higher probability $Pr(w_i w_j|V)$ will be.

Probability $Pr(w_i w_j|V)$ may be computed (at least as an estimate) by any suitable statistical technique. For example, probability $Pr(w_i w_j|V)$ may be computed for a given combination of text segments w_i and w_j based on the total number of occurrence of segment wi in matrix Z, divided by the total number of occurrences of all segments in matrix Z. The probability of shared cluster occurrence of text segments w_i and w_j may be estimated as the ratio between (1) the number of times text segments w_i and w_j can be paired together within semantic clusters of the corpus and (2) the total number of text segments in the corpus. Such an estimation of probability $Pr(w_i|V)$ may be expressed by the following equation:

$$\Pr(w_i w_j|V) \cong \frac{\sum_{k=0}^{N} Min\{Z_{i,k}, Z_{j,k}\}}{\sum_{m=0}^{M}\sum_{k=0}^{N} Z_{m,k}}$$

Step 1060, probabilities $Pr(w_i|V)$ and $Pr(w_i w_j|V)$ are tabulated for each text segment in the subset and method 1000 is completed. An exemplary data structure 1200 for the tabulation of these probabilities may be better understood with reference to FIG. 12. Data structure 1200 includes tabulations of probabilities relating to three example words UNCLE, COORS, and BEACH of an exemplary subset. As discussed above, these words are used to illustrate two examples of message recognition in accordance with a semantic model of the present invention. As illustrated in data structure 1200, for example, the word UNCLE may be expected to have a high probability of shared cluster occurrence with other words related to familial relationships. By way of example (and not intended to be a report of actual results), words AUNT, NEPHEW, RELATIVE, and BROTHER are shown in data structure 1200 as secondary text segments under the primary text segment UNCLE. (In data structure 1200, a text segment that forms the heading of a listing is said to be a primary text segment and a text segment listed under the heading is said to be a secondary text segment.) In a tabulation performed at step 1060 of method 1000, using a training corpus described above, it is expected that the secondary text segments shown in

FIG. 12 would be listed with relatively high probabilities $Pr(w_i w_j |V)$ under each primary text segment shown.

In a variation, step 1060 may include manual editing of a tabulation such as that of data structure 1200. Primary text segments known to be poor indicators of context as stop segments may be manually identified and purged from the tabulation of data structure 1200, along with text segments listed under the purged text segments. For example, a manual (i.e., human) editor may know, based on his or her knowledge of linguistics and human intelligence, that certain secondary text segments have a closer semantic association with a given primary text segment than the probabilities otherwise generated by method 1000 would indicate. Accordingly, the manual editor may adjust the probability $Pr(w_i w_j |V)$ for each of those secondary text segments. In a further variation, step 1060 may include refinement of a tabulation such as that of data structure 1200 in an iterative design process. Such a design process may include manual and/or computer controlled editing of such a tabulation. For example, the design process could add and purge various secondary text segments, and modify probability $Pr(w_i w_j |V)$ for various secondary text segments, with the goal of minimizing an error constraint. A suitable error constraint may be the perplexity of message recognition, which may be (using a suitable test corpus) performed in accordance with each semantic model resulting from each iteration of the tabulation.

As discussed above, a stop segment is any text segment (*e.g.*, word, phrase, portion of a compound word) that has been identified by a user as being expected to be outside the present context or the user context. Stop segments may be identified by a user in a context definition mode. For example, a context definition mode may present the user with (1) a maximum likelihood text segment and (2) alternative text segments that the user could identify as being outside the present context or user context. The user may select alternative text segments to identify them as stop segments, for example by freehand input.

A user may identify stop segments by any suitable system or method. Stop segments may be identified in a context definition mode, which may be initiated whenever the identification of stop segments may be useful to determine context. The context definition mode may be initiated during a message recognition session, or prior to it. (An example of a message recognition session is the dictating of a document by voice input, with editing of the document by freehand

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input.) A context definition mode may be initiated automatically when alternative text segments are located (*e.g.*, during hypothesis testing) that may be expected to be especially useful for indicating context as stop segments. Alternatively or in addition, a context definition mode may be initiated manually (*i.e.*, by the user).

An exemplary method 1300 for user identification of stop segments during message recognition may be better understood with reference to FIG. 13. Method 1300 begins at step 1310 with a segment of message input provided by a user. Such a segment may include, for example, a sentence dictated by the user with voice input or a handwritten phrase conveyed by the user with freehand input.

At step 1320, a message recognizer (*e.g.*, speech recognizer 162, message recognizer 310) performs hypothesis testing to identify text segments that each receive a high score in accordance with a message model. The text segment receiving the highest score (*i.e.*, the maximum likelihood text segment) is conventionally provided as the message recognizer's "best guess" of the text data corresponding to the message input. Text segments receiving high scores (*e.g.*, in the top 10) but not the highest are considered alternative text segments.

Although method 1300 is for the preparation of a semantic model according to various aspects of the present invention, the hypothesis testing of step 1320 may be performed in accordance with only a syntactic model. No semantic model may be used at step 1320 in certain situations, for example at the beginning of a message recognition session when the semantic model may not be considered ready for use.

At decision step 1330, a determination is made as to whether context definition is to be activated. If no context definition is initiated automatically or manually, message recognition proceeds at step 1310. If context definition is to be initiated, a context definition mode is entered for user identification of one or more stop segments.

In method 1300, a context definition mode is activated at step 1340. At step 1340, alternative text segments are listed for possible identification as stop segments by the user. At step 1350, text segments (if any) considered to be outside the present or user context are identified as stop segments.

A user may initiate a context definition mode manually. The context definition mode may be initiated when the user initiates a correction mode to correct a misrecognition by the message recognizer. Alternatively, a user may communicate an appropriate editing command to indicate, without initiating a correction process, that a text segment provided by a message recognizer is out of either the present context or the user context. With an editing command from the set provided in TABLE II above, for example, the user may indicate that a displayed text segment is out of the present context by using a stylus to draw a straight horizontal line through the text segment, then immediately double-tapping the stylus (*i.e.*, tapping the stylus twice, rapidly) somewhere on the text segment. The user may indicate that the text segment is out of the user context by using a stylus to draw a straight horizontal line through the segment, followed immediately by another straight horizontal line back through the segment, then immediately double-tapping the stylus somewhere on the segment.

A message recognizer may also have the ability to initiate a context definition mode automatically. A context definition mode may be automatically initiated when the message recognizer determines that one or more alternative text segments (*e.g.*, text segments receiving a high score during hypothesis testing) may be expected to be especially useful for indicating context as stop segments. A text segment may be expected to be especially useful for indicating context when it has a relatively high probability of global cluster occurrence and a relatively low probability of shared cluster occurrence with text segments in a document being generated (*e.g.*, other alternative text segments or the "best guess" of the message recognizer).

A context definition mode that is initiated automatically a present the user with a list of alternative text segments in addition to the message recognizer's "best guess." Alternatively, the user may be present with a simple question that may be quickly answered. For example, if the user dictates the sentence "Can you recognize speech?", the message recognizer may determine that the word BEACH could be especially useful for indicating context as a stop segment. If the message recognizer is configured to initiate a context definition mode automatically, the user might be presented with a dialog box containing the statement "You dictated the phrase RECOGNIZE SPEECH. Is the word BEACH of context?" and three "radio buttons" labeled "No," "Yes, this time," and "Always." If the word BEACH is not out of context, the user could select (or say) "No." If the word BEACH is outside the present context, the user could select or

say "Yes, this time. " If the word BEACH is outside the user context, the user could select or say "Always."

For optimal configuration of a message recognizer to automatically initiate a context definition mode, a number of factors should be considered and weighed. Text segments that rarely occur in any context (*i.e.*, low probability of global cluster occurrence) are less useful as stop segments because they can be expected to have a high probability of shared cluster occurrence with only a limited number of other text segments. However, text segments that occur in very many contexts (*i.e.*, very high probability of global cluster occurrence) are of limited usefulness as stop segments because they could be expected to cause negative bias to many alternative text segments, in some cases a majority. Text segments that occur frequently in many contexts (*i.e.*, high probability of shared cluster occurrence with many text segments) are also of limited usefulness as stop segments because they can be expected to cause significant negative bias with only a limited number of other text segments. Text segments that have been generated previously in a document (or by a user) may be excluded from consideration as stop segments, since it may be presumed that the user has previously considered such text segments to be in the present (or user) context.

A message recognizer may initiate a context definition mode at the beginning of a message recognition session. For example, a list of text segments that are known to be especially useful as stop segments may be presented to a user. With a conventional dialog user interface, the user may check boxes appropriately labeled (e.g., "User" and "Present") next to listed text segments to identify them as stop segments being outside of the user or present context, respectively. Several lists may be presented interactively to the user to refine the definition of context as user input is processed. For example, if the user identifies the word UNCLE in a first list as being outside the present context (because it relates to familial relationships), a second list of possible stop segments may include the word FRIEND to determine whether the present context excludes discussions of all interpersonal relationships.

Identification of semantic clusters (e.g., by method 1000) may be performed as a nonrecurring software engineering process. Identification of stop segments (e.g., by method 1300) is typically performed as a user interaction process. After identification of semantic

clusters and one or more stop segments, a message recognizer may operate in accordance with a semantic model according to various aspects of the present invention.

As discussed above, a semantic model according to various aspects of the present invention biases against those tested segments that have a high probability of occurrence in clusters considered to be outside the present context. Such a model applies a negative bias against those text segments having a high probability of shared cluster occurrence with one or more stop segments identified by a user.

Negative bias may be applied by any suitable technique or combination of techniques. Examples of techniques for biasing against a tested text segment include: providing one or more suitable mathematical terms in one or more model equations to reduce the hypothesis score of the text segment; subtracting a computed value from the hypothesis score of the text segment; multiplying the hypothesis score of the text segment by a computed value (*e.g.*, a fractional coefficient); and selecting only text segments for further consideration, from within a range of hypothesis scores, that have not received a bias.

The negative biasing in the model may be proportional to the probability of shared cluster occurrence between each tested text segment and the identified stop segment(s). With proportional biasing, the adapted model applies a more negative bias against text segments that can be expected to appear frequently in semantic clusters together with a stop segment. In a variation, the negative biasing may also be inversely proportional to the probability of global cluster occurrence of each tested text segment. The semantic model then does not apply as negative a bias against a text segment that can be expected to appear in many semantic clusters as it would against a text segment that can be expected to appear in only a few semantic clusters, all other factors being equal.

The first exemplary semantic model is a modification of the semantic model disclosed in U.S. Patent 5,828,999 to Bellegarda, incorporated by reference above. The "mixture language model" disclosed in the '999 patent expresses probability of a word (*i.e.*, text segment) as the sum of *products* between (1) probability of the word, given each semantic cluster in the summation, and (2) probability of each respective semantic cluster, given a contextual history. The first exemplary semantic model, according to the present invention, departs from the model of the '999 patent by expressing probability of a text segment as the sum of *ratios* between (1)

probability of the text segment, given each semantic cluster in the summation, and (2). the combined probability of stop words sharing each semantic cluster.

The approach taken in the '999 patent is to determine probability of a tested text segment as a *positive* function of its probability of occurrence in a history of prior words. The inventive approach, generally speaking, is to determine probability of the tested text segment as a *negative* function of its probability of occurrence with user identified stop segments. The former approach calls for the message recognition system to guide itself *toward* a relevant context by looking backward to a history of prior words. The latter approach, generally speaking, asks the user to guide the message recognition system *away* from irrelevant contexts by looking forward to his or her goals for a particular document (present context) and as a writer (user context). In variations, it may be desirable for both approaches to be used in a combined language model, or combined in one semantic model.

The first exemplary semantic model, adapted with M stop segments, may be implemented mathematically, using the following equation:

$$\Pr(w_i) = \sum_{k=1}^{M} \left[\frac{\Pr(w_i | C_k)}{A + \sum_{j=1}^{L} B_j \Pr(s_j | C_k)} \right]$$

During message recognition in accordance with the first exemplary semantic model, when implemented by the equation above, a ratio is computed for each semantic cluster $C_1 \ldots C_M$ in the model. The probability of the tested text segment w_i occurring in each semantic cluster is divided by the combined probability of user identified stop segments $s_1 \ldots s_L$ occurring in the same semantic cluster. The combined probability may be computed in any suitable fashion. In the equation above, the individual probabilities of each stop segment s_j occurring in a given semantic cluster C_k are simply summed together. Although such a summation could result in a combined probability greater than 1.00, the combined probability permits multiple stop segments to contribute to an overall negative bias.

In a variation of the first exemplary semantic model, the combined probability may be computed as the inverse of the product of negative probabilities. (A negative probability in this example is considered the probability of a stop segment *not* occurring in a given semantic cluster.) In this variation, a high probability of any one stop segment occurring in a given semantic cluster will cause one low negative probability to be included in the product. Consequently, the inverse of the product, which in this variation is the combined probability, will be relatively high. The ratio computed in the first exemplary semantic model will thus be relatively low, effecting a negative bias based on the high probability of a single stop segment occurring in a given semantic cluster with the tested text segment.

The negative bias incurred by identified stop segments may be tempered in the second exemplary semantic model by the inclusion of suitable mathematical terms. In the equation above, for example, a constant term A is included in the denominator of the ratio to limit the effect of the combined probability. The value of the constant term A may be selected in accordance with design or user preference.

The second exemplary semantic model, according to the present invention, expresses probability of a tested text segment as the product of negative biasing terms. A negative biasing term in this example is any term that varies between zero and one based on probability of shared cluster occurrence between the tested text segment and a stop segment. The closer such a negative biasing term is to zero, the more it will reduce the product of biasing terms, and the more negative a bias it will cause in the second exemplary semantic model. In the second exemplary semantic model, the product may include one negative biasing term for each identified stop segment.

The second exemplary semantic model, adapted with M stop segments, may be implemented mathematically, using the following equation:

$$\Pr(w_i) = \prod_{j=1}^{M}\left[1 - \frac{B_j \Pr(w_i s_j | \mathrm{V})}{\Pr(w_i | \mathrm{V})}\right]$$

In the equation above, each negative biasing term is computed as the ratio between (1) the probability of shared cluster occurrence $\Pr(w_i s_j | V)$ between the tested text segment w_i and a stop

segment s_j, and (2) the probability of global cluster occurrence $Pr(w_i|V)$ of the tested text segment w_i.

During message recognition in accordance with the second exemplary semantic model, when implemented by the equation above, a high probability of any one stop segment occurring in the same semantic cluster as the tested text segment will cause one small negative biasing term to be included in the product. Consequently, the probability (here, the score) assigned to the tested text segment during hypothesis testing will be relatively low, effecting a negative bias based on the high probability of a single stop segment occurring in the same semantic cluster as the tested text segment.

In a semantic model according to various aspects of the present invention, the severity of negative bias effected by a particular stop segment may be varied depending on one or more factors. For example, a stop segment that has been identified as being outside a present context may be "downgraded with age" with the passage of time following the identification. As another example, the severity of negative bias may be downgraded (*i.e.*, less negative bias) with the generation of additional text following the identification. In the exemplary equation above, a bias limiting coefficient B_j is included to limit the negative effect of each biasing term, as desired.

A semantic model may be combined with a syntactic model using any conventional technique. Suitable combination techniques may include maximum entropy, backoff, linear interpolation, and linear combination. By way of example, a maximum entropy language model integrating N-gram (*i.e.*, syntactic) and topic dependencies is disclosed in a paper entitled "A Maximum Entropy Language Model Integrating N-Grams And Topic Dependencies For Conversational Speech Recognition," by Sanjeev Khudanpur and Jun Wu (Proceedings of ICASSP '99), incorporated herein by reference. By way of a further example, combination of models by linear interpolation and, alternatively, by backoff is disclosed in a paper entitled "A Class-Based Language Model For Large-Vocabulary Speech Recognition Extracted From Part-Of-Speech Statistics" by Christer Samuelsson and Wolfgang Reichl (Proceedings of ICASSP '99), incorporated herein by reference.

In a variation, a semantic model may be integrated with a syntactic model in a single, hybrid language model of the type disclosed in U.S. Patent 5,839,106 to Bellegarda, incorporated by reference above.

In a further variation, the second exemplary semantic model may be combined with a conventional syntactic model by treating the semantic model as a negative biasing factor to the syntactic model. In the combination, the semantic model may be appropriately limited such that even a text segment that is a stop word may be selected as the message recognizer's "best guess" if the segment is a very strong fit in the syntactic model. Such a combination may be implemented mathematically, using the equation below. In the equation, the left-hand product term $Pr(w_i|LM_{syn})$ is the probability assigned to the tested text segment by the conventional syntactic model.

$$\Pr(w_i) = \Pr(w_i|LM_{syn}) \prod_{j=1}^{M} \left[1 - \frac{B_j \Pr(w_i s_j|\mathrm{V})}{\Pr(w_i|\mathrm{V})} \right]$$

An example of the operation of system 200 may be better understood with reference to the data flow diagrams of FIGS. 4 and 5. Exemplary processes, described below with reference to these data flow diagrams, may be variously implemented with and without user intervention, in hardware and/or software. The example provided below illustrates the benefits of various aspects of the present invention when these aspects are employed in an exemplary embodiment and operation example. However, benefits of certain aspects may be obtained even when various other aspects are omitted. Thus, the example below should not be considered as limiting the scope of the invention in any way.

The operation of stylus 210, in the example, may be better understood with reference to the data flow diagram of FIG. 4. Process 410 determines activation status of stylus 210. When user 242 moves stylus 210 toward his or her head to begin dictation, process 410 positively asserts an activation signal to process 420. Process 420 provides a voice signal responsive to voice input from user 242. Process 420 provides an enabled voice signal to process 430 upon two conditions. The first condition is that the activation signal from process 410 has been positively

asserted to indicate that stylus 210 is situated to receive voice input from user 242. The second condition is that user 242 has provided voice input by speaking into the microphone of stylus 210.

Process 440 provides an identification signal based on a 48-bit stylus identification code 442. (A longer code may be used when the identification signal is employed for decryption.) Process 430 responds to the identification signal and to the enabled voice signal from process 420 to provide an electromagnetic signal. The electromagnetic signal suitably combines the identification signal and the voice signal. The electromagnetic signal is transmitted from stylus 210 to domain controller 220 (communications link 235).

The operation of domain controller 220, in the example, may be better understood with reference to the data flow diagram of FIG. 5. Process 510 extracts signal components from the electromagnetic signal provided by process 430. The identification signal identifies the source of the electromagnetic signal as stylus 210 and, consequently, the source of the voice signal as user 242.

Process 520 initializes local message model 316 in domain controller 220 to be in conformance with user message model 262. (Process 520 may employ any appropriate network protocol to transfer digital indicia of user message model 262.) Not shown in FIG. 5 is a process for initializing user message model 262 to be in conformance with local message model 316 after adaptation of local message model 316.

Process 530 performs speech recognition in accordance with initialized message model 316 to generate text data responsive to the voice signal. Process 540 performs handwriting recognition, also in accordance with initialized message model 316, to generate text data responsive to freehand input from user 242. Process 540 further interprets editing commands from user 242 responsive to freehand input. User 242 conveys freehand input by manipulating stylus 210 on a tablet surface (not specifically shown) of tablet 252.

Process 550 edits text generated by process 530 and process 540 responsive to editing commands interpreted by process 540. Editing may include user modification of text that has been correctly generated by processes 530 and 540, but which the user desires to modify. Editing may further include user training, conveyed by freehand input, voice input, and/or character input. User training may include correction of misrecognition by processes 530 and

540, which is conveyed back to processes 530 and 544 for adaptation of local message model 316. Correction conveyed back to either process adapts local message model 316. Process 550 provides text output for display on tablet 252.

The processes illustrated in the data flow diagrams of FIGS. 4 and 5 continue as user 242 continues providing voice and/or freehand input for generation and editing of text data.

Multiple displays, for example integrated with tablet surfaces of tablets, may be advantageously used to display multiple views of a single document in accordance with various aspects of the present invention. A first view of the document may be provided on a first display (*e.g.*, of a first tablet), while a second view of the document may be provided on a second display (*e.g.*, of a second tablet). Upon modification of the document, the first and second views are modified as needed to reflect the modification to the document.

When first and second tablets are networked together, modification made to the document by user input to the first tablet is communicated to the second tablet to modify the second view as needed to reflect the modification. Similarly, modification made to the document by user input to the second tablet is communicated to the first tablet to modify the first view as needed to reflect the modification.

An example of the use of multiple displays to provide multiple views of a single document may be better understood with reference to FIG. 15 (including FIGS. 15A and 15B). Tablet 252 is illustrated in FIG. 15A as displaying a first view of a graphical document 1500. The first view shows a circle 1510 and a rectangle 1520. A portion of the circle having a cutout 1512 is enclosed by a bounding box 1530.

Tablet 254 is illustrated in FIG. 15B as displaying a second view of document 1500. The second view shows a different portion of document 1500, namely the portion inside bounding box 1530. Cutout 1512 takes up most of the display of tablet 254.

Advantageously, modifications made to a portion of document 1500 inside bounding box 1530 (e.g., filling in of notch 1512) are displayed on both tablet 252 and tablet 254. The first view of document 1500, displayed on tablet 252, is updated according to various aspects of the invention to reflect modification made by user input to tablet 254. Modifications to the document may be centrally registered in a single data store, for example in domain controller

220. Alternatively, each tablet displaying a view of the document may update a complete copy of the document in a data store local to the tablet.

While the present invention has been described in terms of preferred embodiments and generally associated methods, it is contemplated that alterations and permutations thereof will become apparent to those skilled in the art upon a reading of the specification and study of the drawings. The present invention is not intended to be defined by the above description of preferred exemplary embodiments, nor by any of the material incorporated herein by reference. Rather, the present invention is defined variously by the issued claims. Each variation of the present invention is intended to be limited only by the recited limitations of its respective claim, and equivalents thereof, without limitation by terms not present therein.

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~~The claims below are provided in the present provisional application to particularly point out some, but not all, of the subject matter described above that the Applicant regards as his invention.~~

What is claimed is:

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1. A system responsive to voice input and freehand input to generate and edit text, the system comprising:

(a) a stylus comprising:

(1) a pointer for communicating freehand input; and

(2) a microphone for receiving voice input;

(b) a speech recognizer responsive to voice input to provide text data;

(c) a first tablet interface including a first tablet surface, the first tablet interface being responsive to freehand input to provide indicia of editing commands; and

(d) an editor having access to the text data, responsive to the indicia of editing commands to modify the text data as specified by the editing commands.

2. The system of claim 1 wherein:

(a) the stylus has a proximal end and a distal end;

(b) the pointer is toward the distal end; and

(c) the microphone is toward the proximal end.

3. The system of claim 1 wherein the microphone is responsive to sound impinging on the stylus from the direction of the proximal end with a first sensitivity and from the direction of the

distal end with a second sensitivity, the first sensitivity being significantly greater than the second sensitivity.

4. The system of claim 1 further comprising a first display integrated into the first tablet surface.

5. The system of claim 4 further comprising:

(a) a second tablet interface including a second tablet surface; and

(b) a second display integrated into the second tablet surface.

6. The system of claim 5 further comprising:

(a) a communications link interconnecting the displays; and

(b) a command interpreter for controlling the communications link, the command interpreter being responsive to the indicia of editing commands to transfer text data between the displays as specified by the editing commands.

7. The system of claim 1 wherein the speech recognizer is part of a message recognizer that further comprises a handwriting recognizer, the handwriting recognizer being responsive to freehand input to further provide text data.

8. The system of claim 7 wherein:

(c) the speech recognizer generates text data in accordance with an acoustic model and a shared language model; and

(d) the handwriting recognizer generates text data in accordance with a handwriting model and the shared language model; and

(e) the message recognizer is responsive to the indicia of editing commands to adapt at least the shared language model.

9. The system of claim 8 further comprising a character interface responsive to character input communicated via the pointing interface to provide character data, wherein the shared language model is adaptable by a correction process comprising:

specifying, responsive to freehand input, a selection of text generated by the message recognizer;

initiating a correction mode for modifying the selection;

providing a list of alternative text comparable to the selection;

updating the list based on character data communicated after initiation of the correction mode;

modifying the selection responsive to character data; and

adapting the shared language model in accordance with the modification to the selection.

10. The system of claim 1 wherein:

(a) the speech recognizer provides text data in accordance with at least one model; and

(b) the speech recognizer is responsive to the indicia of editing commands to adapt the model.

11. The system of claim 10 further comprising a character interface responsive to character input communicated via the pointing interface to provide character data, wherein the speech recognizer provides text data in accordance with at least a syntactic model that is adaptable by a correction process comprising:

specifying, responsive to freehand input, a selection of text generated by the speech recognizer;

initiating a correction mode for modifying the selection;

providing a list of alternative text comparable to the selection;

updating the list based on character data communicated after initiation of the correction mode;

modifying the selection responsive to character data; and

adapting the model in accordance with the modification to the selection.

12. The system of claim 10 wherein:

(c) the speech recognizer provides text data in accordance with at least a semantic model, the model comprising a plurality of semantic clusters; and

(d) the semantic model is adaptable by a process comprising:

listing a plurality of text segments having a low probability of shared cluster occurrence;

selecting, responsive to freehand input, at least one text segment of the plurality; and

adapting the semantic model to bias against text segments having a high probability of

shared cluster occurrence with each selected text segment.

13. The system of claim 10 wherein:

(a) the speech recognizer provides text data in accordance with at least a semantic model, the semantic model comprising a plurality of semantic clusters; and

(b) the semantic model is adaptable by a process comprising:

generating a maximum likelihood text segment responsive to voice input;

listing at least one alternative text segment, the maximum likelihood text segment and each alternative text segment forming a plurality of text segments, each text segment of the plurality having a high probability of global cluster occurrence and a low probability of shared cluster occurrence;

selecting, responsive to freehand input, at least one text segment of the plurality; and

adapting the semantic model to apply a negative bias against a tested text segment, the severity of the bias being proportional to the probability of shared cluster occurrence between the tested text segment and the selected text segment or segments.

14. The system of claim 13 wherein the bias is inversely proportional to the probability of global cluster occurrence of the tested text segment.

15. The system of claim 13 wherein the bias is inversely proportional to the amount of text data separating the tested text segment and the selected text segment or segments.

16. The system of claim 1 wherein the stylus further comprises an identification circuit for

providing, to the speech recognizer, an identification of an owner of the stylus.

17. The system of claim 1 wherein the stylus further comprises an activation circuit for automatically activating the speech recognizer.

18. The system of claim 17 wherein the activation circuit comprises:

(a) a first sound sensor responsive to sound impinging on the stylus within a first angular range to provide a first sensing signal;

(b) a second sound sensor responsive to sound impinging on the stylus outside the first angular range to provide a second sensing signal; and

(c) a comparator for comparing the first and second sensing signals.

19. The system of claim 17 wherein the activation circuit comprises a proximity sensor, responsive to proximity of the microphone to a human head, for controlling activation of the speech recognizer by the activation circuit.

20. The system of claim 19 wherein the proximity sensor comprises a radiation sensor responsive to field radiation impinging on the stylus.

21. The system of claim 20 wherein the radiation sensor is responsive to electromagnetic field radiation in the infrared spectrum.

22. The system of claim 20 wherein:

(a) the radiation sensor is responsive to field radiation impinging on the stylus within a first angular range to provide a first sensing signal and within a second angular range to provide a second sensing signal; and

(b) the proximity sensor further comprises a comparator for comparing the first and second sensing signals.

23. The system of claim 22 wherein:

(a) the activation circuit is configured to activate the speech recognizer when the microphone is at a predetermined proximity to the human head, wherein the microphone is:

(1) oriented toward the human head within a predetermined angular range; and

(2) displaced from the human head within a predetermined separation range;

(b) the second angular range falls completely within the first angular range; and

(c) the predetermined proximity is determined by all of at least two conditions being true, wherein the conditions are:

(1) the amplitude of the second sensing signal reaching a first predetermined threshold; and

(2) the ratio between the amplitude of the second sensing signal and the amplitude difference between the first and second sensing signals reaching a second predetermined threshold.

24. The system of claim 20 wherein the radiation sensor is responsive to acoustic field radiation, the system further comprising:

(a) an ultrasonic transmitter for sending acoustic field radiation to the human head, such that the radiation sensor provides a time-varying signal descriptive of reflected acoustic field radiation impinging on the stylus from the human head;

(b) a signal processor responsive to the time-varying signal so as to provide a distance profile of the acoustic field radiation; and

(c) a comparator for comparing the distance profile to an expected profile, the expected profile corresponding to acoustic field radiation expected to impinge on the stylus from the human head when the microphone is at a predetermined proximity to the human head.

25. A system responsive to voice input and freehand input to generate and edit text, the system comprising:

(a) a stylus comprising:

(1) a pointer for communicating freehand input; and

(2) a microphone for receiving voice input;

(b) at least one speech recognizer responsive to voice input to provide text data;

(c) a plurality of tablet interfaces, each including a respective tablet surface and being responsive to freehand input to provide indicia of editing commands;

(d) a plurality of displays, each being integrated into a respective tablet surface; and

(e) at least one editor having access to the text data, responsive to the indicia of editing commands to modify the text data as specified by the editing commands.

26. The system of claim 25 further comprising:

(a) a communications link interconnecting the displays; and

(b) a command interpreter for controlling the communications link, the command interpreter being responsive to the indicia of editing commands to transfer text data between the displays as specified by the editing commands.

27. A method for processing text, the method comprising:

providing a stylus comprising a pointing interface and a microphone;

providing a tablet responsive to the pointing interface;

generating text by dictating into the microphone; and

editing text by manually manipulating the pointing interface on the tablet.

28. The method of claim 27 further comprising:

moving the stylus across visual indicia of dictated text that has been erroneously generated to specify a selection from the text; and

correcting the selection.

29. The method of claim 28 further comprising:

generating text in accordance with an adaptable language model; and

adapting the language model responsive to the correction of the selection.

30. The method of claim 29 further comprising:

providing a character interface responsive to the pointing interface;

providing a list of alternative text comparable to the selection;

updating the list based on character input communicated after specification of the selection;

modifying the selection responsive to character input communicated via the pointing interface; and

adapting the language model in accordance with the modification to the selection.

31. The method of claim 29 wherein the language model comprises a syntactic model and a semantic model, the semantic model comprising a plurality of semantic clusters, the method further comprising:

listing a plurality of text segments having a low probability of shared cluster occurrence;

selecting, responsive to freehand input, at least one text segment of the plurality; and

adapting the semantic model to bias against text segments having a high probability of shared cluster occurrence with each selected text segment.

32. The method of claim 29 wherein the language model comprises a syntactic model and a semantic model, the semantic model comprising a plurality of semantic clusters, the method further comprising:

generating a maximum likelihood text segment responsive to voice input;

listing at least one alternative text segment, the maximum likelihood text segment and each alternative text segment forming a plurality of text segments, each text segment of the plurality having a high probability of global cluster occurrence and a low probability of shared cluster occurrence;

selecting, responsive to freehand input, at least one text segment of the plurality; and

adapting the semantic model to apply a negative bias against a tested text segment, the severity of the bias being proportional to the probability of shared cluster occurrence between the tested text segment and the selected text segment or segments.

33. The method of claim 32 wherein the bias is inversely proportional to the probability of global cluster occurrence of the tested text segment.

34. The method of claim 32 wherein the bias is inversely proportional to the amount of text data separating the tested text segment and the selected text segment or segments.

35. The method of claim 27 further comprising sending an identification signal to the speech recognizer to identify the stylus.

36. The method of claim 27 further comprising activating the speech recognizer by moving the stylus within a predetermined proximity of a human head.

37. A stylus comprising:

(a) a stylus body having a proximal end and a distal end;

(b) a pointing interface toward the distal end;

(c) an identification circuit for providing an identification signal; and

(d) a wireless transmitter for transmitting an electromagnetic signal comprising the voice signal and the identification signal.

38. The stylus of claim 37 further comprising a microphone toward the proximal end for providing a voice signal responsive to voice input, wherein the electromagnetic signal further comprises the voice signal.

39. The stylus of claim 38 wherein the identification signal and the voice signal are time-division multiplexed on the electromagnetic signal.

40. The stylus of claim 37 wherein the microphone is responsive to sound impinging on the stylus from the direction of the proximal end with a first sensitivity and from the direction of the distal end with a second sensitivity, the first sensitivity being significantly greater than the second sensitivity.

41. The stylus of claim 37 further comprising an activation circuit for automatically enabling the voice signal.

42. The stylus of claim 41 wherein the activation circuit comprises a proximity sensor, responsive to proximity of the microphone to a human head, for controlling enabling of the voice signal by the activation circuit.

43. A stylus comprising:

(a) a stylus body having a proximal end and a distal end;

(b) a pointing interface toward the distal end;

(c) a microphone toward the proximal end for providing a voice signal responsive to voice

input;

(d) an activation circuit for automatically enabling the voice signal; and

(e) a wireless transmitter for transmitting an electromagnetic signal comprising the voice signal.

44. The system of claim 43 wherein the activation circuit comprises:

(a) a first sound sensor responsive to sound impinging on the stylus within a first angular range to provide a first sensing signal;

(b) a second sound sensor responsive to sound impinging on the stylus outside the first angular range to provide a second sensing signal; and

(c) a comparator for comparing the first and second sensing signals.

45. The system of claim 43 wherein the activation circuit comprises a proximity sensor, responsive to proximity of the microphone to a human head, for controlling the enabling of the voice signal.

46. The system of claim 45 wherein the proximity sensor comprises a radiation sensor responsive to field radiation impinging on the stylus.

47. The system of claim 46 wherein the radiation sensor is responsive to electromagnetic field radiation in the infrared spectrum.

48. The system of claim 46 wherein:

(a) the radiation sensor is responsive to field radiation impinging on the stylus within a first angular range to provide a first sensing signal and within a second angular range to provide a second sensing signal; and

(b) the proximity sensor further comprises a comparator for comparing the first and second sensing signals.

49. The system of claim 48 wherein:

(a) the activation circuit is configured to enable the voice signal when the microphone is at a predetermined proximity to the human head, wherein the microphone is:

(1) oriented toward the human head within a predetermined angular range; and

(2) displaced from the human head within a predetermined separation range;

(b) the second angular range falls completely within the first angular range; and

(c) the predetermined proximity is determined by all of at least two conditions being true, wherein the conditions are:

(1) the amplitude of the second sensing signal reaching a first predetermined threshold; and

(2) the ratio between the amplitude of the second sensing signal and the amplitude difference between the first and second sensing signals reaching a second predetermined threshold.

50. The system of claim 46 wherein the radiation sensor is responsive to acoustic field radiation, the system further comprising:

(a) an ultrasonic transmitter for sending acoustic field radiation to the human head, such that the radiation sensor provides a time-varying signal descriptive of reflected acoustic field radiation impinging on the stylus from the human head;

(b) a signal processor responsive to the time-varying signal so as to provide a distance profile of the acoustic field radiation; and

(c) a comparator for comparing the distance profile to an expected profile, the expected profile corresponding to acoustic field radiation expected to impinge on the stylus from the human head when the microphone is at a predetermined proximity to the human head.

51. A method for message recognition in accordance with at least a semantic language model, the method comprising performing a plurality of hypothesis tests between a plurality of text segments and at least one stop segment, each hypothesis test including computing a probability according to the equation:

$$\Pr(w_i) = \sum_{k=1}^{M} \left[\frac{\Pr(w_i|C_k)}{A + \sum_{j=1}^{L} B_j \Pr(s_j|C_k)} \right]$$

wherein w_i is the text segment being tested, C_k is a semantic cluster from a plurality of semantic clusters, and B_j is a weighting factor for a respective stop segment.

The system of claim 25 wherein the speech includes

52. ~~In a message~~ recognizer, a semantic language model comprising a plurality of semantic clusters, the language model being adaptable by a process comprising the steps of:

(a) listing a plurality of text segments;

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(b) selecting, ~~responsive to a first type of input,~~ at least one text segment of the plurality; and

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(c) adapting the semantic model to bias against text segments having a high probability of shared cluster occurrence with each selected text segment.

53. The language model of claim 52 wherein the listed text segments have a low probability of shared cluster occurrence.

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54. The language model of claim ~~52~~ wherein:

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the context identification further comprises generating a maximum likelihood text segment responsive to a second type of input;

said step (a) further comprises listing at least one alternative text segment, the maximum likelihood text segment and each alternative text segment forming a plurality of text segments, each text segment of the plurality having a high probability of global cluster occurrence and a low probability of shared cluster occurrence;

said step (b) further comprises selecting, responsive to the first type of input, at least one text segment of the plurality; and

said step (c) further comprises adapting the semantic model to apply a negative bias against a tested text segment, the severity of the bias being proportional to the probability of shared cluster occurrence between the tested text segment and the selected text segment or segments.

55. The language model of claim 54 wherein:

(a) the first type of input is freehand input; and

(b) the second type of input is voice input.

56. The language model of claim 54 wherein the bias is inversely proportional to the probability of global cluster occurrence of the tested text segment.

57. The language model of claim 54 wherein the bias is inversely proportional to the amount of text data separating the tested text segment and the selected text segment or segments.

58. A method for adapting a semantic language model comprising a plurality of semantic clusters, the method comprising the steps of:

(a) listing a plurality of text segments having a low probability of shared cluster occurrence;

(b) selecting ~~, responsive to freehand input,~~ at least one text segment of the plurality; and

(c) adapting the semantic model to bias against text segments having a high probability of shared cluster occurrence with each selected text segment.

59. The method of claim 58 wherein:

the context identification further comprises generating a maximum likelihood text segment responsive to voice input;

said step (a) further comprises listing at least one alternative text segment, the maximum likelihood text segment and each alternative text segment forming a plurality of text segments, each text segment of the plurality having a high probability of global cluster occurrence and a low probability of shared cluster occurrence;

said step (b) further comprises selecting, responsive to freehand input, at least one text segment of the plurality; and

said step (c) further comprises adapting the semantic model to apply a negative bias against a tested text segment, the severity of the bias being proportional to the probability of shared cluster occurrence between the tested text segment and the selected text segment or segments.

60. The method of claim 59 wherein the bias is inversely proportional to the probability of global cluster occurrence of the tested text segment.

61. The method of claim 59 wherein the bias is inversely proportional to the amount of text data separating the tested text segment and the selected text segment or segments.

62. A system for generating text responsive to message input of a first type and a second type, the system comprising:

(a) a unified message model including:

(1) a shared language model;

(2) a first model specific to a first type of message recognition; and

(3) a second model specific to a second type of message recognition;

(b) a first message recognizer, responsive to the first type of message input to provide text data in accordance with both the shared language model and the first model; and

(c) a second message recognizer, responsive to the second type of message input to provide

Microsoft Exhibit 1005

text data in accordance with both the shared language model and the second model.

63. The system of claim 62 wherein:

(a) the first message recognizer is a speech recognizer, the first type of message input is voice input, and the first model is an acoustic model; and

(b) the second message recognizer is a handwriting recognizer, the second type of message input is freehand input, and the second model is a handwriting model.

64. The system of claim 62 wherein the shared language model comprises a syntactic model and a semantic model.

65. The system of claim 62 wherein the message model is a local message model, and wherein the system further comprises a network node for establishing a network connection to a user message model such that the local message model may be initialized to be in conformance with the user message model.

66. The system of claim 65 wherein the network node connects to a wide area network.

67. A method for recognizing a message input from a specific user, the method comprising:

providing:

(1) a local message model responsive to initialization by a user message model;

(2) a network including a first node and a second node, the first node being proximate the user and the second node being proximate the user message model; and

identifying the specific user to establish a connection on the network between the local message model and the user message model;

transferring data on the connection to modify the local message model to be in conformance with the user message model; and

recognizing message input from the user in accordance with the initialized local message model.

68. The method of claim 67 further comprising:

after modifying the local message model to be in conformance with the user message model, adapting the local message model in accordance with editing commands from the user; and

transferring data on the connection to modify the user message model to be in conformance with the adapted local message model.

69. The method of claim 67 wherein the local message model is implemented in a speech recognizer that is proximate the first node.

70. The method of claim 67 wherein:

(a) the message input comprises voice input; and

(b) the local message model comprises a language model and an acoustic model.

71. The method of claim 67 wherein:

(a) the message input comprises freehand input; and

(b) the local message model comprises a language model and a handwriting model.

72. The method of claim 67 wherein:

(a) the message input comprises voice input and freehand input; and

(b) the local message model comprises a language model, an acoustic model, and a handwriting model.

73. The system of claim 67 wherein the specific user is identified by an identification circuit in a stylus employed by the user to convey message input.

74. The system of claim 67 wherein the network is a wide area network.

75. A system responsive to voice input and freehand input to generate and edit text, the system comprising:

(a) a stylus comprising:

(1) a pointer for communicating freehand input; and

(2) a microphone for receiving voice input;

(b) means for generating text data responsive to voice input; and

(c) means for editing the text data responsive to freehand input.

76. A method for displaying a document, the method comprising:

Attorney Docket No. 50277-0005

displaying a first view of the document on a first display;

displaying a second view of the document on a second display; and

upon modification of the document, modifying the first and second views as needed to reflect the modification.

77. The method of claim 76 wherein:

(a) the first display is integrated into a tablet surface of a first tablet;

(b) the second display is integrated into a tablet surface of a second tablet; and

(c) the first and second tablets are coupled together such that:

(1) modification made to the document by user input to the first tablet is communicated to the second tablet to modify the second view as needed to reflect the modification; and

(2) modification made to the document by user input to the second tablet is communicated to the first tablet to modify the first view as needed to reflect the modification.

78. A text processing system comprising:

(a) a stylus having a proximal end and a distal end, the stylus comprising:

(1) a pointer toward the distal end for communicating freehand input;

(2) a microphone toward the proximal end for receiving voice input;

(3) an activation circuit for automatically activating the speech recognizer; and

(4) an identification circuit for providing, to the speech recognizer, an identification of the stylus;

(b) a tablet interface, responsive to freehand input, comprising a plurality of tablet surfaces;

(c) a plurality of self-contained enclosures, each of the enclosures comprising:

(1) a front face having a height and a width, the front face comprising a respective one of the tablet surfaces; and

(2) a back face, separated from the front face by a depth, the depth being significantly less than either the height or the width;

(d) a display comprising a plurality of displays, each of the displays being integrated into a respective tablet surface;

(e) a wireless transmitter and a wireless receiver for effecting a communications link to interconnect the displays;

(f) a command interpreter for controlling the communications link, the command interpreter being responsive to command indicia communicated via freehand input to transfer text between the displays; and

(g) a speech recognizer responsive to voice input to generate text in accordance with a language model specific to an owner of the stylus, for display on the display.

79. The method of claim 52 wherein selecting at least one text segment of the plurality is performed responsive to a first type of input.

80. The method of claim 58 wherein selecting at least one text segment of the plurality is performed responsive to freehand input.

GS
7/14/00

Docket No. 2000-0052

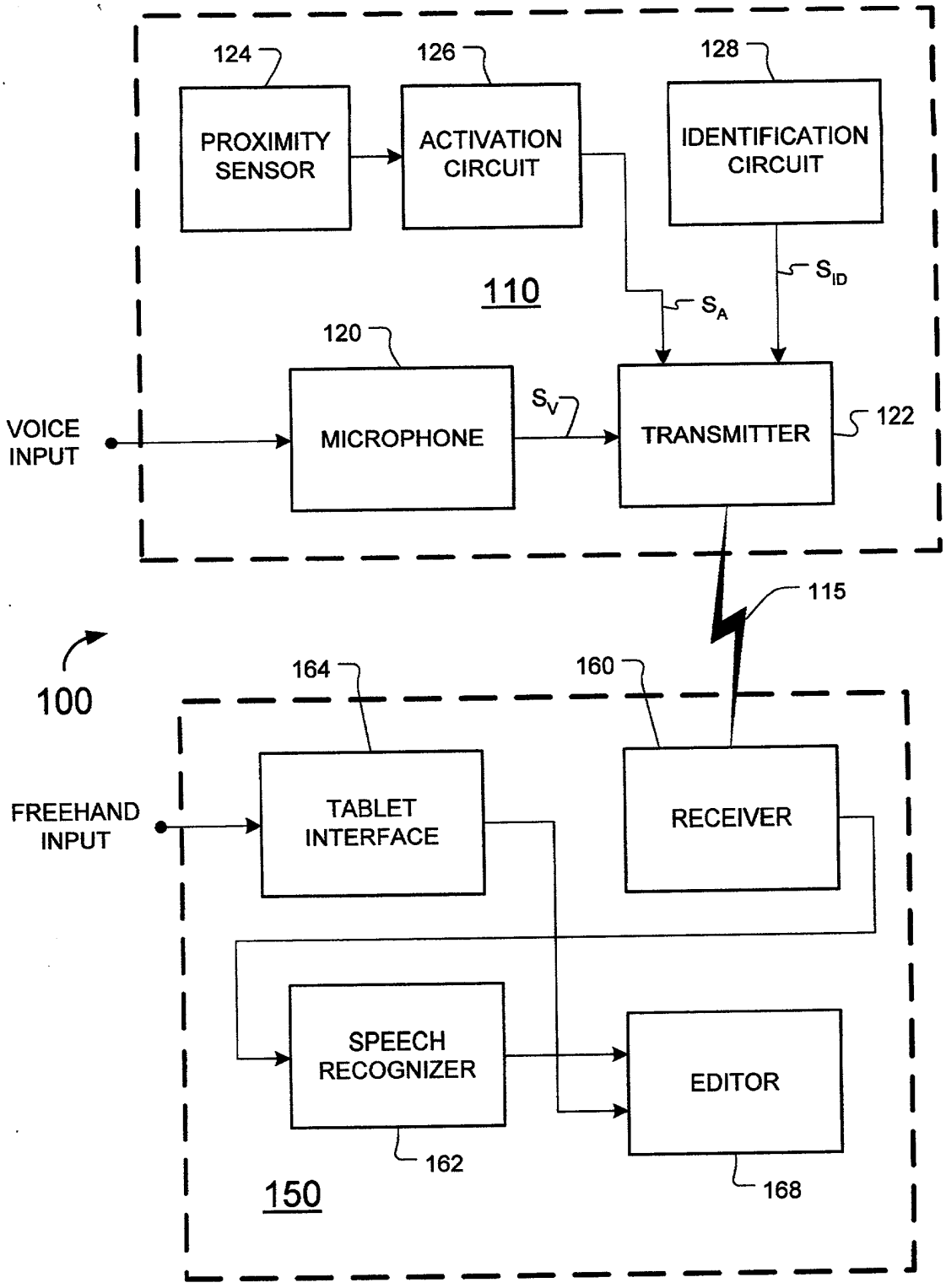

124
126
128
PROXIMITY SENSOR
ACTIVATION CIRCUIT
IDENTIFICATION CIRCUIT
S_{ID}
110
S_A
120
VOICE INPUT
MICROPHONE
S_V
TRANSMITTER
122
115
100
164
160
FREEHAND INPUT
TABLET INTERFACE
RECEIVER
SPEECH RECOGNIZER
EDITOR
162
168
150

FIG. 1A

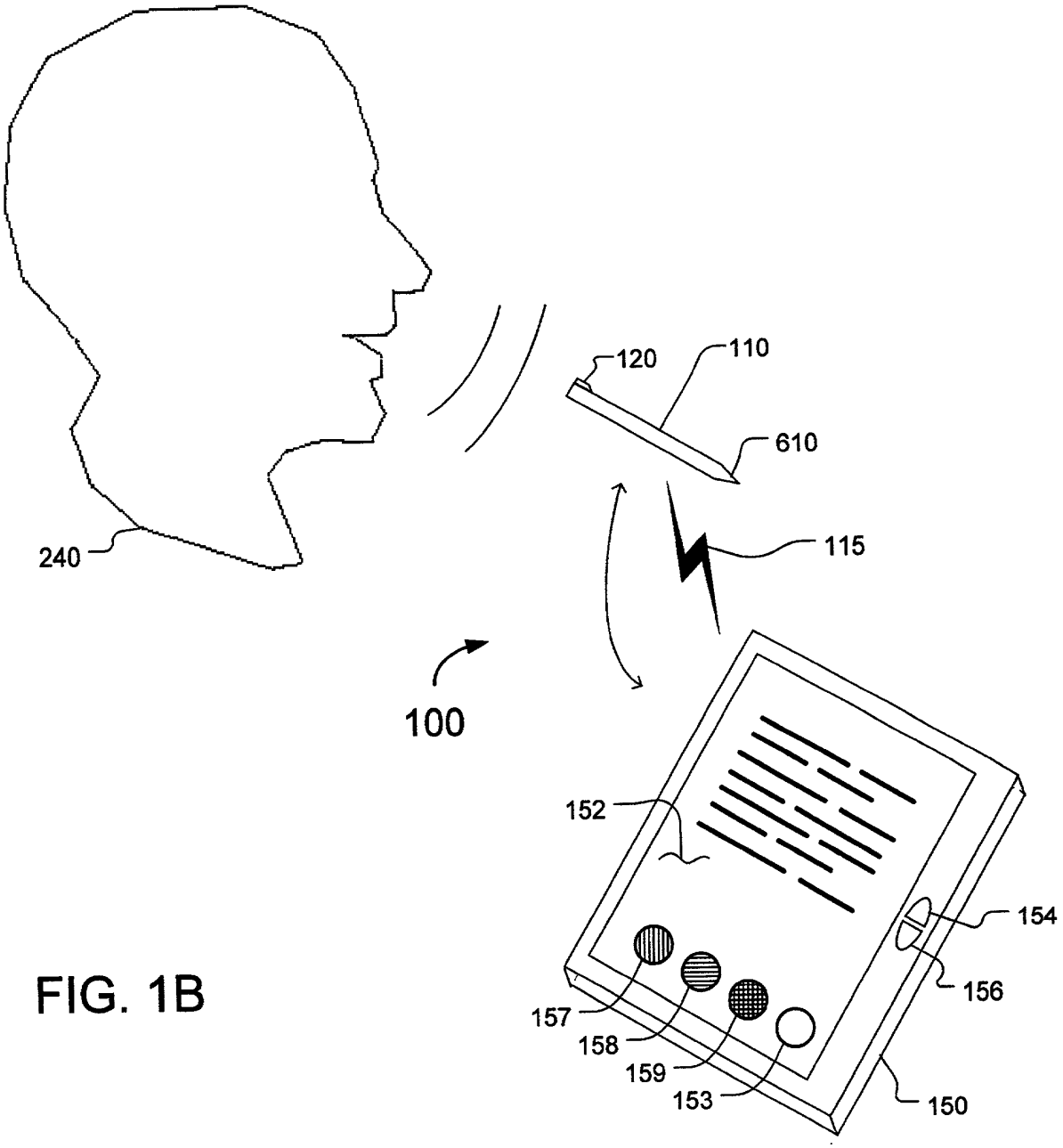


FIG. 1B

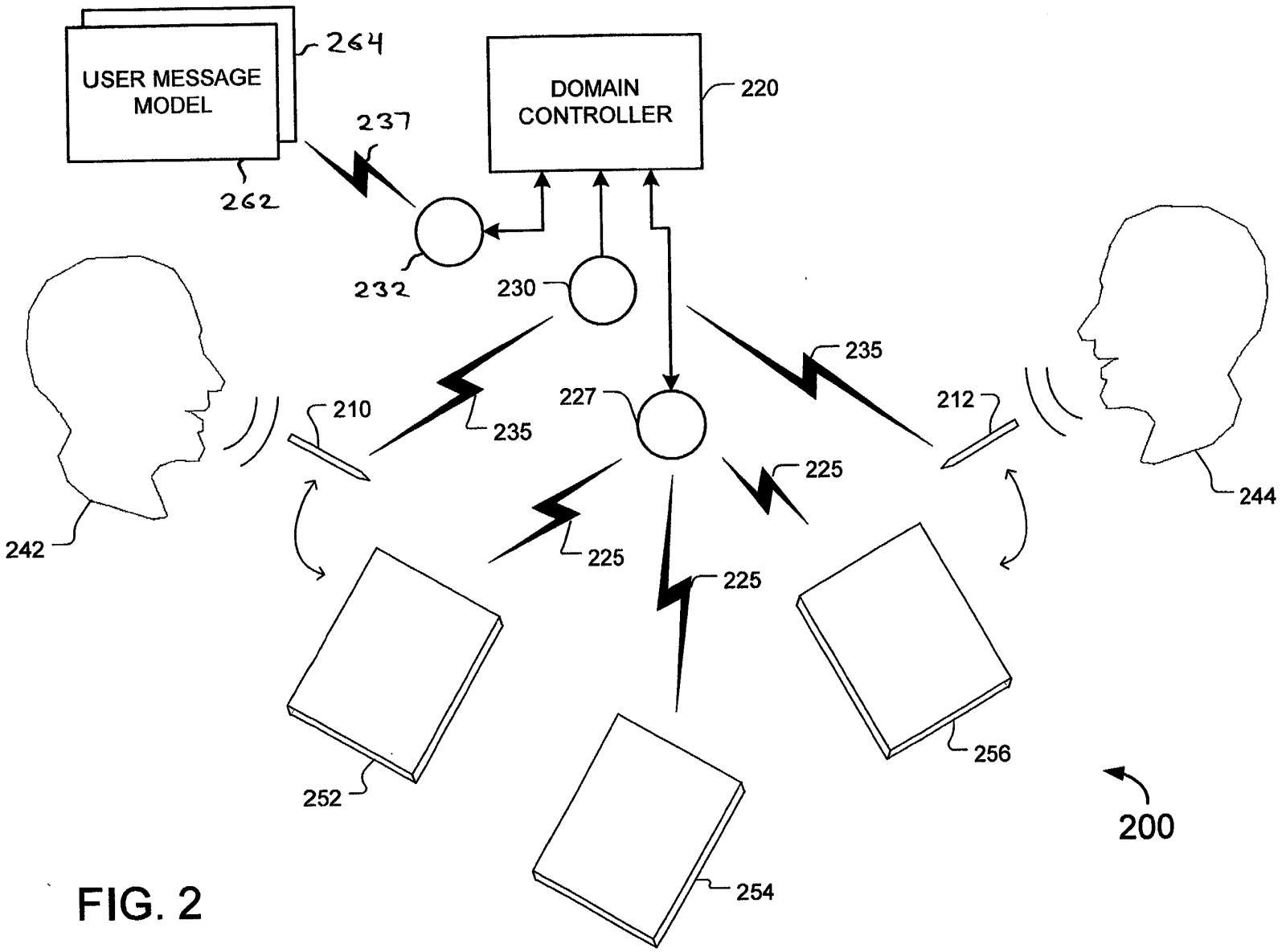
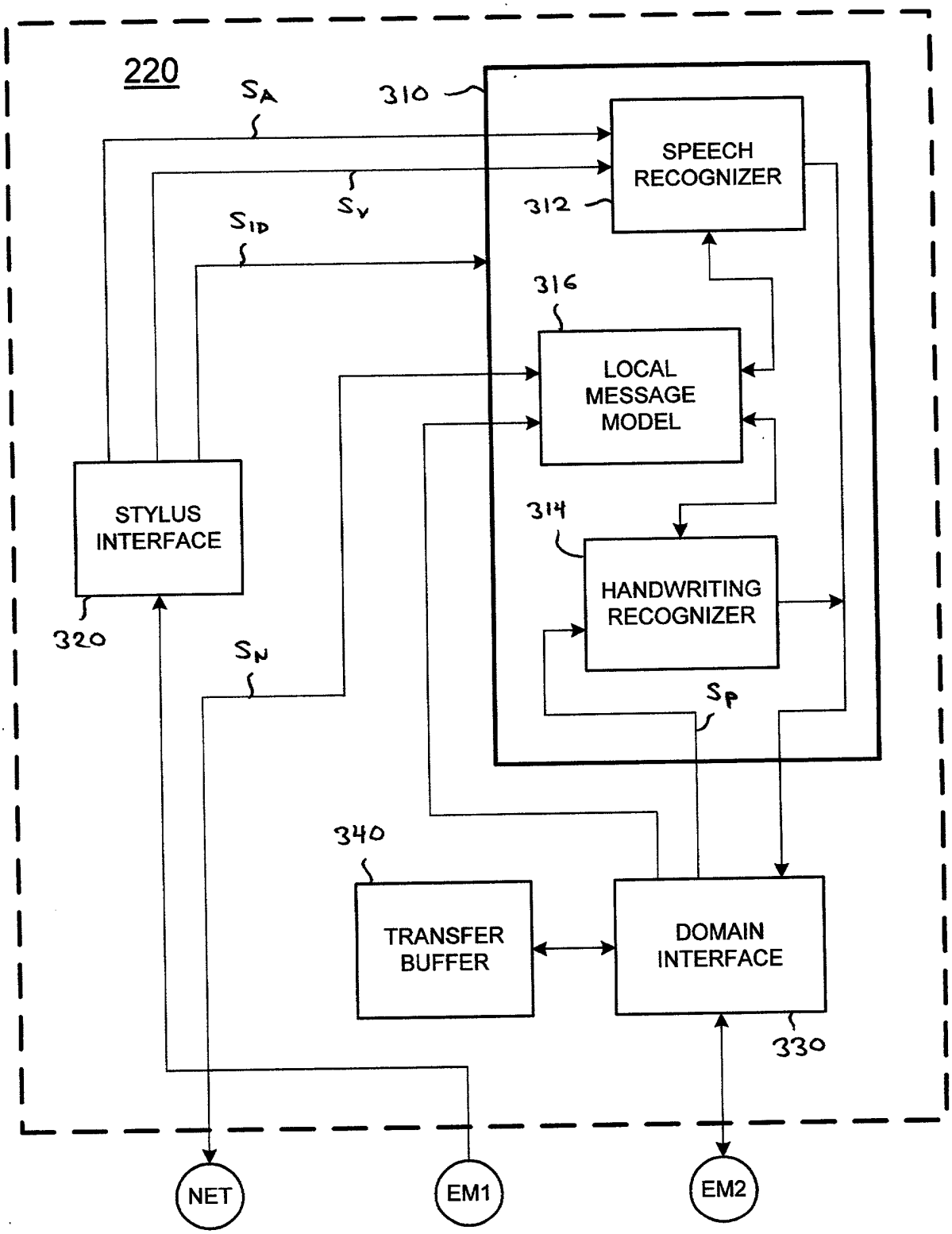

USER MESSAGE MODEL
264
262
237
DOMAIN CONTROLLER
220
232
230
235
210
235
227
212
225
225
225
242
244
252
254
256
200

FIG. 2

FIG. 3A



Docket No. 2002P04052US

Case 2:20-cv-00052-JRG Document 1-6 Filed 02/04/20 Page 292 of 424 PageID #: 350

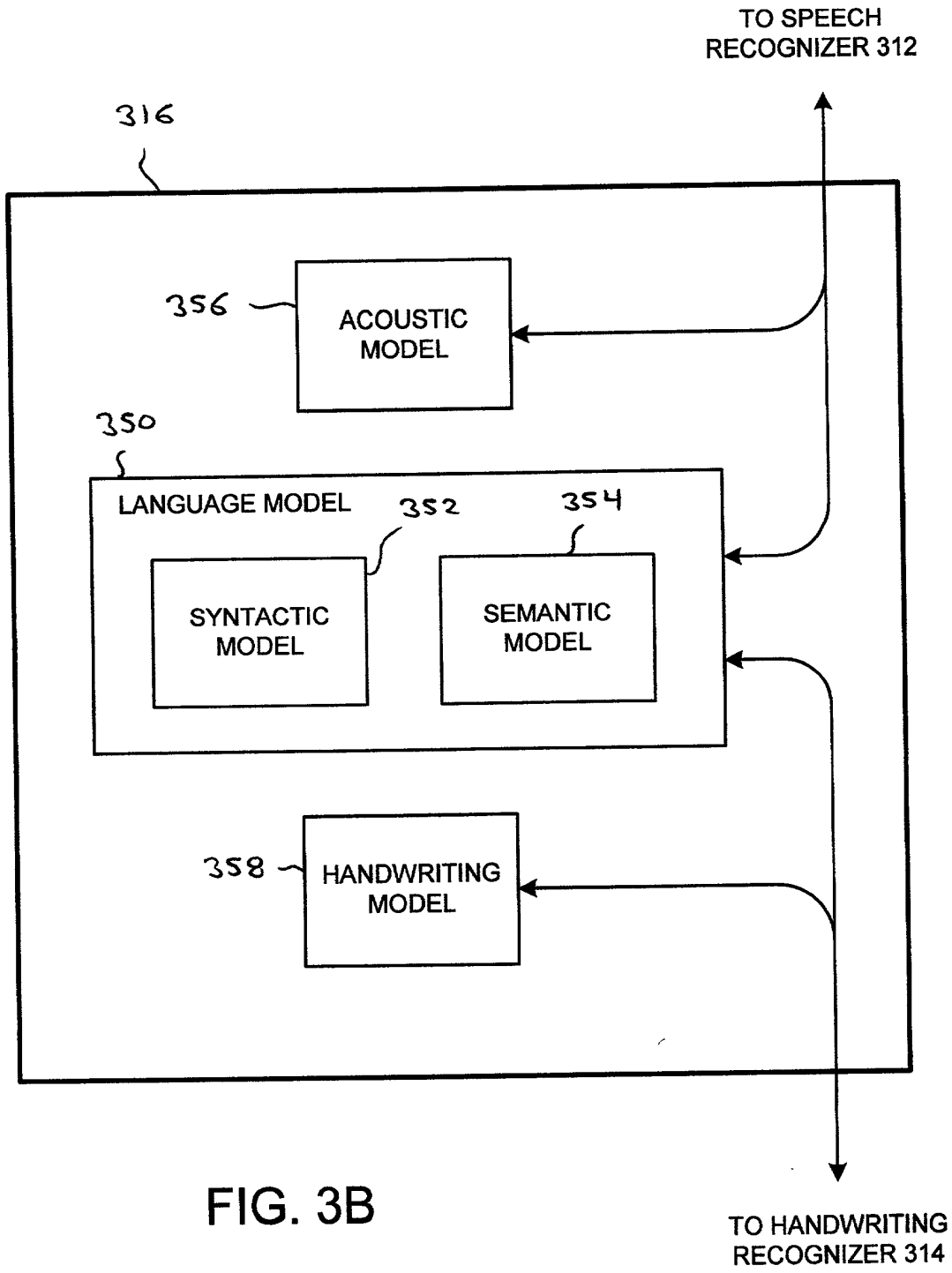


FIG. 3B

20020170 "2507S001"

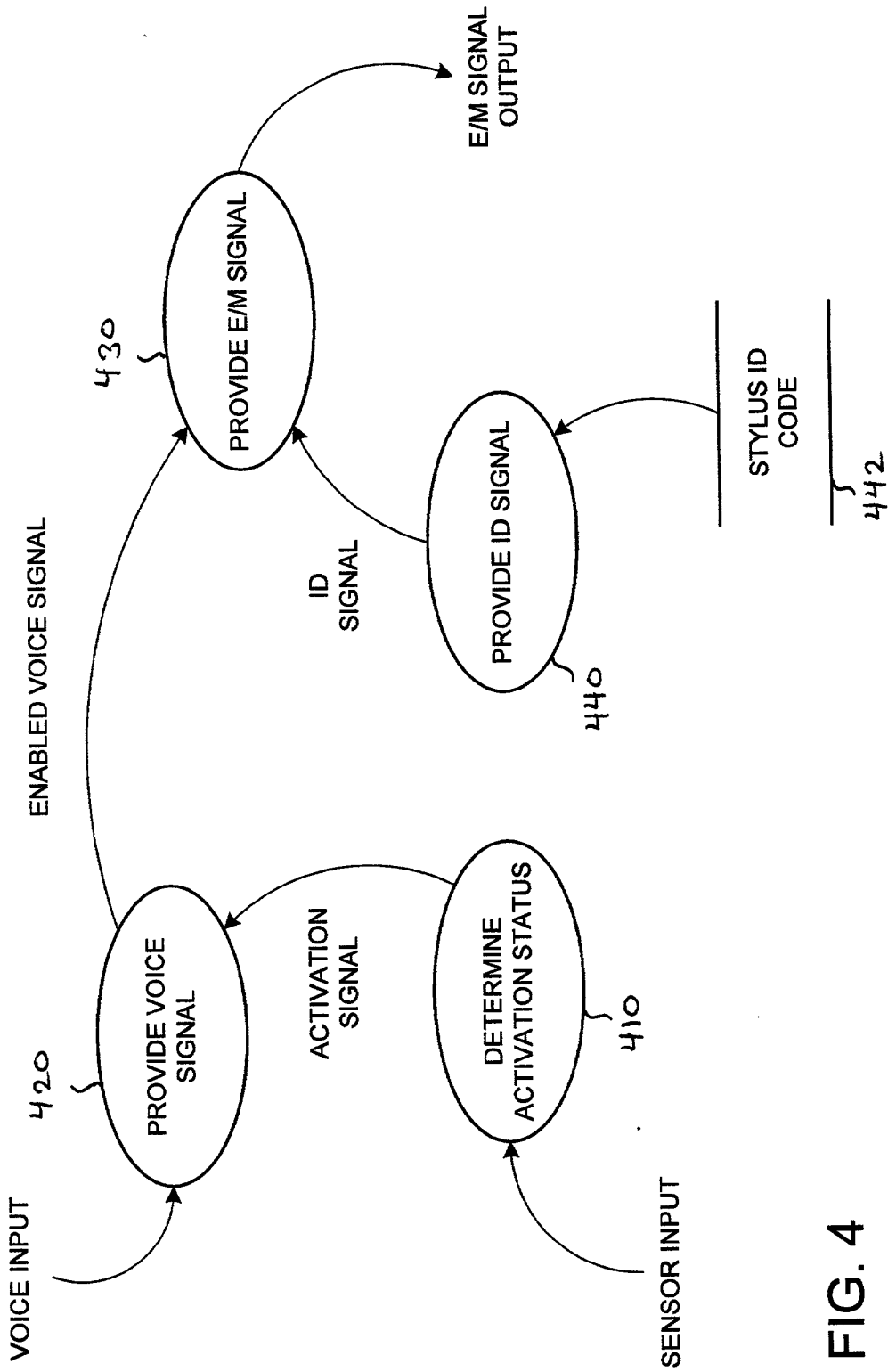


FIG. 4

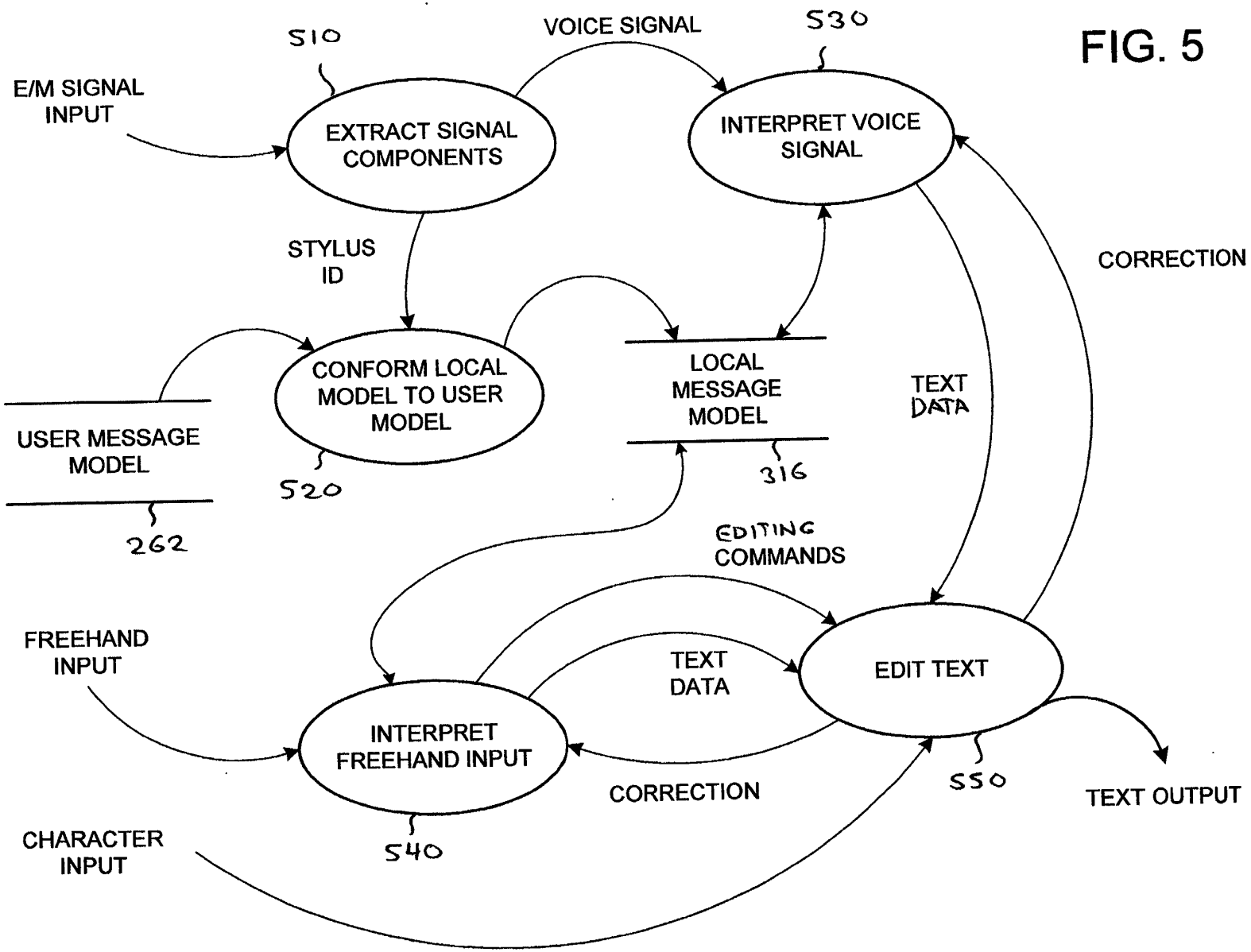

510
VOICE SIGNAL
530
E/M SIGNAL INPUT
EXTRACT SIGNAL COMPONENTS
INTERPRET VOICE SIGNAL
STYLUS ID
CORRECTION
CONFORM LOCAL MODEL TO USER MODEL
LOCAL MESSAGE MODEL
TEXT DATA
USER MESSAGE MODEL
520
316
262
EDITING COMMANDS
FREEHAND INPUT
TEXT DATA
EDIT TEXT
INTERPRET FREEHAND INPUT
CORRECTION
550
TEXT OUTPUT
CHARACTER INPUT
540

FIG. 5

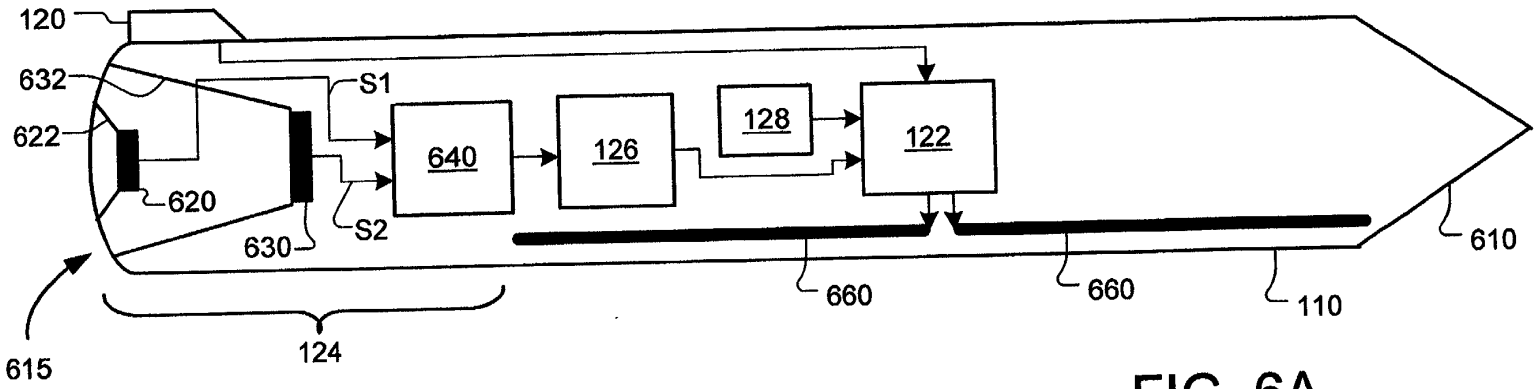

120
632
622
620
630
S1
S2
640
126
128
122
610
660
660
110
615
124

FIG. 6A

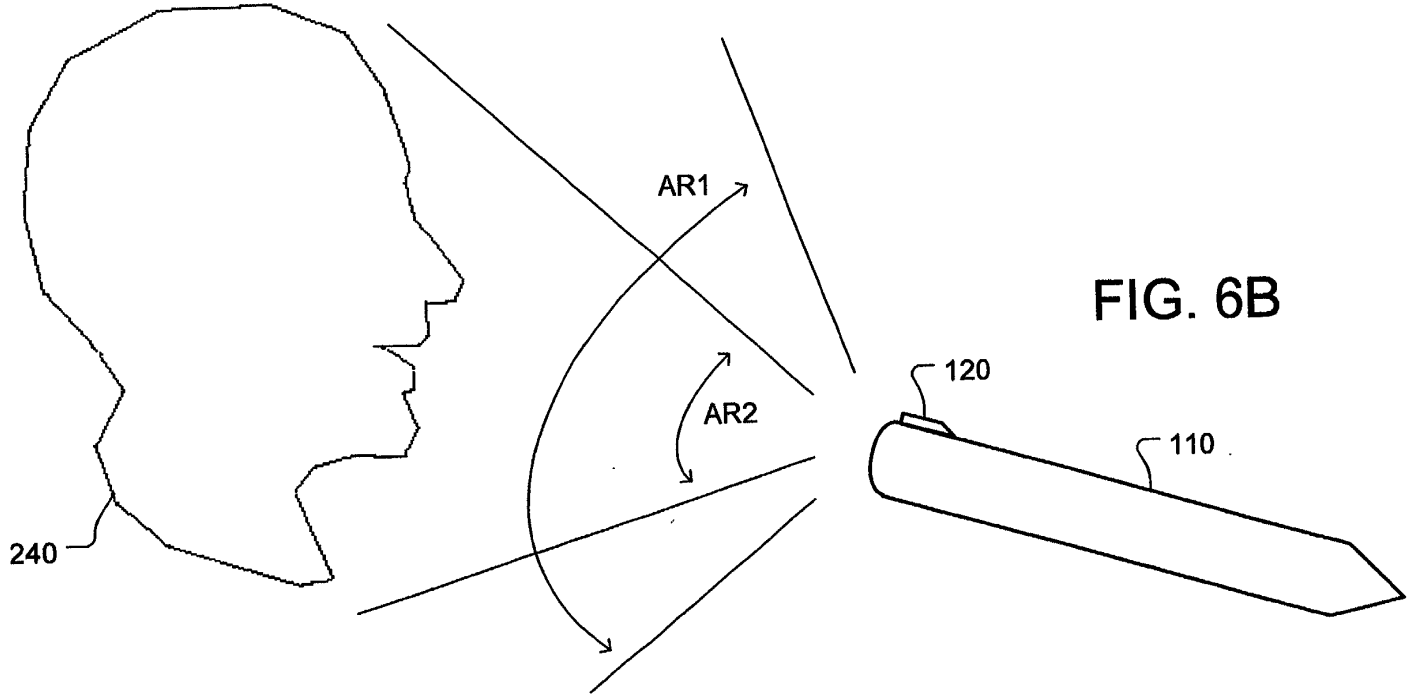

AR1
AR2
240
120
110

FIG. 6B

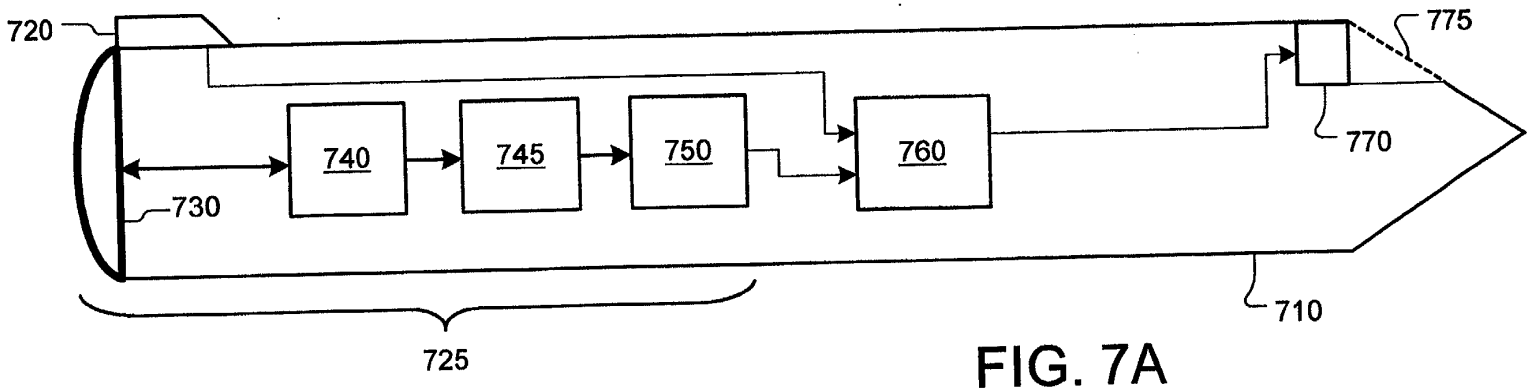


FIG. 7A

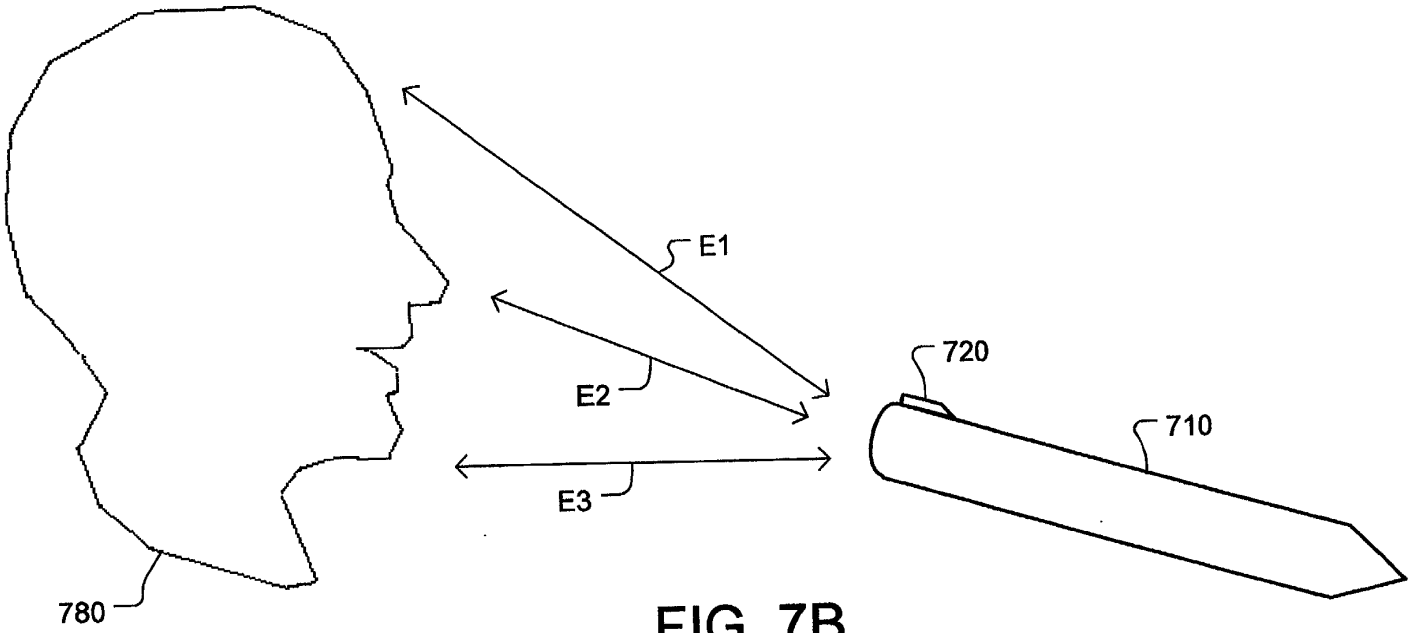


FIG. 7B

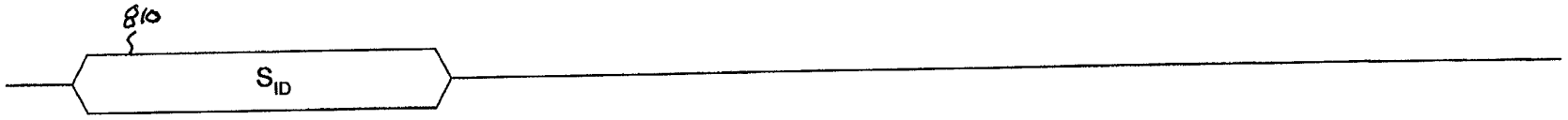


FIG. 8A

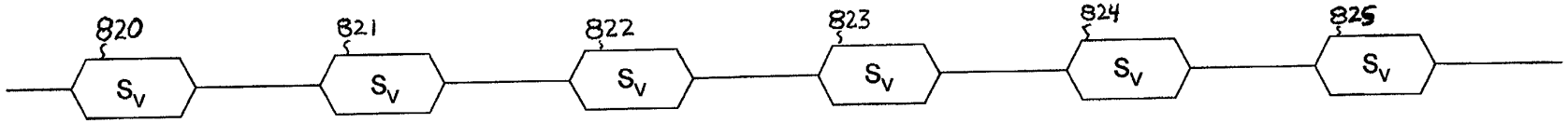


FIG. 8B

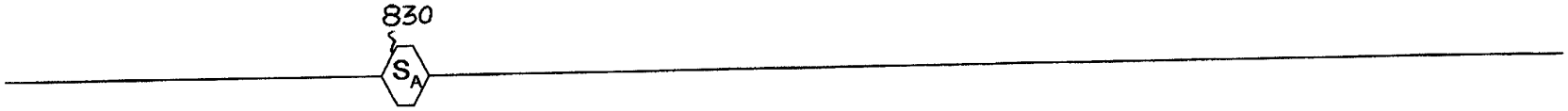


FIG. 8C

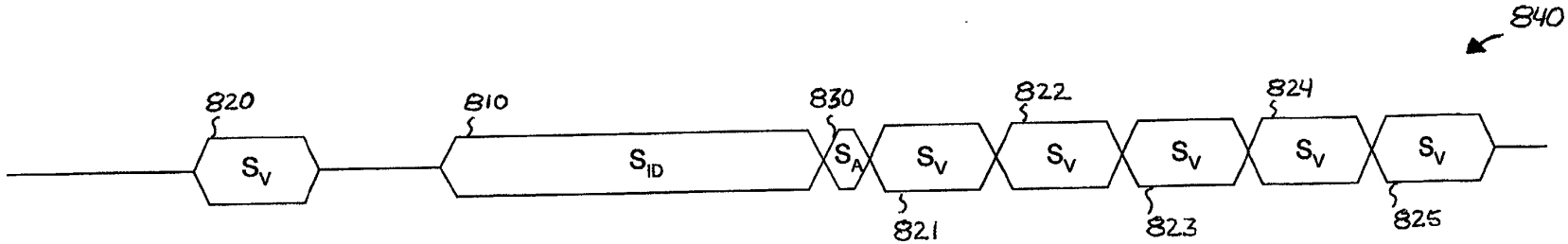
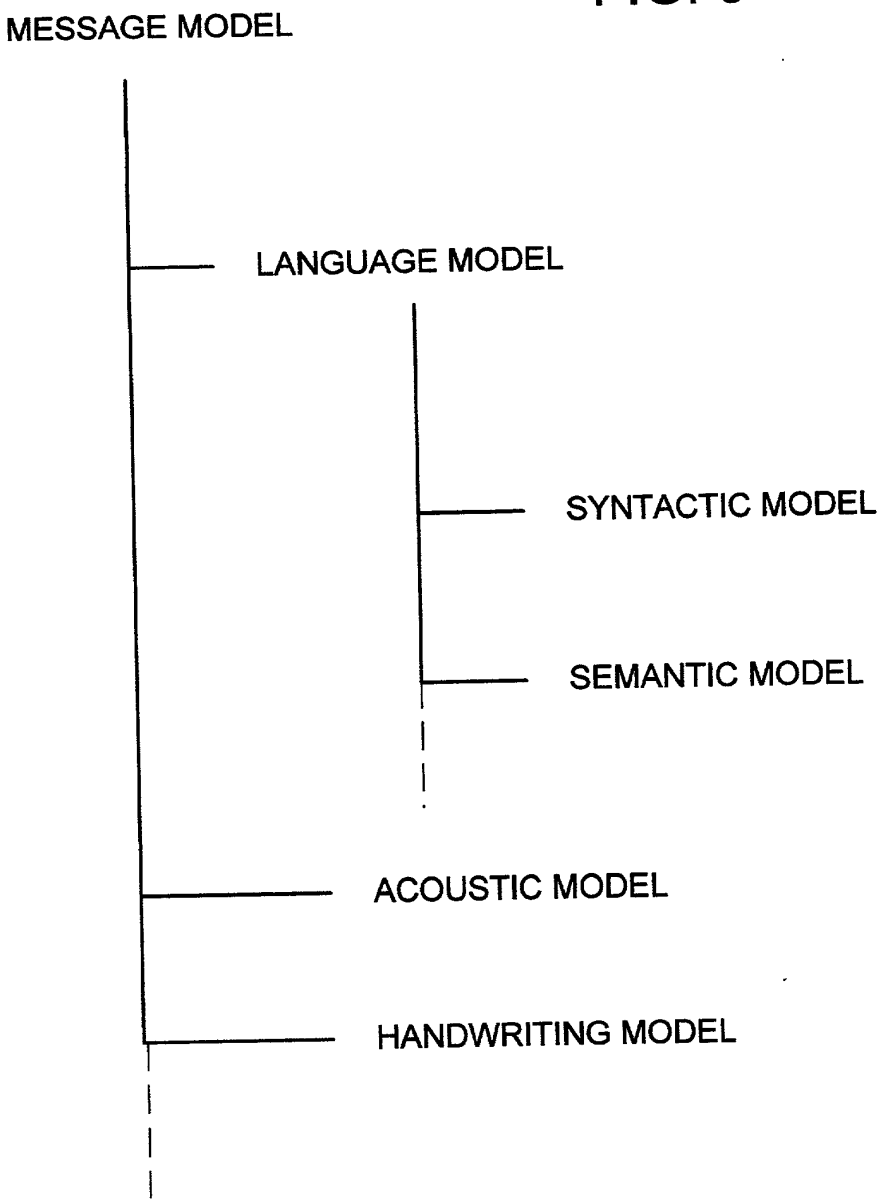


FIG. 8D

FIG. 9



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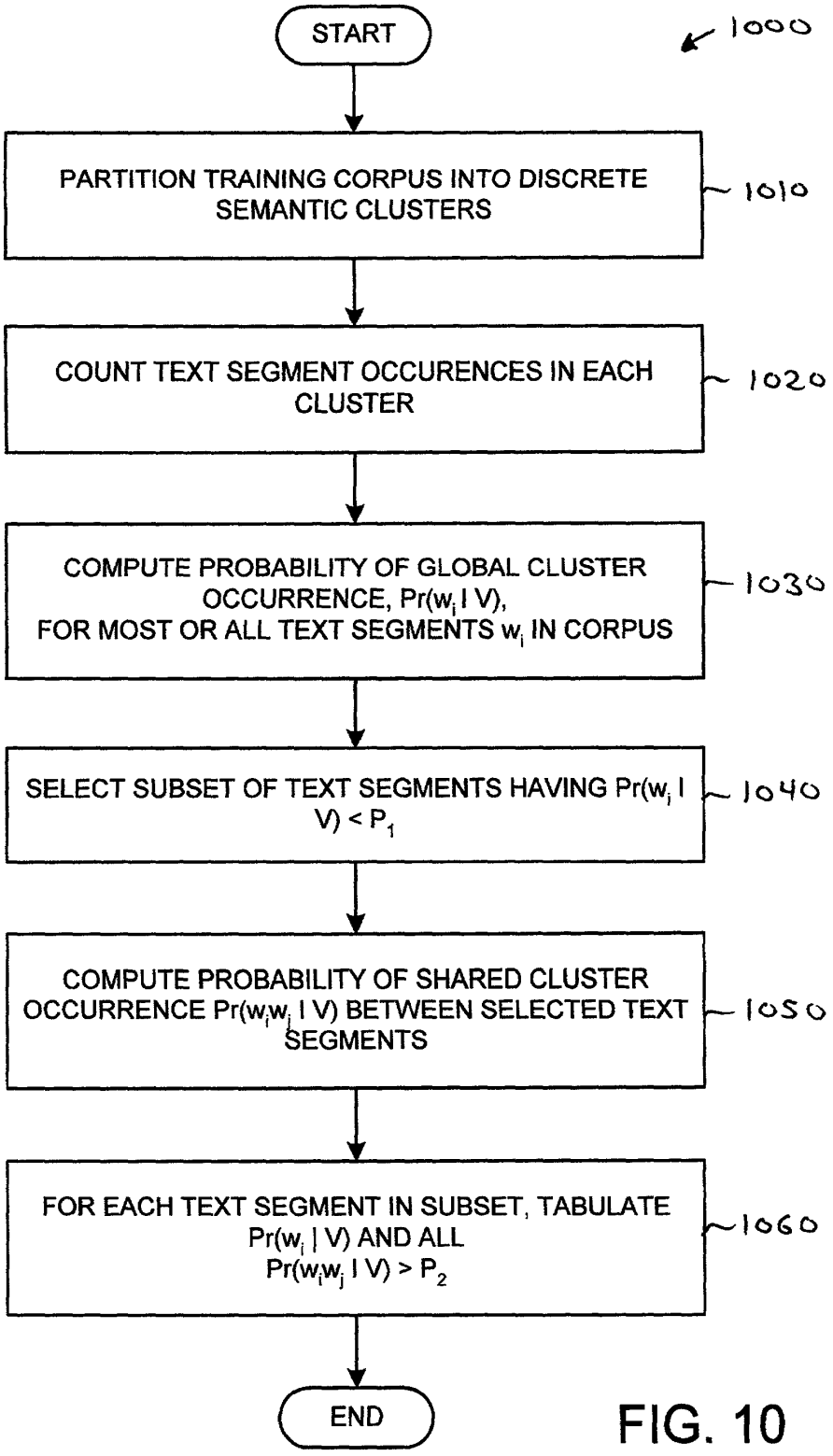

START
1000
PARTITION TRAINING CORPUS INTO DISCRETE SEMANTIC CLUSTERS
1010
COUNT TEXT SEGMENT OCCURENCES IN EACH CLUSTER
1020
COMPUTE PROBABILITY OF GLOBAL CLUSTER OCCURRENCE, Pr(w_i | V), FOR MOST OR ALL TEXT SEGMENTS w_i IN CORPUS
1030
SELECT SUBSET OF TEXT SEGMENTS HAVING Pr(w_i | V) < P_1
1040
COMPUTE PROBABILITY OF SHARED CLUSTER OCCURRENCE Pr(w_i w_j | V) BETWEEN SELECTED TEXT SEGMENTS
1050
FOR EACH TEXT SEGMENT IN SUBSET, TABULATE Pr(w_i | V) AND ALL Pr(w_i w_j | V) > P_2
1060
END

FIG. 10

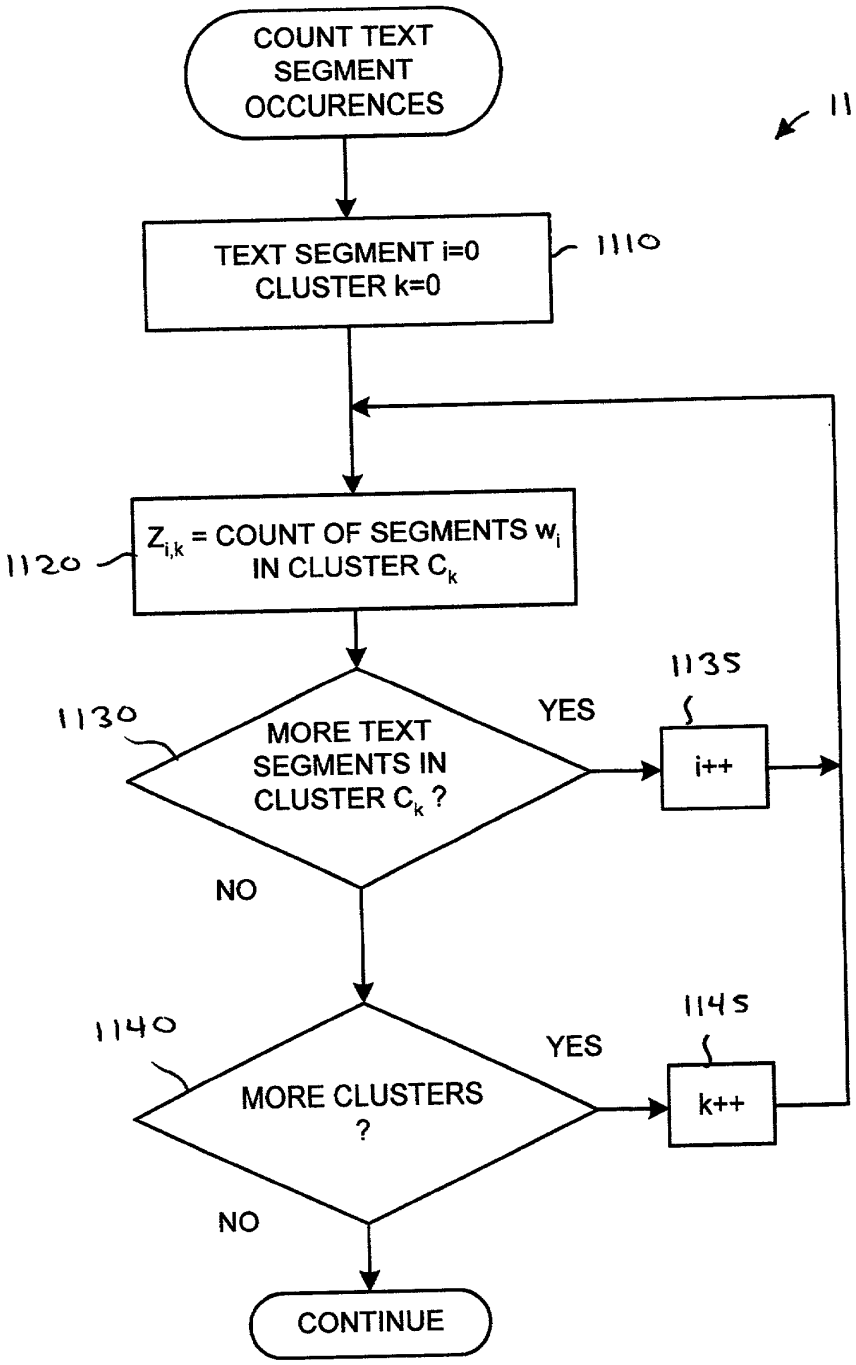


FIG. 11

Case 4:05-cv-00252-JMM Document 1-2 Filed 04/29/2005

W_0 HEADER - "UNCLE", RECORDS = ...
PR(W_0 | V) = ...
W_{0A} - AUNT - PR(W_0W_{0A} | V) = ...
W_{0B} - NEPHEW - PR(W_0W_{0B} | V) = ...
W_{0C} - RELATIVE - PR(W_0W_{0C} | V) = ...
W_{0D} - BROTHER - PR(W_0W_{0D} | V) = ...
. . .
W_1 HEADER - "COORS", RECORDS = ...
PR(W_1 | V) = ...
W_{1A} - BAR - PR(W_1W_{1A} | V) = ...
W_{1B} - BEER - PR(W_1W_{1B} | V) = ...
W_{1C} - CAN - PR(W_1W_{1C} | V) = ...
W_{1D} - BREWING - PR(W_1W_{1D} | V) = ...
. . .
W_2 HEADER - "BEACH", RECORDS = ...
PR(W_2 | V) = ...
W_{2A} - WATER - PR(W_2W_{2A} | V) = ...
W_{2B} - SAND - PR(W_2W_{2B} | V) = ...
W_{2C} - OCEAN - PR(W_2W_{2C} | V) = ...
W_{2D} - PACIFIC - PR(W_2W_{2D} | V) = ...

FIG. 12

1200

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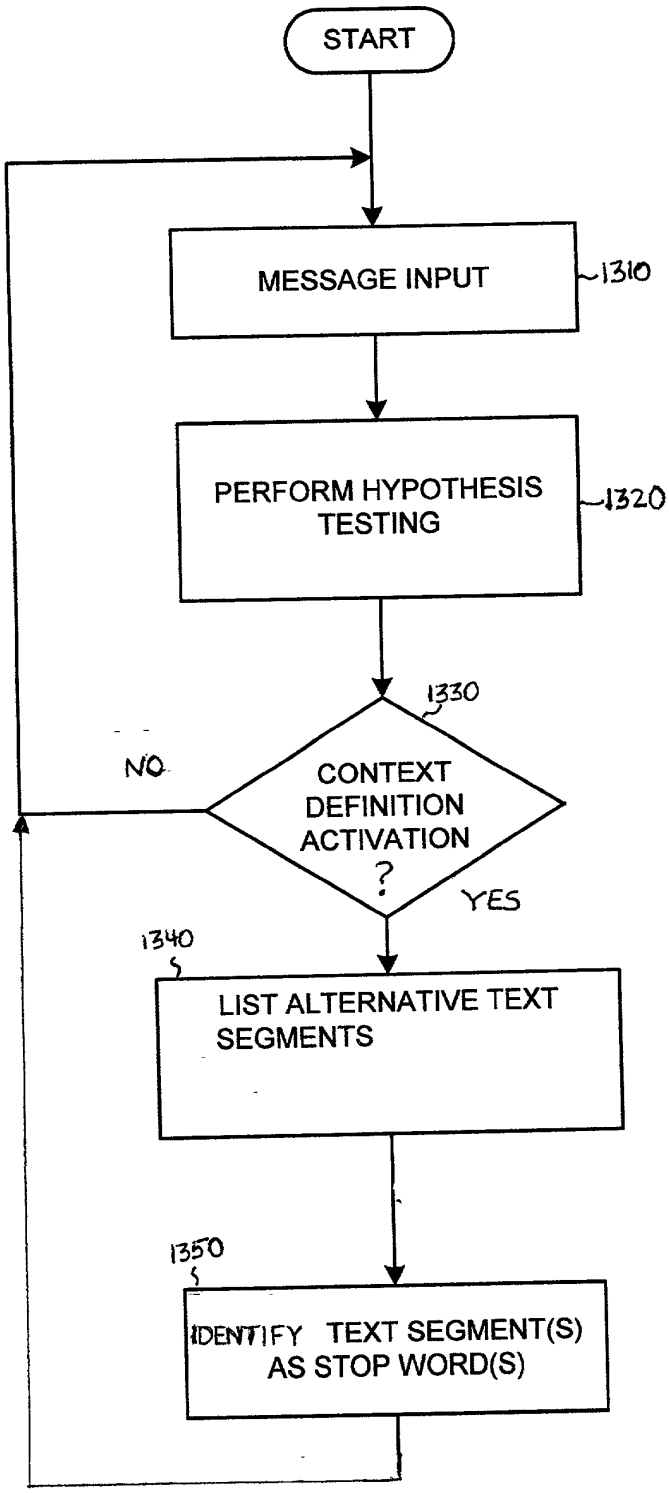


FIG. 13

1300

Case 1:05-cv-00643-SLR Document 1-2 Filed 09/30/2005

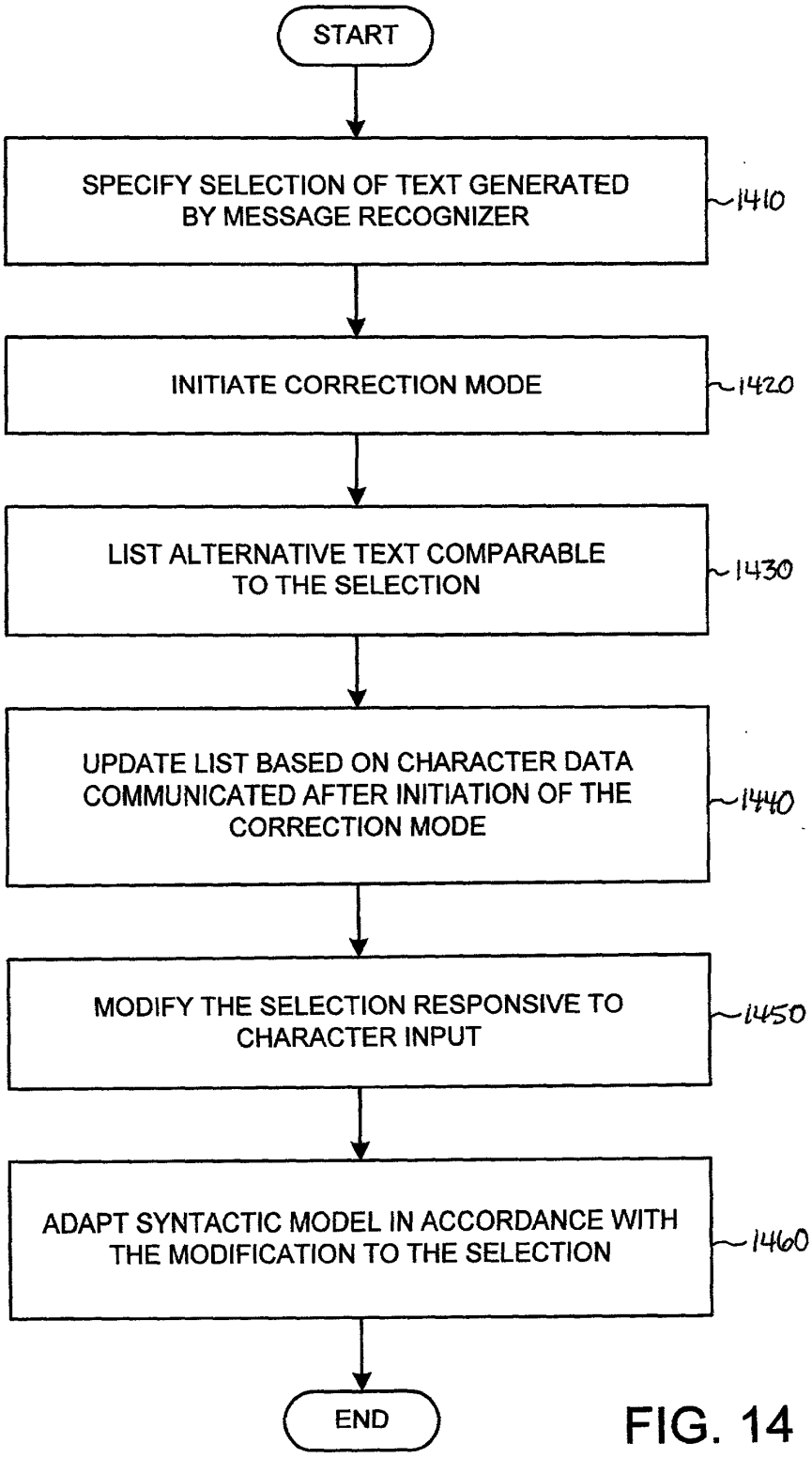


FIG. 14

Google Exhibit 1009

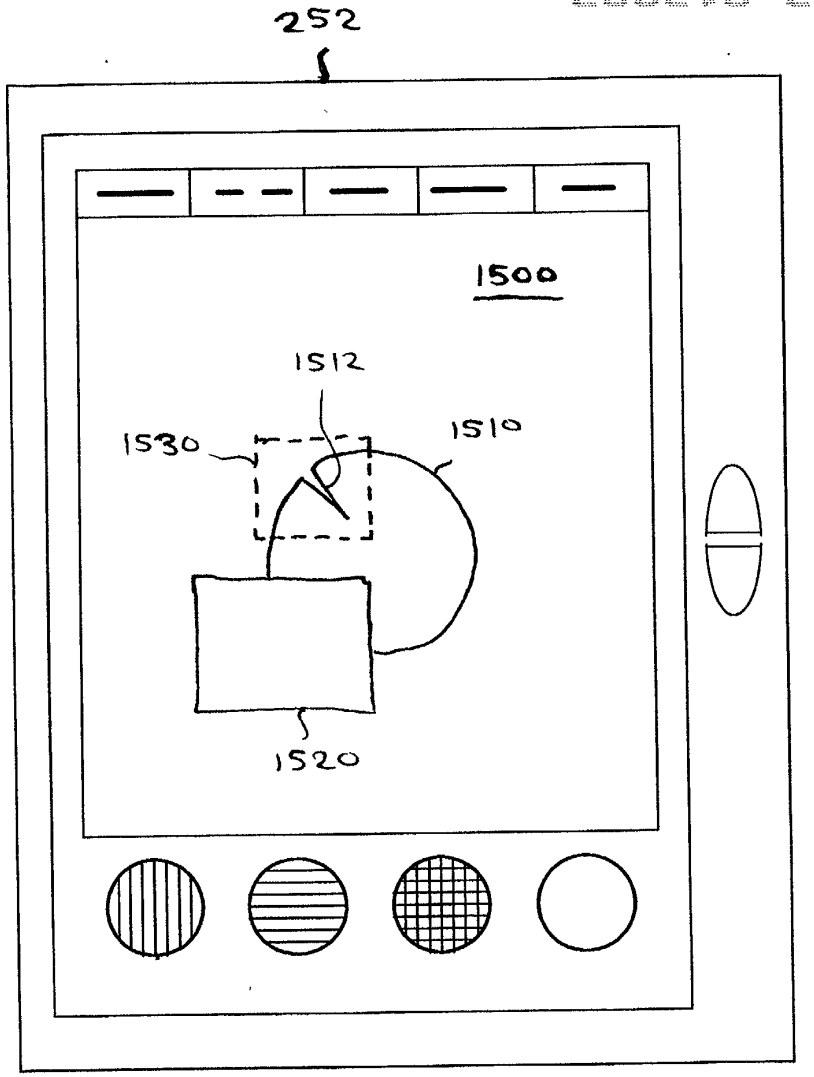


FIG. 15A

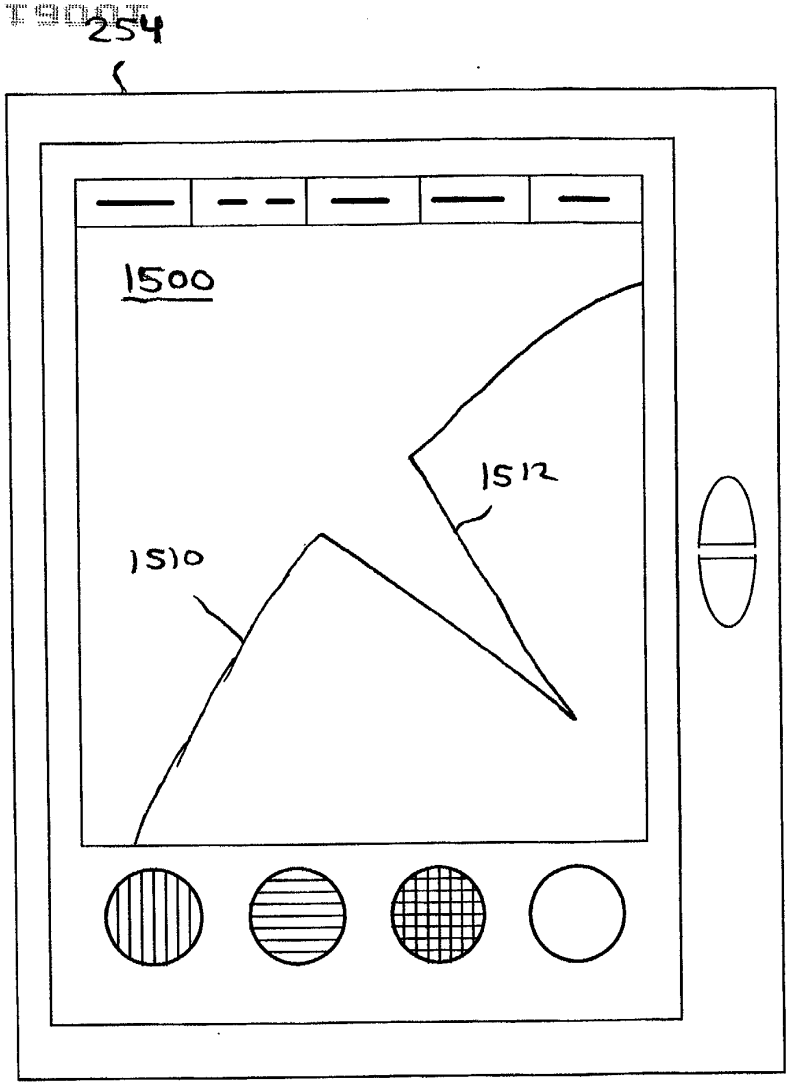


FIG. 15B

PTO/SB/01 (10-01)
Approved for use through 10/31/2002. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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DECLARATION FOR UTILITY OR DESIGN PATENT APPLICATION (37 CFR 1.63)

☑ Declaration Submitted with Initial Filing **OR** ☐ Declaration Submitted after Initial Filing (surcharge (37 CFR 1.16 (e)) required)

Attorney Docket Number	
First Named Inventor	Edwin A. Suominen
COMPLETE IF KNOWN	
Application Number	
Filing Date	01/28/2002
Art Unit	2641*
Examiner Name	Nolan, D.* **in parent app.*

As the below named inventor, I hereby declare that:

My residence, mailing address, and citizenship are as stated below next to my name.

I believe I am the original and first inventor of the subject matter which is claimed and for which a patent is sought on the invention entitled:

Text Processing System

No power of attorney granted in this application, which is a Continuation of U.S. Application No. 09/616,157 filed July 14, 2000.

(Title of the Invention)

the specification of which

☑ is attached hereto

OR

☐ was filed on (MM/DD/YYYY) ☐ as United States Application Number or PCT International Application Number ☐ and was amended on (MM/DD/YYYY) ☐ (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 specifically referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR 1.56, including for continuation-in-part applications, material information which became available between the filing date of the prior application and the national or PCT international filing date of the continuation-in-part application.

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

Prior Foreign Application Number(s)	Country	Foreign Filing Date (MM/DD/YYYY)	Priority Not Claimed	Certified Copy Attached? YES	NO
			☐	☐	☐
			☐	☐	☐
			☐	☐	☐
			☐	☐	☐

☐ Additional foreign application numbers are listed on a supplemental priority data sheet PTO/SB/02B attached hereto:

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DECLARATION — Utility or Design Patent Application

Direct all correspondence to: ☐ Customer Number or Bar Code Label [ ] OR ☑ Correspondence address below

Edwin A. Suominen
Name

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Address

Scottsdale	Arizona	85254
City	**State**	**ZIP**

USA	(480) 948-3295	(480) 948-3387
Country	**Telephone**	**Fax**

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 with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S.C. 1001 and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

NAME OF SOLE OR FIRST INVENTOR : ☐ A petition has been filed for this unsigned inventor

Edwin A.	Suominen
Given Name (first and middle [if any])	**Family Name or Surname**

Inventor's Signature	**Date** Jan. 28, 2002

Valley	Washington	USA	USA
Residence: City	**State**	**Country**	**Citizenship**

3355 East Jump Off Joe Road
Mailing Address

Valley	Washington	99181	USA
City	**State**	**ZIP**	**Country**

NAME OF SECOND INVENTOR: ☐ A petition has been filed for this unsigned inventor

Given Name (first and middle [if any])	**Family Name or Surname**

Inventor's Signature	**Date**

Residence: City	**State**	**Country**	**Citizenship**

Mailing Address

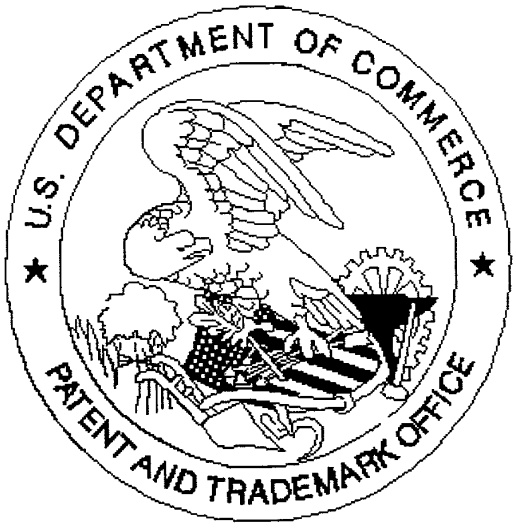
City	**State**	**ZIP**	**Country**

☐ Additional inventors are being named on the ____supplemental Additional Inventor(s) sheet(s) PTO/SB/02A attached hereto.

[Page 2 of 2]

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11017 U.S. PTO
10/061052
01/28/02

U.S. UTILITY Patent Application

PATENT NUMBER and ISSUE DATE

APPL NUM	FILING DATE	CLASS	SUBCLASS	GAU	EXAMINER
10061052	01/28/2002	704	235	2641	Nolan

2654

**APPLICANTS: Suominen Edwin;

**CONTINUING DATA VERIFIED:
THIS APPLICATION IS A CON OF 09/616,157 07/14/2000 ABN
WHICH CLAIMS BENEFIT OF 60/144,481 07/17/1999

** FOREIGN APPLICATIONS VERIFIED:

PG-PUB	DO NOT PUBLISH ☐	RESCIND ☐	
Foreign priority claimed	☐ yes ☐ no		ATTORNEY DOCKET NO
35 USC 119 conditions met	☐ yes ☐ no		
Verified and Acknowledged Examiners's intials			

TITLE : Text processing system

U.S.DEP'T. OF COMM./PAT.& TM-PTO-436L(Rev. 12-94)

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NOTICE OF ALLOWANCE MAILED		Assistant Examiner	CLAIMS ALLOWED	
			Total Claims	Print Claim for O.G
ISSUE FEE			DRAWING	
Amount Due	Date Paid		Sheets Drwg.	Figs.Drwg. / Print Fig.
☐ TERMINAL DISCLAIMER		Primary Examiner		
		PREPARED FOR ISSUE	Application Examiner	

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SEARCH

Class	Sub.	Date	Exmr.
704	231 257 235 270 259 260	31MAY04	DAN

SEARCH NOTES

(List databases searched. Attach search strategy inside.)

	Date	Exmr.
STIC POST SCAN SEARCH	14MAY04	DAN
EAST FULL TEXT SEARCH	31MAY04	DAN
NPL TEXT SEARCH	↓	↓

INTERFERENCE SEARCHED

Class	Sub.	Date	Exmr.

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ORIGINAL		CROSS REFERENCE(S)	
CLASS	SUBCLASS	CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)
INTERNATIONAL CLASSIFICATION			
	/		
	/		
	/		
	/		
	/		^ Continued on Issue Slip Inside File Jacket

INDEX OF CLAIMS

✓ ..... Rejected – (Through numeral) ... Canceled N ..... Non-elected A ..... Appeal
= ..... Allowed + ... Restricted I ..... Interference O ..... Objected

Claim Final	Claim Original	Date	Claim Final	Claim Original	Date	Claim Final	Claim Original	Date
	1			51			101	
	2			52			102	
	3			53			103	
	4			54			104	
	5			55			105	
	6			56			106	
	7			57			107	
	8			58			108	
	9			59			109	
	10			60			110	
	11			61			111	
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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

09/061052 01/28/02 U.S. PTO 11017

Applicant	:	Edwin A. Suominen	Art Unit:	:	2641*
Serial No.	:	10/_____	Examiner:	:	Nolan, D.*
Filing Date	:	January 28, 2002	* *In parent application*		
Title	:	Text Processing System			

BOX PATENT APPLICATION
Assistant Commissioner for Patents
Washington, DC 20231

Express Mail Label No.: EK739151725US

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APPLICATION TRANSMITTAL UNDER 37 C.F.R. 1.53(b)

Dear Sir:

Transmitted herewith is a patent application of Edwin A. Suominen entitled "Text Processing System."

CONTINUATION APPLICATION

The present application is a continuation, filed under 37 C.F.R. 1.53(b), of Application No. 09/616,157, filed on July 14, 2000, naming Edwin A. Suominen as inventor. The present application claims the benefit of that prior, co-pending U.S. application under 35 U.S.C. §120.

A complete copy of the prior application is enclosed, except the declaration, which is replaced by a new one.

PAPERS ENCLOSED WHICH WERE FILED WITH THE PRIOR APPLICATION

- 80 pages of specification, including 23 pages of claims. (Pages 58, 72-74, and 80 include handwritten modifications made by applicant before signing of the declaration in the '157 parent application.)
- 17 formal drawing sheets.

ADDITIONAL PAPERS ENCLOSED

Enclosed also in support of this application are the following papers for the continuation application, for entry once a filing date has been granted:

- Preliminary Amendment.
- New inventor's Declaration, form PTO/SB/01, which replaces the prior application's combined Declaration and Power of Attorney because the application's original Power of Attorney has been revoked.

FEES

Small entity status is claimed. Upon entry of the enclosed preliminary amendment, this application contains 2 independent claims and 2 claims total. A Form PTO-2038 is enclosed authorizing credit card payment of $370 to cover the basic small-entity filing fee.

POWER OF ATTORNEY / AUTHORIZATION OF AGENT

This application is being prosecuted by the applicant (a registered agent) *pro se*. No power of attorney or authorization of agent is being filed.

RELATED PAPERS

Submitted concurrently in the '157 parent application are:

- Petition for Extension of Time with an accompanying Form PTO-2038 authorizing credit card payment of $460 to cover the small-entity extension fee.
- Express Abandonment of the '157 application in favor of the presently filed Continuation Application.

Please direct all correspondence to the undersigned at the address given below.

Respectfully submitted,

Dated: January 28, 2002

By: _____

Edwin A. Suominen
Reg. No. 43,174

14614 North Kierland Boulevard
Suite 300
Scottsdale, Arizona 85254
(480) 948-3295

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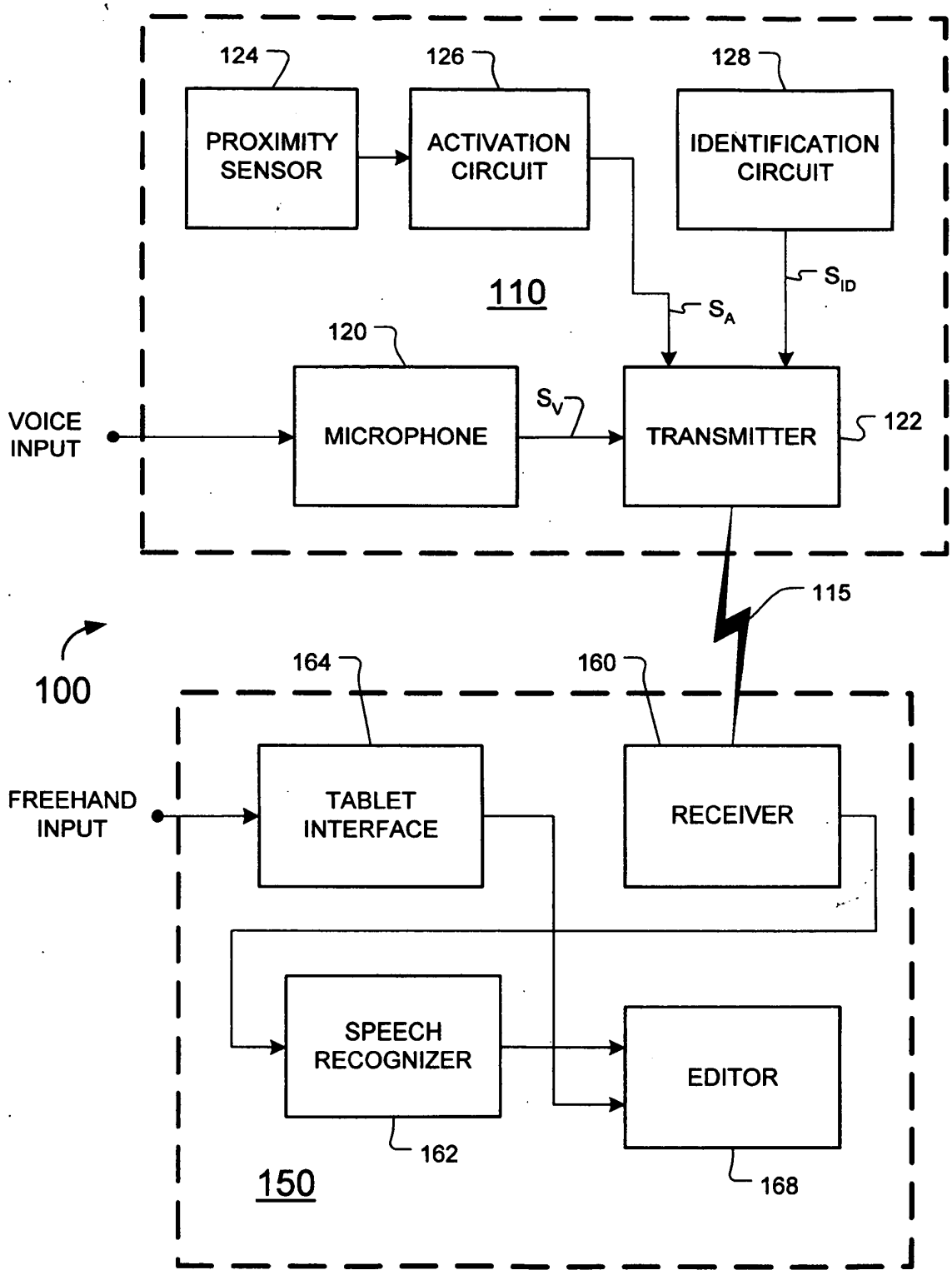


FIG. 1A

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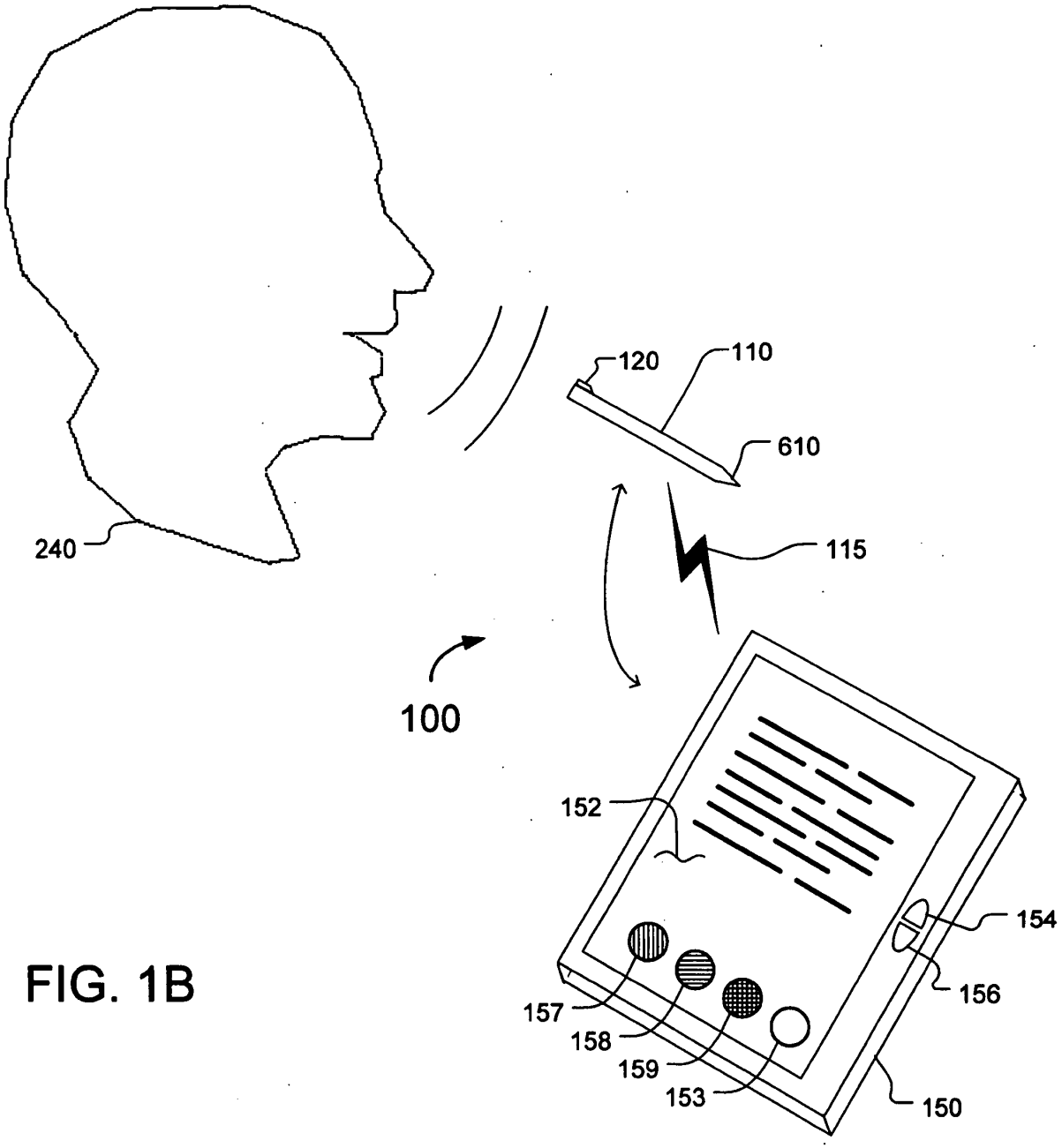


FIG. 1B

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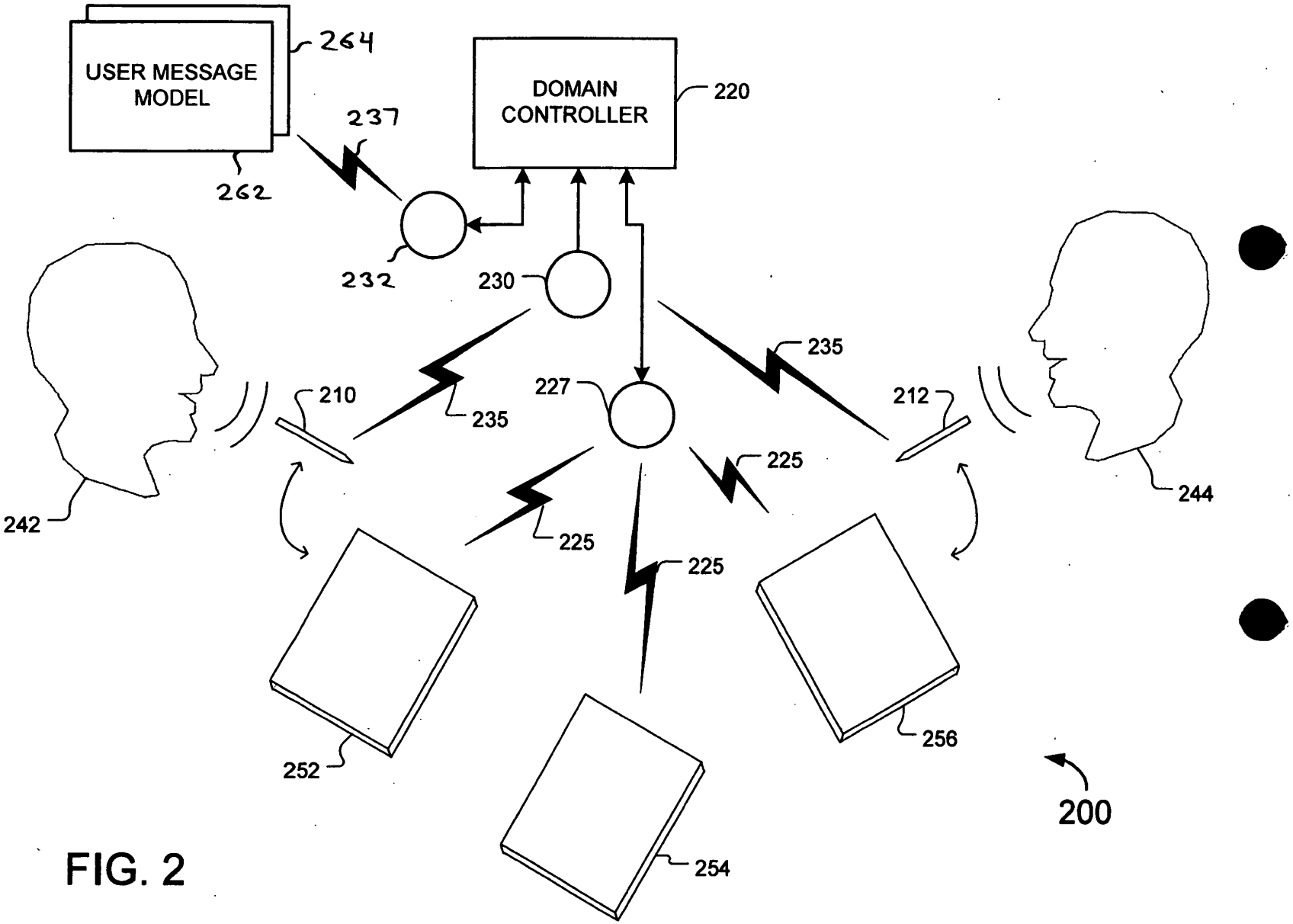
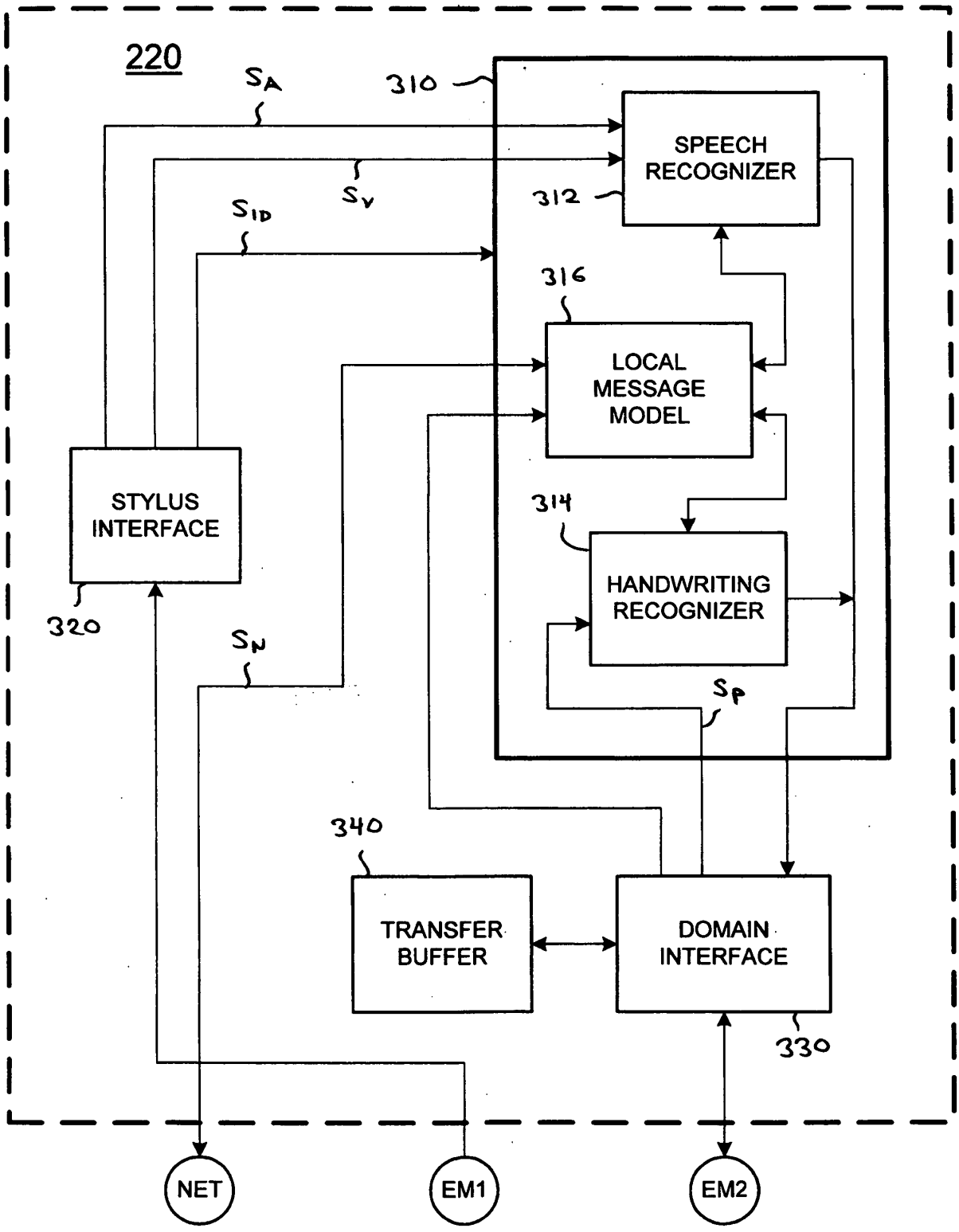


FIG. 2

FIG. 3A



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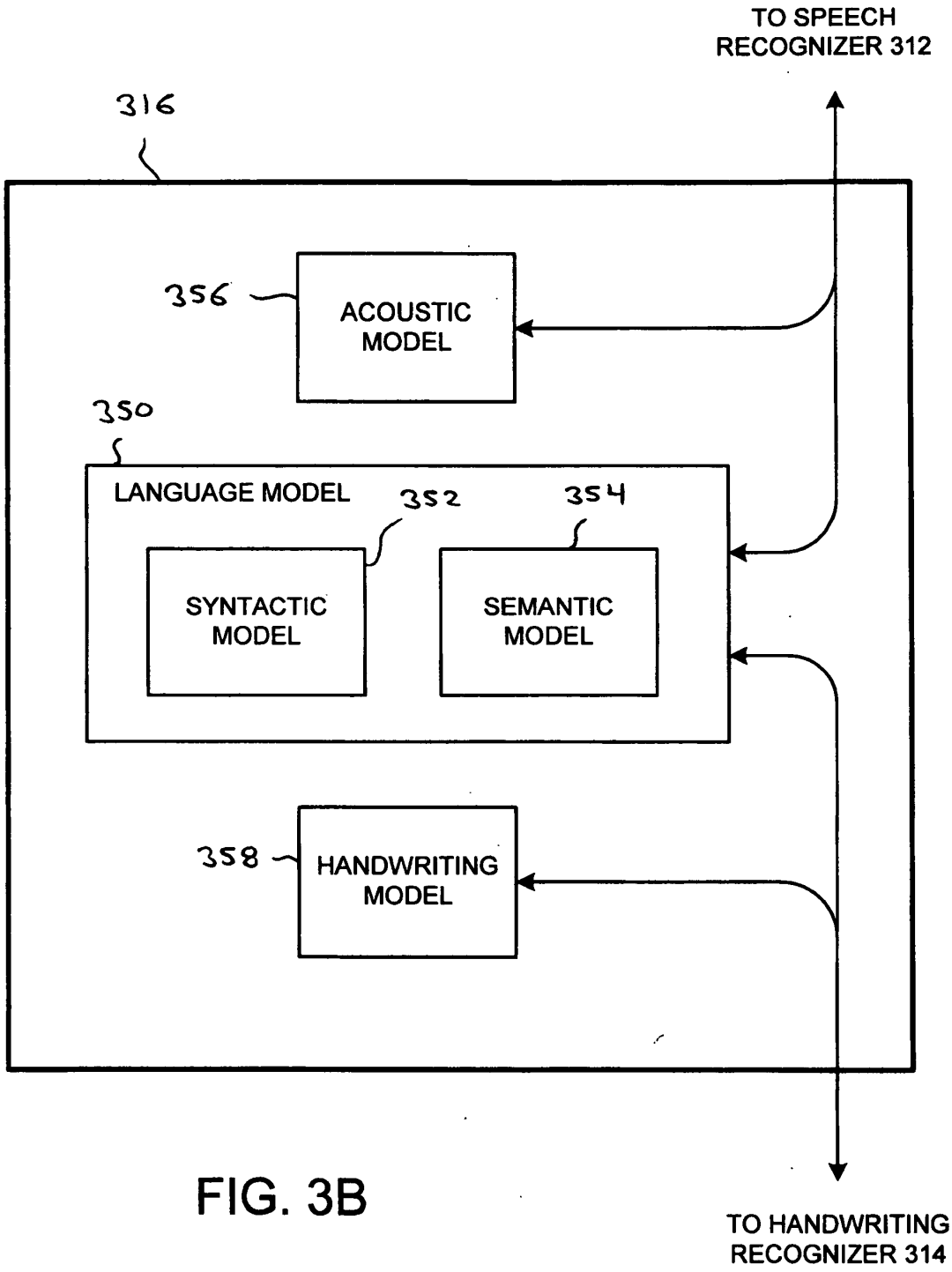


FIG. 3B

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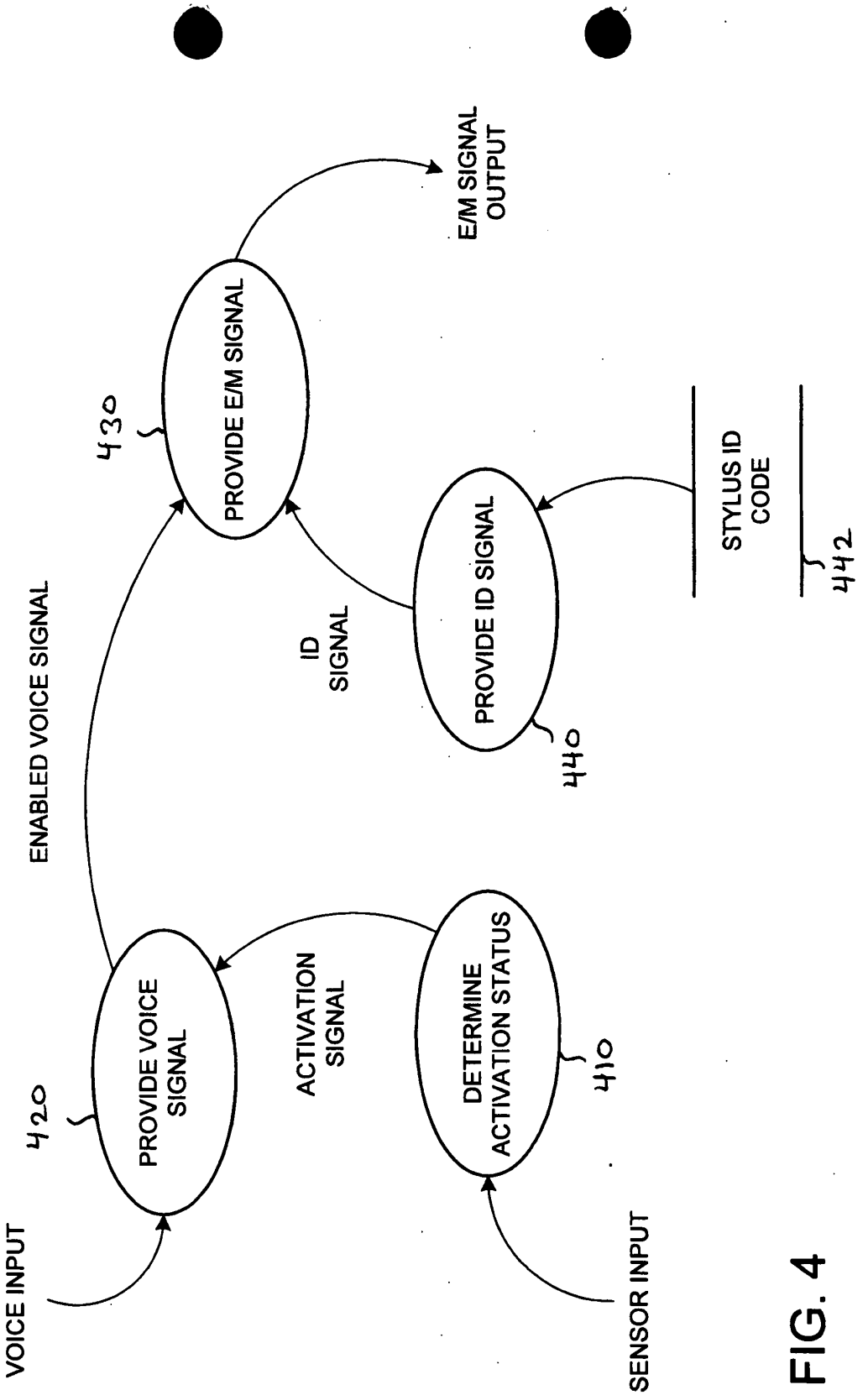
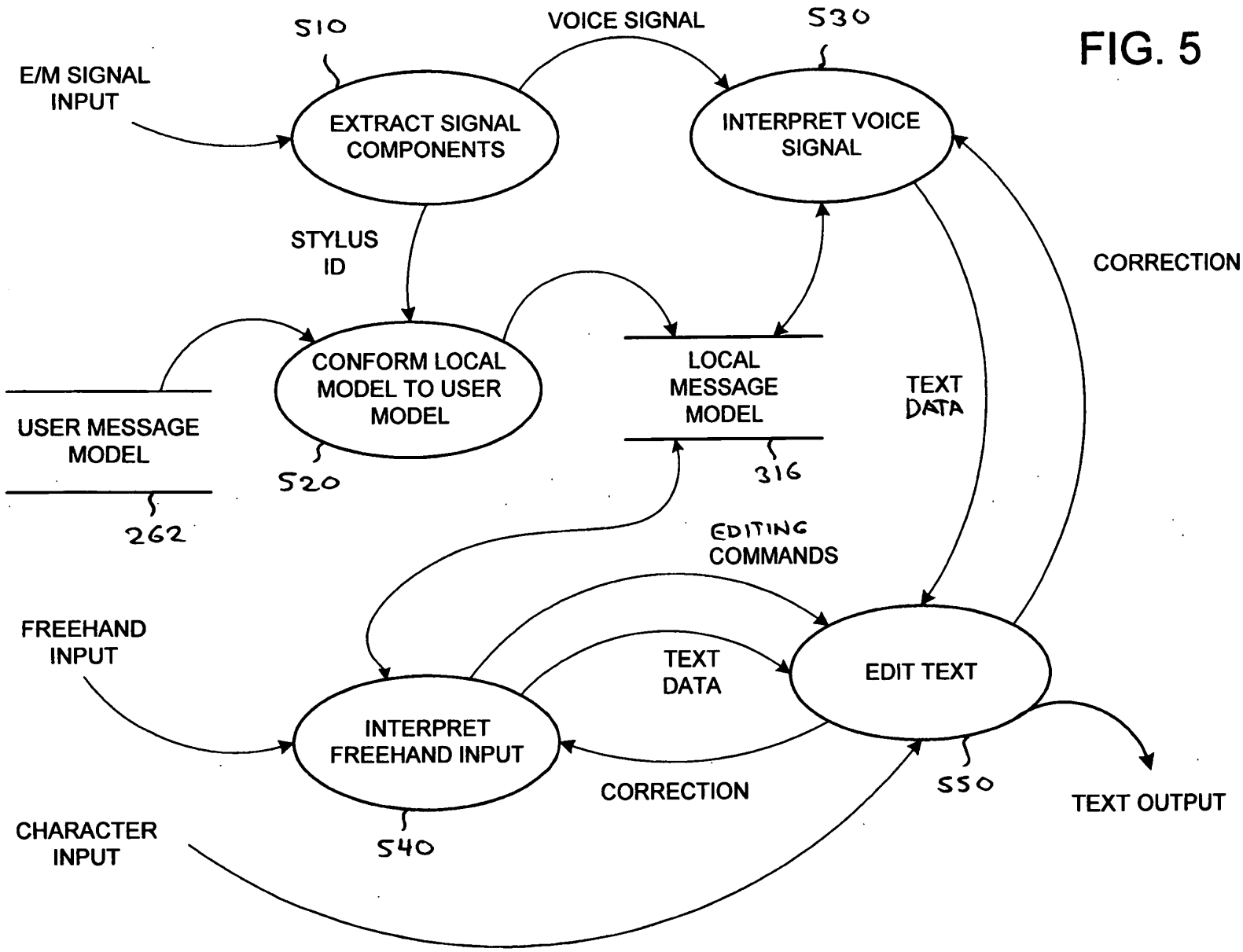


FIG. 4

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FIG. 5



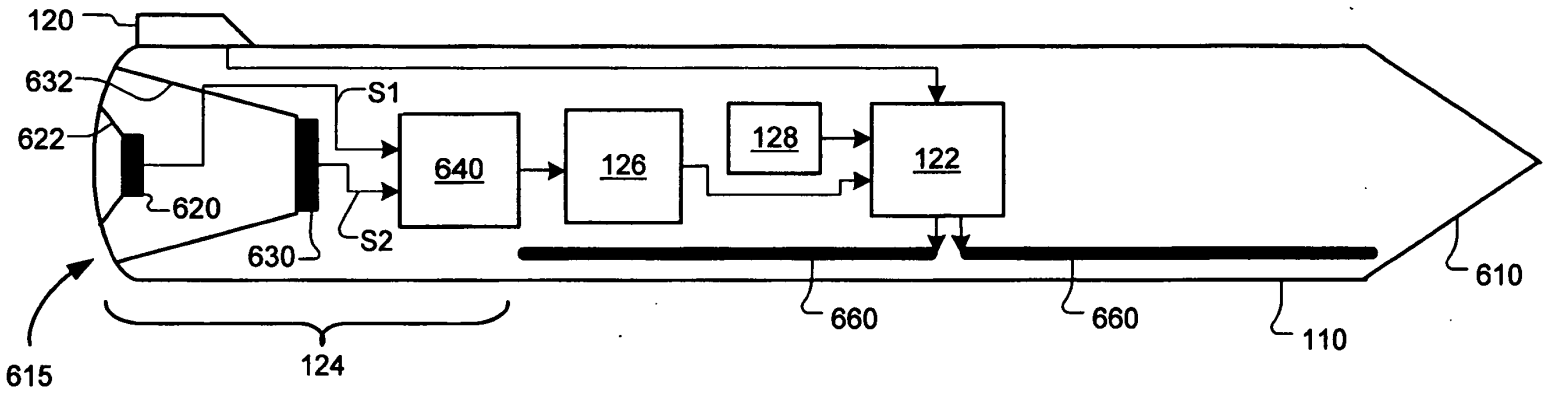

120
632
622
620
630
S1
S2
640
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128
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660
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124

FIG. 6A

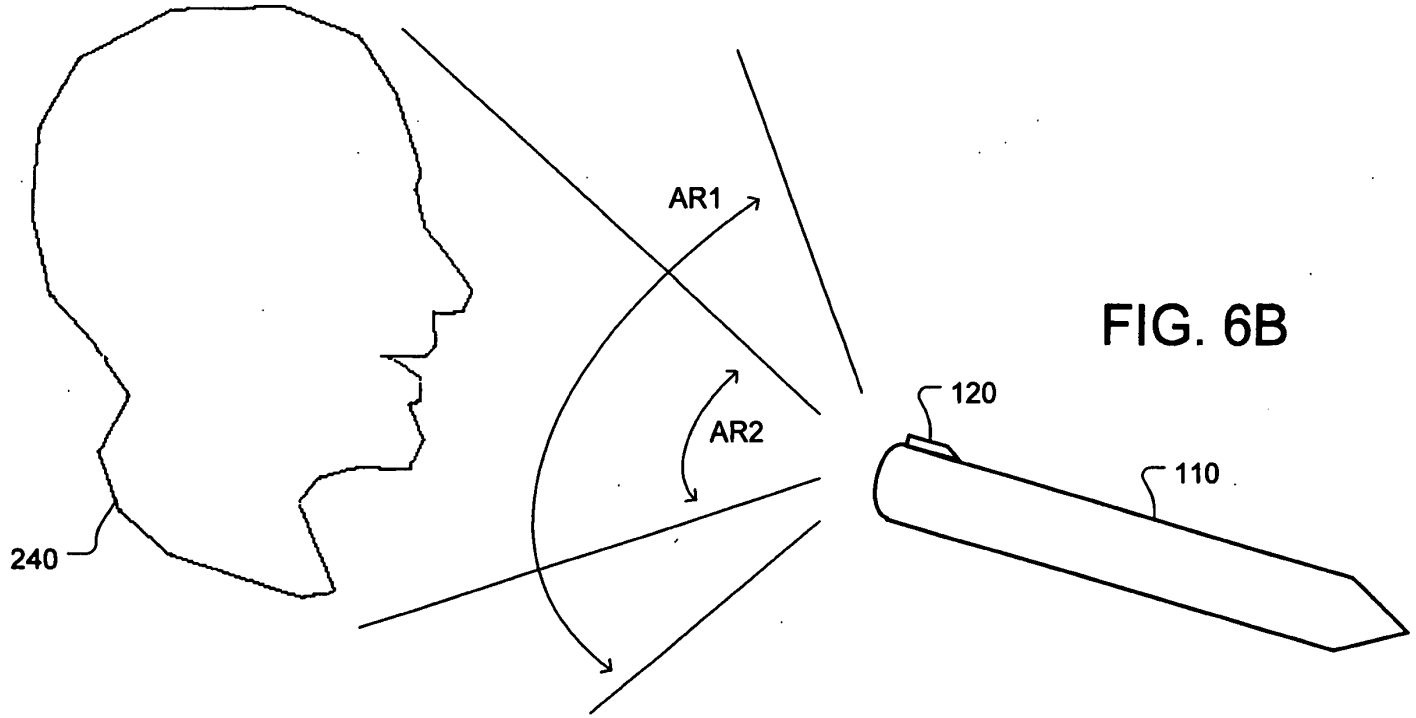

AR1
AR2
240
120
110

FIG. 6B

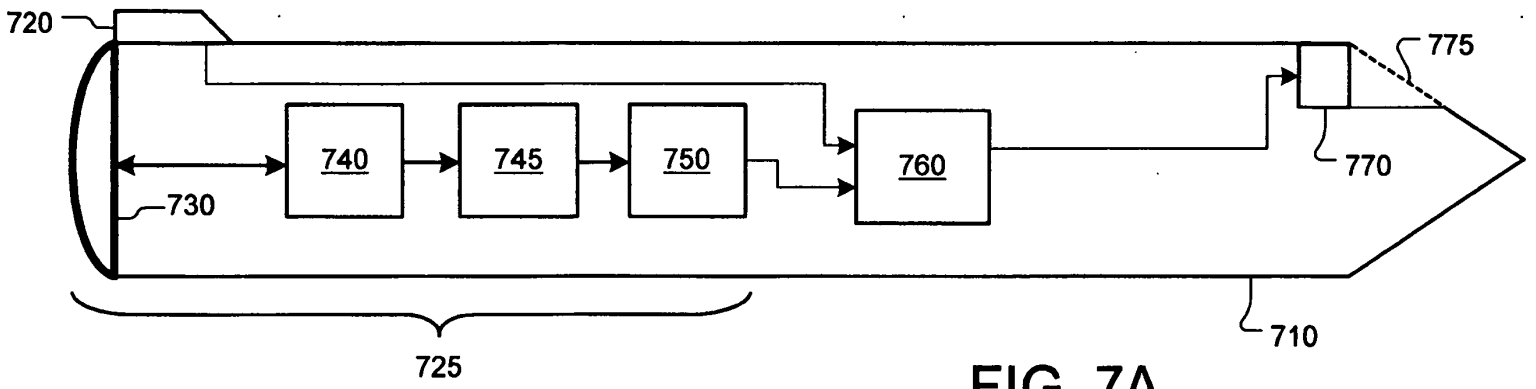


FIG. 7A

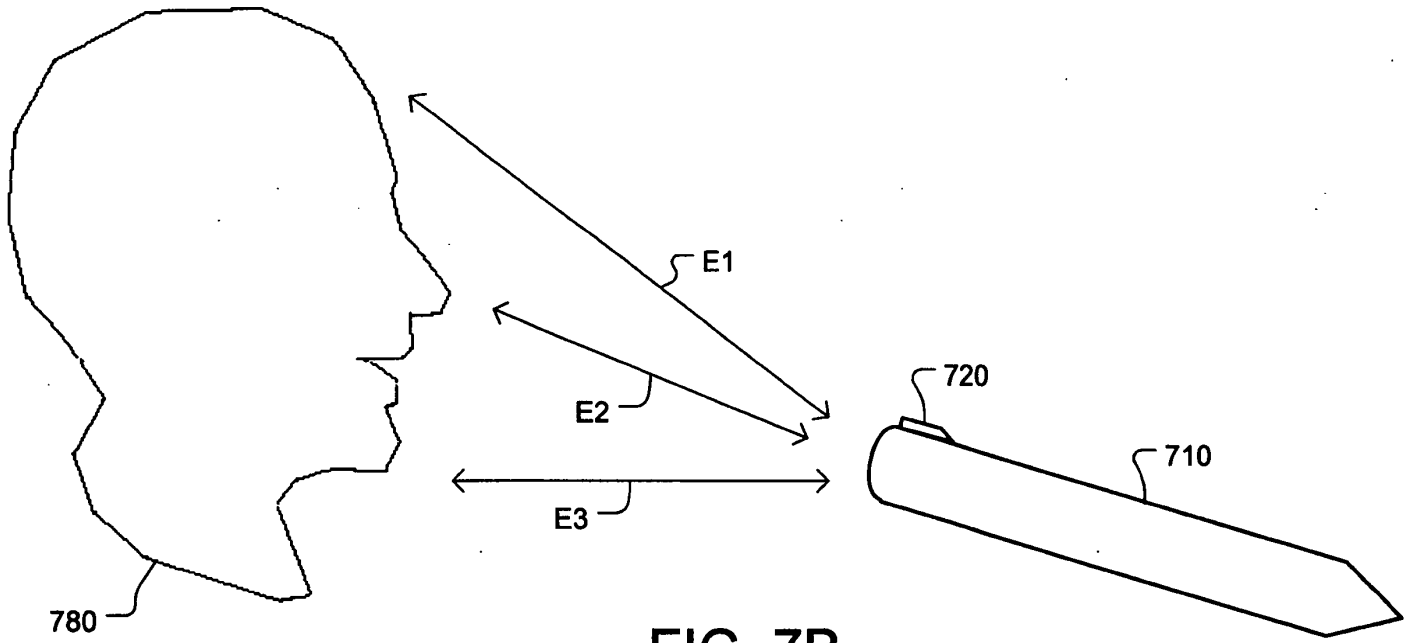


FIG. 7B

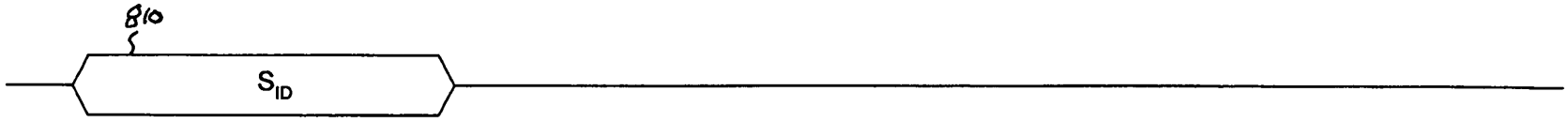


FIG. 8A

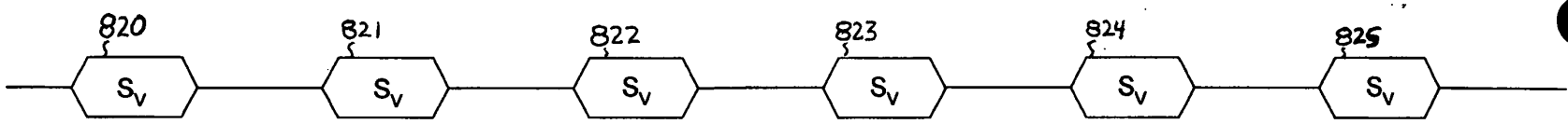


FIG. 8B

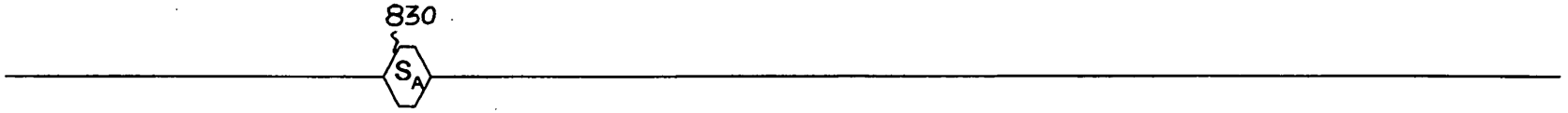


FIG. 8C

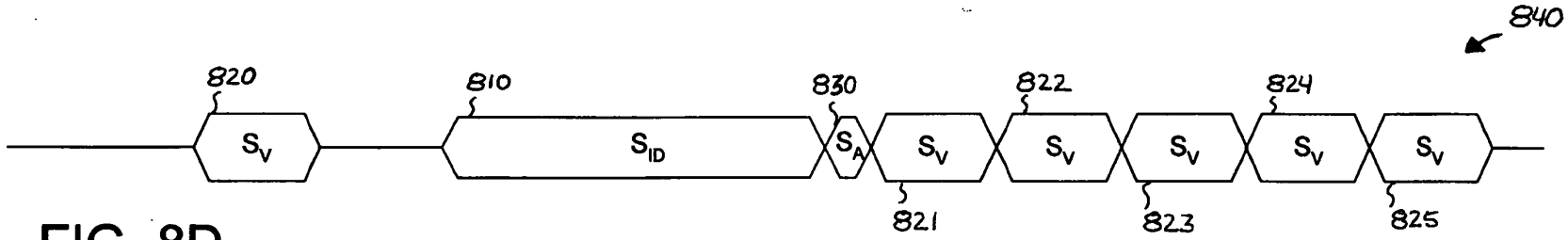
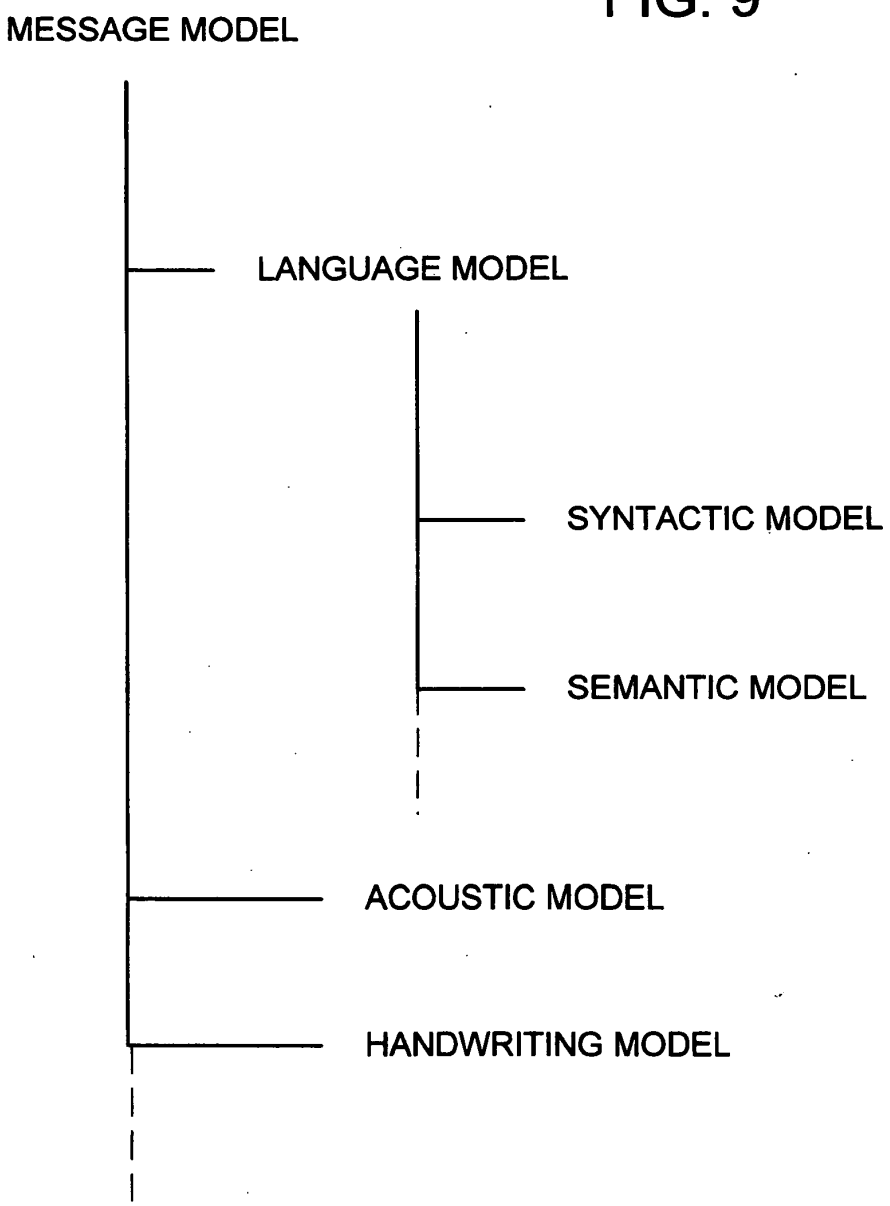


FIG. 8D

FIG. 9



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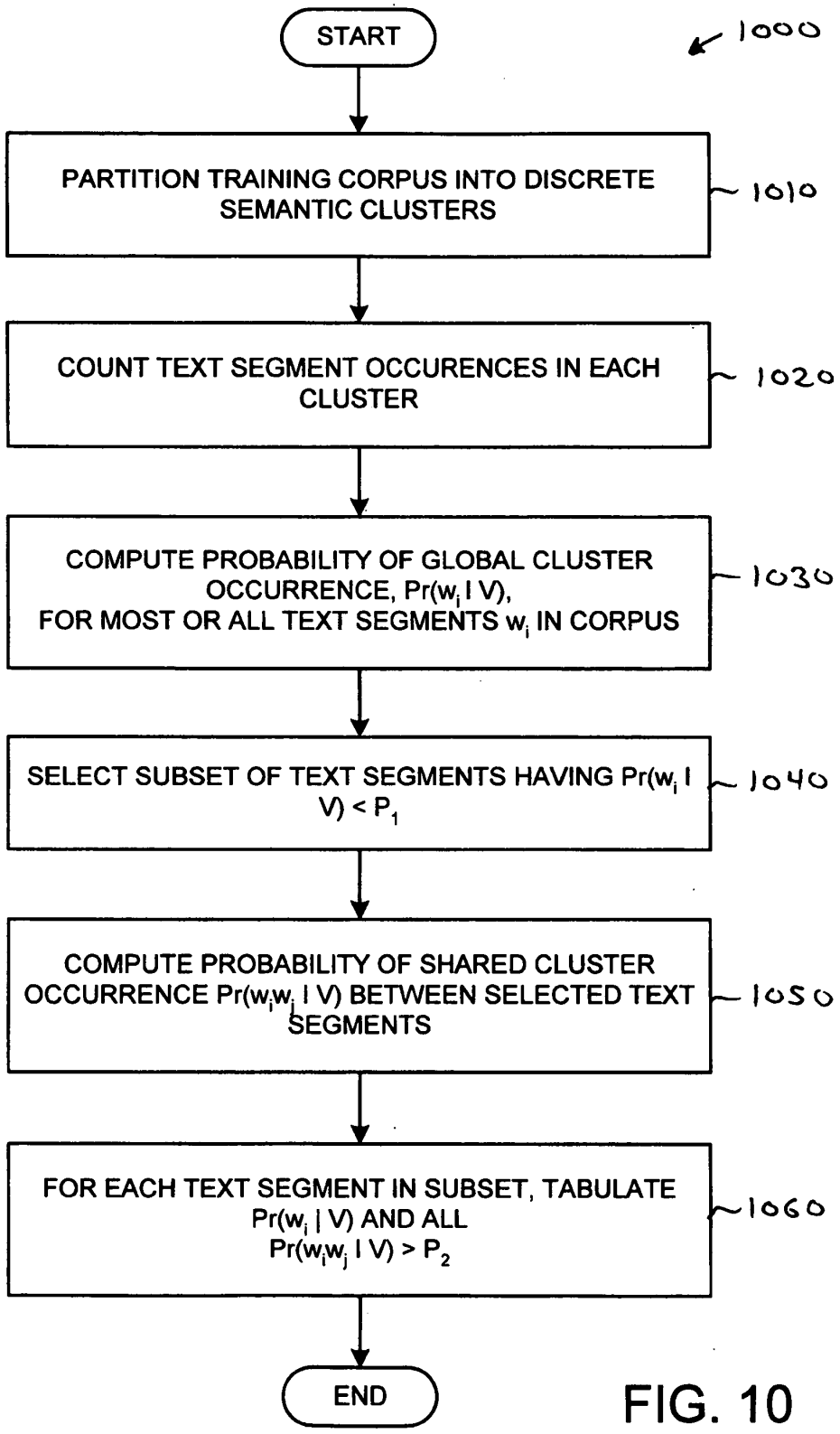


FIG. 10

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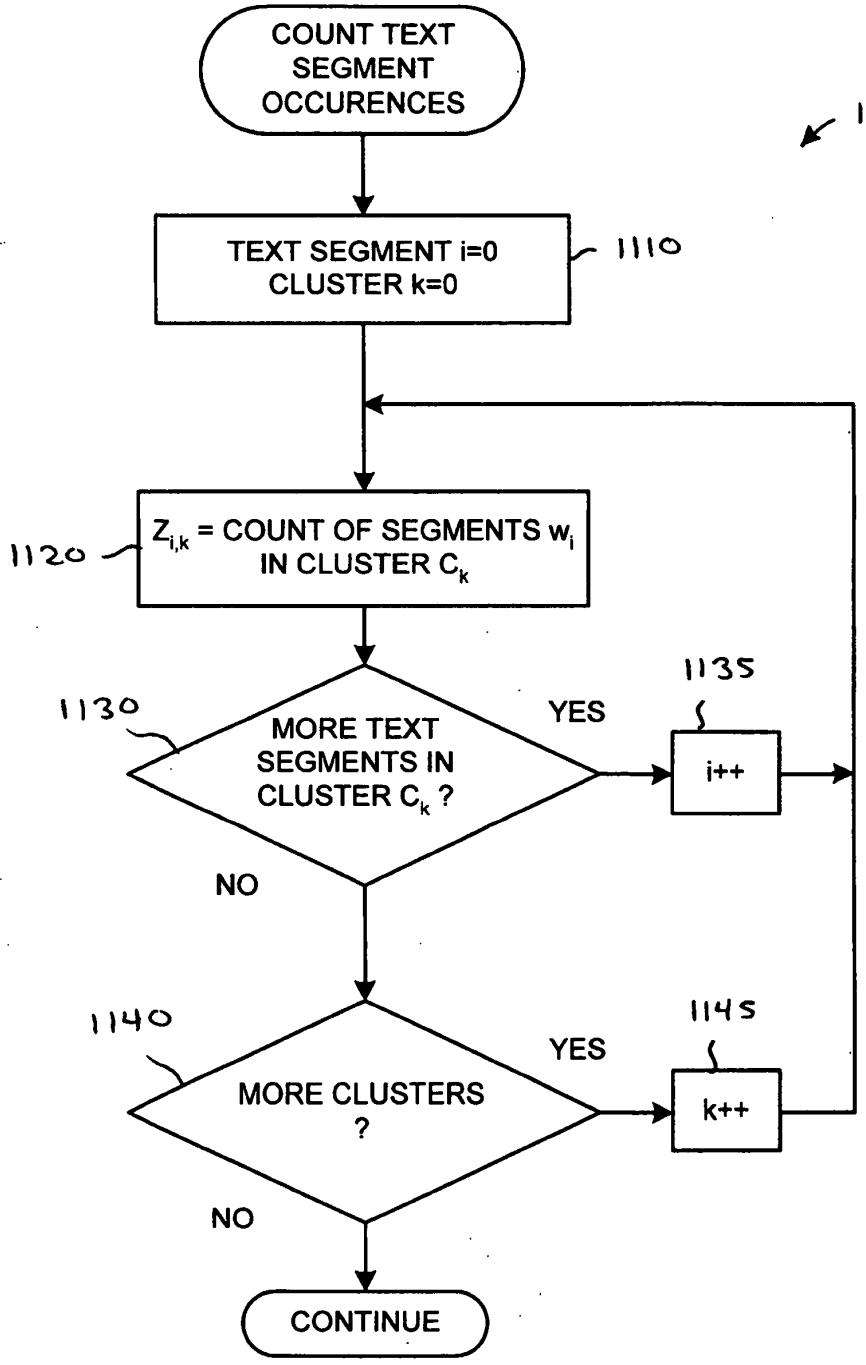


FIG. 11

W_0 HEADER - "UNCLE", RECORDS = ...
$PR(W_0 \mid V)$ = ...
W_{0A} - AUNT - $PR(W_0W_{0A} \mid V)$ = ...
W_{0B} - NEPHEW - $PR(W_0W_{0B} \mid V)$ = ...
W_{0C} - RELATIVE - $PR(W_0W_{0C} \mid V)$ = ...
W_{0D} - BROTHER - $PR(W_0W_{0D} \mid V)$ = ...
. . .
W_1 HEADER - "COORS", RECORDS = ...
$PR(W_1 \mid V)$ = ...
W_{1A} - BAR - $PR(W_1W_{1A} \mid V)$ = ...
W_{1B} - BEER - $PR(W_1W_{1B} \mid V)$ = ...
W_{1C} - CAN - $PR(W_1W_{1C} \mid V)$ = ...
W_{1D} - BREWING - $PR(W_1W_{1D} \mid V)$ = ...
. . .
W_2 HEADER - "BEACH", RECORDS = ...
$PR(W_2 \mid V)$ = ...
W_{2A} - WATER - $PR(W_2W_{2A} \mid V)$ = ...
W_{2B} - SAND - $PR(W_2W_{2B} \mid V)$ = ...
W_{2C} - OCEAN - $PR(W_2W_{2C} \mid V)$ = ...
W_{2D} - PACIFIC - $PR(W_2W_{2D} \mid V)$ = ...

FIG. 12

1200

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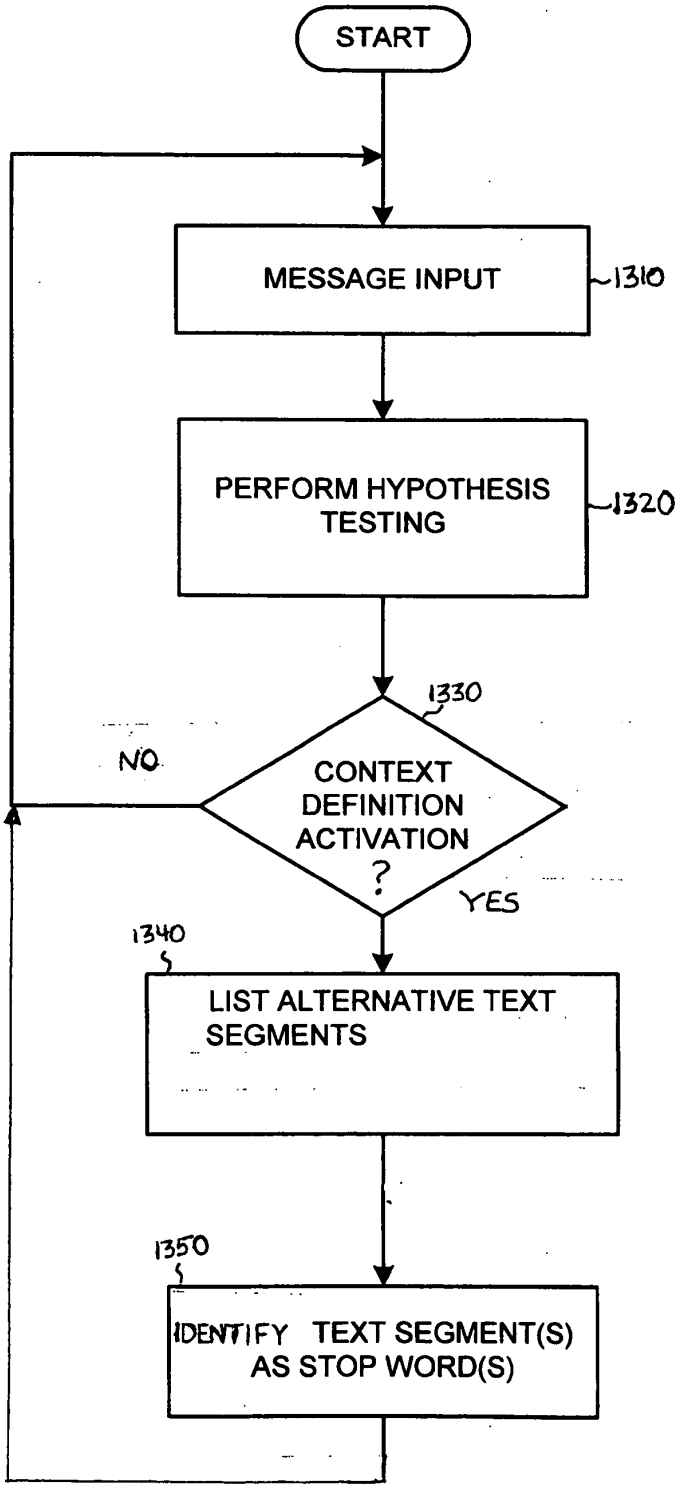


FIG. 13

1300

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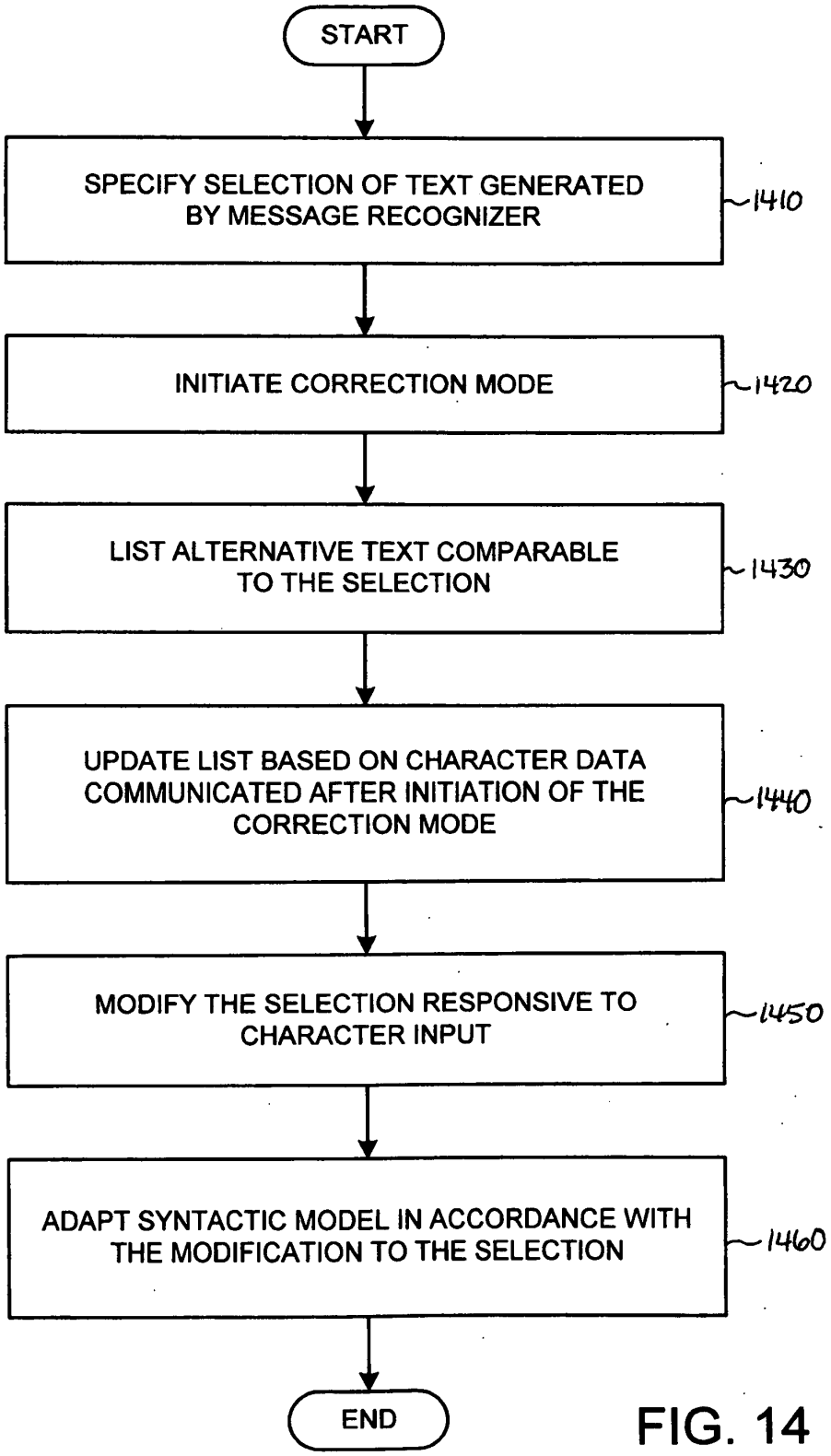


FIG. 14

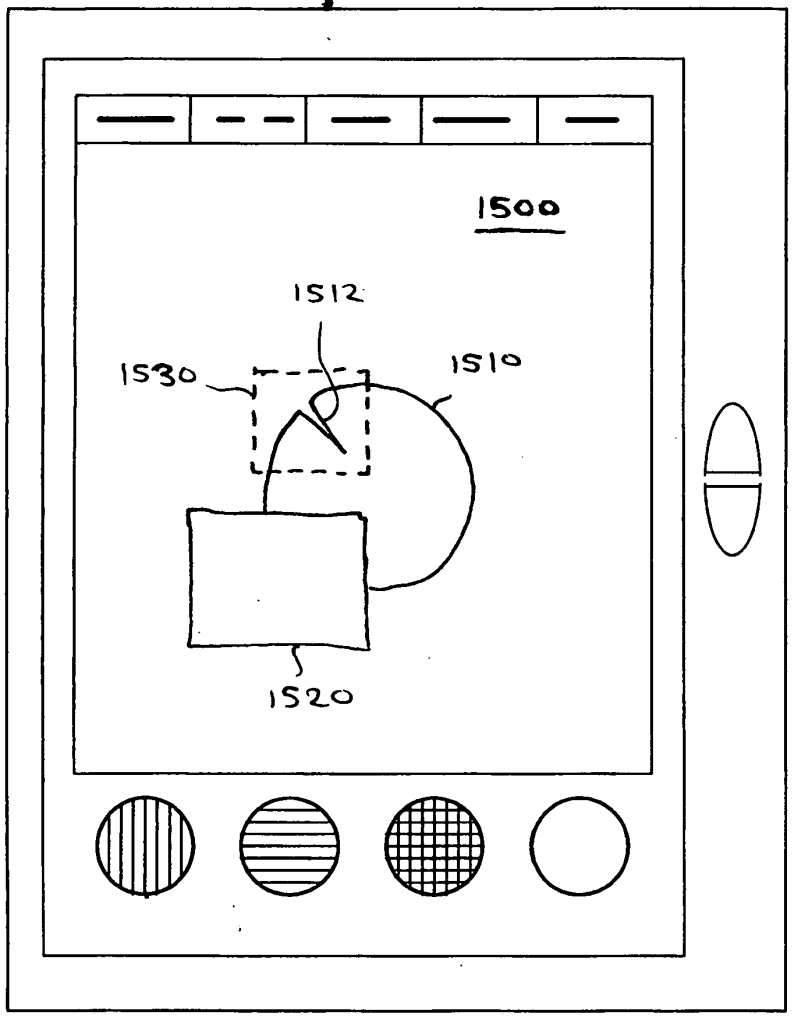


FIG. 15A

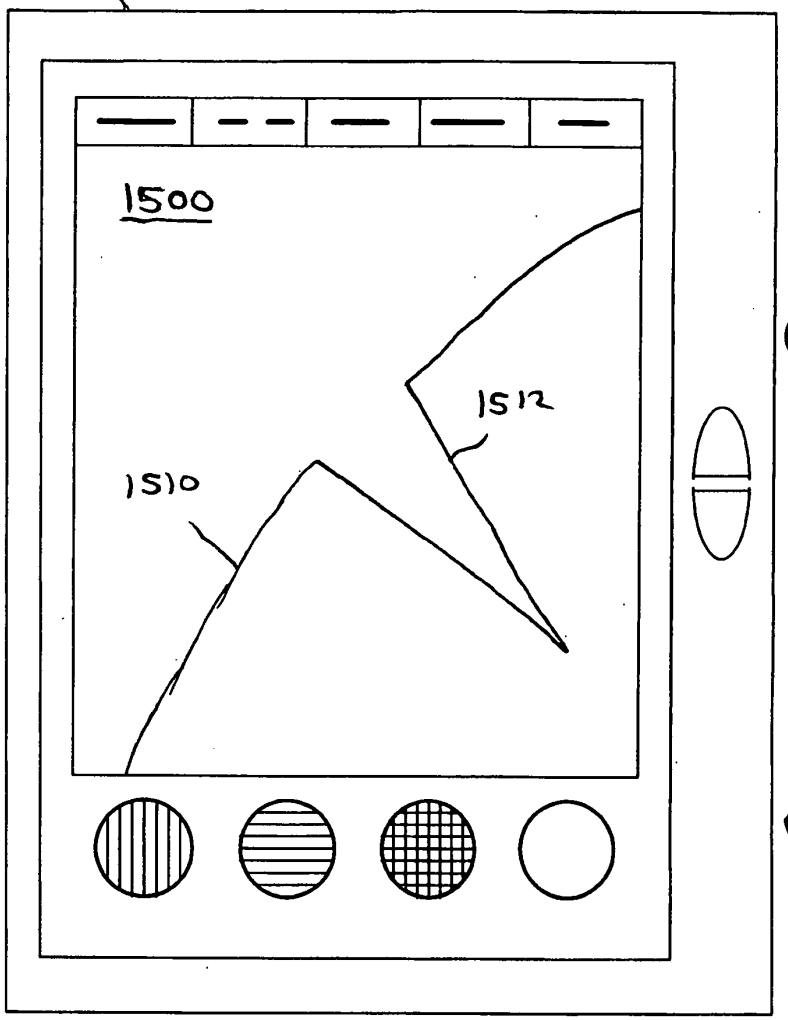


FIG. 15B

TEXT PROCESSING SYSTEM

Inventor: Edwin A. Suominen

BACKGROUND OF THE INVENTION

Conventional computer workstations use a "desktop" interface to organize information on a single display screen. Users of such workstations may work with multiple documents on the desktop interface. However, many users find it more desirable to organize multiple documents on a work surface than to focus attention to multiple windows on a fixed display screen. A physical work surface is usually much larger than the screen display, and multiple documents may be placed on the surface for quick access and review. For many users, it is more natural and convenient to look for a desired document by visual inspection in a physical workspace than to click on one of a number of windows on a display screen. Because it is desirable to shift positions throughout a long workday, many users also prefer to physically pick up a document and review it in a reclining position instead of remaining in a fixed, upright seated position to review the document on a fixed display screen.

In an article entitled "The Computer for the 21st Century," which appeared in the September 1991 issue of *Scientific American*, Mark Weiser has proposed "electronic pads" that may be spread around on a desk like conventional paper documents. These pads are intended to be "scrap computers", analogous to scrap paper and having no individualized identity or importance. The pads can be picked up and used anywhere in the work environment to display an electronic document and receive freehand input with a stylus.

An article in the September 17, 1993 issue of *Science* included a further description of Weiser's ideas. In the article, electronic pads are characterized as thin note pads with a flat screen on top that a user could scribble on. The pads are intended to be as easy to use as paper. Instead of constantly opening and closing applications in the on-screen windows of a single desktop machine, a user could stack the pads around an office like paper and have all of them in use for various tasks at the same time.

The need has long been felt to generate text data (*e.g.*, character codes in a word processor) by voice input, and to integrate voice input with pen-based computers. An article headlined "Pen

and Voice Unite" in the October 1993 issue of *Byte Magazine*, for example, describes a system for responding to alternating spoken and written input. In the system described, the use of pen and voice alternates as the user either speaks or writes to the system. The article states that using a pen to correct misrecognitions as they occur could make an otherwise tedious dictation system acceptable. According to the article, misrecognized words could be simply crossed out. The article suggests, however, that a system in which the use of pen and voice alternates as the user either speaks or writes to the system is less interesting than possibilities that could arise from simultaneous speech and writing.

The effectiveness and convenience of generating text data by voice input is directly proportional to the accuracy of the speech recognizer. Frequent misrecognitions make generation of text data tedious and slow. To minimize the frequency of misrecognitions, it is desirable to provide voice input of relatively high acoustic quality to the speech recognizer. A signal with high acoustic quality has relatively consistent reverberation and amplitude, and a high signal-to-noise ratio. Such quality is conventionally obtained by receiving voice input via a headset microphone. By being mounted on a headset, a microphone may be mounted at a close, fixed proximity to the mouth of a person dictating voice input and thus receive voice input of relatively high acoustic quality.

Head mounted headsets have long been viewed with disfavor for use with speech recognition systems, however. In a 1993 article entitled "From Desktop Audio to Mobile Access: Opportunities for Voice in Computing," Christopher Schmandt of MIT's Media Laboratory concludes that "obtaining high-quality speech recognition without encumbering the user with head mounted microphones is an open challenge which must be met before recognition will be accepted for widespread use." In the November 7, 1994 issue of *Government Computer News,* an IBM marketing executive in charge of IBM speech and pen products is quoted as saying that, *inter alia*, a way must be found to eliminate head-mounted microphones before natural-language computers become pervasive. The executive is further quoted as saying that the headset is one of the biggest inhibitors to the acceptance of voice input.

Being tethered to a headset is especially inconvenient when the user needs to frequently walk away from the computer. Even a cordless headset can be inconvenient. Users may feel self-conscious about wearing such a headset while performing tasks away from the computer.

The long felt need for a system incorporating speech recognition capability with pen-based computers has remained largely unfulfilled. Such a system presents conflicting requirements for high acoustic quality and freedom of movement. Pen-based computers are often used in collaborative environments having high ambient noise and extraneous speech. In such environments, the user may be an engaging in dialogue and gesturing in addition to dictation. Although a headset-mounted microphone would maintain acoustic quality in such situations, the headset is inconsistent with the freedom of movement desired by users of pen-based computers.

It has long been known to incorporate a microphone into a stylus for the acquisition of high-quality speech in a pen-based computer system. For example, the June 1992 edition of IBM's *Technical Disclosure Bulletin* discloses such a system, stating that speech is a way of getting information into a computer, either for controlling the computer or for storing and/or transmitting the speech in digitized form. However, the *Bulletin* states that such a system is not intended for applications where speech and pen input are required simultaneously or in rapid alteration.

IBM's European patent application EP 622724, published in 1994, discloses a microphone in a stylus for providing speech data to a pen-based computer system, which can be recognized by suitable voice recognition programs, to produce operational data and control information to the application programs running in the computer system. *See*, for example, column 18, lines 35-40 of EP 622724. Speech data output from the microphone and received at the disclosed pen-based computer system can be converted into operational data and control information by a suitable voice recognition program in the system.

To provide an example of a "suitable voice recognition program," the EP 622724 application refers to U.S. Patent Application 07/968,097, which matured into U.S. patent 5,425,129 to Garman. At column 1, lines 54-56, the '129 patent states the object of providing a speech recognition system with word spotting capability, which allows the detection of indicated words or phrases in the presence of unrelated phonetic data.

Due to the shortcomings of available references such as the aforementioned June 1992 IBM *Technical Disclosure Bulletin*, EP 622724 European application, and 07/968,097 U.S. application, the need remains to integrate high-quality voice input for dictation with pen-based computers. This need is especially unfulfilled for a system that includes voice dictation capability with a number of electronic pads. Such a system would need to maintain acoustic

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quality while providing voice input to a desired one of the pads, which are spread out on a work surface, possibly in a noisy collaborative environment, at varying distances from the source of voice input.

The need also remains for a speech recognizer that may be automatically activated when voice input is desired. U.S. patent 5,857,172 to Rozak, for example, identifies a difficulty encountered with conventional speech recognizers in that such speech recognizers are either always listening and processing input or not listening. When such a speech recognizer is active and listening, all audio input is processed, even undesired audio input in the form of background noise and inadvertent comments by a speaker. As discussed above, such undesired audio input may be expected to be especially problematic in collaborative environments where pen-based computers are often used. The '172 patent discloses a manual activation system having a designated hot region on a video display for activating the speech recognizer. Using this manual system, the user activates the speech recognizer by positioning a cursor within the hot region. It would be desirable however, for a speech recognizer to be automatically activated without the need for a specific selection action by the user.

Speech recognition may be viewed as one possible subset of message recognition. As defined in Merriam-Webster's *WWWebster Dictionary* (Internet edition), a message is "a communication in writing, in speech, or by signals." U.S. Patent 5,502,774, issued March 26, 1996 to Bellegarda discloses a "message recognition system" using both speech and handwriting as complementary sources of information. Speech recognizers and handwriting recognizers are both examples of message recognizers.

A need remains for message recognition with high accuracy. Misrecognitions by conventional message recognizers, when frequent, make generation of text data tedious and slow. Conventional language, acoustic, and handwriting models respond to user training (*e.g.*, corrections of misrecognized words) to adapt and improve recognition with continued use.

In conventional message recognition systems, user training is tied to a specific computer system (*e.g.*, hardware and software). Such training adapts language, acoustic, and/or handwriting models that reside in data storage of the specific computer system. The adapted models may be manually transferred to a separate computer system, for example, by copying files to a magnetic storage medium. The inconvenience of such a manual operation limits the

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portability of models in a conventional speech recognition system. Consequently, a user of a second computer system is often forced to duplicate training that was performed on a first computer system. In addition, rapid obsolescence of computer hardware and software often renders adapts language, acoustic, and/or handwriting models unusable after the user has invested a significant amount of time to adapt those models.

Conventionally, user training is also tied to a specific type of message recognizer. Correction of misrecognized words typically improves only the accuracy of the particular type of message recognizer being corrected. U.S. Patent 5,502,774 to Bellegarda discloses a multi-source message recognizer that includes both a speech recognizer and a handwriting recognizer. The '774 patent briefly states, at column 4, lines 54-58, that the training of respective source parameters for speech and handwriting recognizers may be done globally using weighted sum formulae of likelihood scores with weighted coefficients. However, the need remains for a multi-source message recognizer that can apply user correction to appropriately perform training for multiple types of recognition, by applying the correction of a message misrecognition only to those models employed in the type of message recognition to which the training is directly relevant.

Conventional message recognition systems include a language model and a type-specific model (*e.g.*, acoustic or handwriting). As discussed in U.S. patent 5,839,106, issued November 17, 1998 to Bellegarda, conventional language models rely upon the classic N-gram paradigm to define the probability of occurrence, within a spoken vocabulary, of all possible sequences of N words. Given a language model consisting of a set of *a priori* N-gram probabilities, a conventional speech recognition system can define a "most likely" linguistic output message based on acoustic input signal. As the '106 patent points out, however, the N-gram paradigm does not contemplate word meaning, and limits on available processing and memory resources preclude the use of models in which N is made large enough to incorporate global language constraints. Accordingly, models based purely on the N-gram paradigm can utilize only limited information about the context of words to enhance recognition accuracy.

Semantic approaches to language modeling have been disclosed. Generally speaking, such techniques attempt to capture meaningful word associations within a more global language context. For example, U.S. patent 5,828,999, issued October 27, 1998 to Bellegarda *et al.*

discloses a large-span semantic language model which maps words from a vocabulary into a vector space. After the words are mapped into the space, vectors representing the words are clustered into a set of clusters, where each cluster represents a semantic event. After clustering the vectors, a first probability that a first word will occur (given a history of prior words) is computed. The probability is computed by calculating a second probability that the vector representing the first word belongs to each of the clusters; calculating a third probability of each cluster occurring in a history of prior words; and weighting the second probability by the third probability.

The '106 patent discloses a hybrid language model that is developed using an integrated paradigm in which latent semantic analysis is combined with, and subordinated to, a conventional N-gram paradigm. The integrated paradigm provides an estimate of the likelihood that a word, chosen from an underlying vocabulary, will occur given a prevailing contextual history.

A prevailing contextual history may be a useful guide for performing general semantic analysis based on a user's general writing style. However, a specific context of a particular document may be determined only after enough words have been generated in that document to create a specific contextual history for the document. In addition, the characterization of a contextual history by a machine may itself be inaccurate. For effective semantic analysis, the need remains for accurate and early identification of context.

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BRIEF DESCRIPTION OF THE DRAWING

Embodiments of the present invention are described below with reference to the drawing, wherein like designations denote like elements, and:

FIGS. 1A and 1B are, respectively, a functional block diagram and simplified pictorial view of a single-tablet system responsive to freehand input and voice input, according to various aspects of the present invention;

FIG. 2 is a combination block diagram and simplified pictorial view of a multiple-tablet system responsive to freehand input and voice input, according to various aspects of the present invention;

FIG. 3A is a functional block diagram of a domain controller in the system of FIG. 2;

FIG. 3B is a functional block diagram of a message model in the domain controller of FIG. 3A;

FIG. 4 is a data flow diagram of the operation of a stylus according to various aspects of the present invention;

FIG. 5 is a data flow diagram of the operation of the domain controller of FIG. 3A in cooperation with the stylus of FIG. 4;

FIG. 6A is a functional and simplified schematic block diagram of a stylus that includes an activation circuit having an infrared radiation sensor responsive to infrared field radiation according to various aspects of the present invention;

FIG. 6B is a simplified pictorial view illustrating operation of the activation circuit in the stylus of FIG. 6A;

FIG. 7A is a functional and simplified schematic block diagram of a stylus that includes an activation circuit having an acoustic radiation sensor and ultrasonic transmitter according to various aspects of the present invention;

FIG. 7B is a simplified pictorial view illustrating operation of the activation circuit in the stylus of FIG. 7A;

FIG. 8, including FIGS. 8A through 8D, is a timing diagram of signals provided by a stylus according to various aspects of the present invention;

FIG. 9 is a diagram of relationships among various models of a message model according to various aspects of the present invention;

FIG. 10 is a flow diagram of a method for the identification of semantic clusters according to various aspects of the present invention;

FIG. 11 is a flow diagram of a process for analyzing semantic clusters of a training corpus according to various aspects of the present invention;

FIG. 12 illustrates a partial example of a data structure tabulating probabilities computed in the method of FIG. 10;

FIG. 13 is a flow diagram of a method for adapting a semantic model by user identification of context according to various aspects of the present invention;

FIG. 14 is a flow diagram of a method for adapting a syntactic model by user correction of misrecognition according to various aspects of the present invention; and

FIGS. 15A and 15B are planar views of respective tablets displaying respective views of a document according to various aspects of the present invention.

DESCRIPTION OF PREFERRED EXEMPLARY EMBODIMENTS

A text processing system according to various aspects of the present invention may be responsive to both voice input and freehand input to generate and edit text data. Text data is any indicia of text that may be stored and conveyed numerically. For example, text data may be numerical codes used in a computer to represent individual units (*e.g.*, characters, words, kanji) of text. Voice input may be used primarily to generate text data, while freehand input may be used primarily to edit text data generated by voice input. For example, system 100 of FIG. 1 (including FIGS. 1A and 1B) suitably includes a stylus 110 responsive to voice input and a tablet 150 responsive to freehand input, coupled together via a communications link 115.

A tablet according to various aspects of the present invention includes any suitable hardware and/or software for performing functions of, *inter alia*, a speech recognizer and an editor. Tablet 150, for example, may include a conventional CPU and memory (not shown) having indicia of suitable software instructions for the CPU to implement tablet interface 164, speech recognizer 162, and editor 168. Tablet 150 may further include suitable conventional hardware (*e.g.*, "glue logic," display driving circuitry, battery power supply, etc.) and/or software (*e.g.*, operating system, handwriting recognition engine, etc.).

Tablet 150 may be an "electronic book" type of portable computer having a tablet surface and a display integrated into the tablet surface. Such a computer may include hardware and software of the type disclosed in U.S. Patent 5,602,516, issued September 1, 1998 to Shwarts *et al.*, and U.S. Patent 5,903,668, issued May 11, 1999 to Beernink. The detailed description portion (including referenced drawing figures) of each of these two aforementioned patents is incorporated herein by reference. Further, the detailed description portion (including referenced drawing figures) of any U.S. patent or U.S. patent application incorporated by reference into either of these two aforementioned patents is also specifically incorporated herein by reference.

Functional blocks implemented by hardware and/or software in tablet 150 include: tablet interface 164 for receiving freehand input communicated via pointer 610 of stylus 110; receiver 160 for receiving (indirectly) voice input communicated via microphone 120 of stylus 110; speech recognizer 162 for generating text data responsive to the voice input; and editor 168. In FIG. 2 and also in FIGS. 3A and 3B (discussed below), interconnection between functional blocks is depicted by single lines. Such lines represent transfer of data by any suitable hardware or software interconnection, including, for example, the transfer of memory contents between software objects instantiated in a single processing environment.

Microphone 120 couples voice input from stylus 110 to speech recognizer 162 via transmitter 122 and receiver 160. Transmitter 122 is coupled to receiver 160 via communications link 115. Speech recognizer 162 generates text data responsive to voice input from user 240 and provides the text data to editor 168. Tablet interface 164 interprets editing commands responsive to freehand input and provides indicia of the editing commands to editor 168. Editor 168 performs any modifications to the text data that are suitably specified by the editing commands. Speech recognizer 162, tablet interface 164, and editor 168 are described in greater detail below.

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According to various aspects of the present invention, a communications link may employ any suitable medium, modulation format, and/or communications protocol to convey information from transmitter in a stylus to a receiver in, for example, a table. A communications link may use a wired (*i.e.*, physical) connection, or a wireless connection through modulated field radiation. Field radiation includes acoustic radiation and electromagnetic radiation in the radio, infrared, or visible light spectrum. For example, communications link 115 uses modulated radio transmission to convey information from transmitter 122 to receiver 160.

A transmitter according to various aspects of present invention includes any suitable hardware and/or software for transmitting voice input via a communications link 115. When a simple wired connection is utilized for a communications link, no transmitter may be needed. When a wireless connection is utilized, a transmitter may include appropriate conversion, modulation, and/or transmission circuitry. For example, transmitter 122 in stylus 110 includes a conventional analog-to-digital converter for converting voice input into digital samples, and a conventional modulator/transmitter for converting the digital samples into an analog signal

having a desired modulation format (*e.g.*, FSK, QPSK). A transmitter may be coupled to a radiating device for converting the analog signal into a desired form of field radiation (*e.g.*, an RF signal in the 1-5 GHz range). For example, transmitter 122 couples an RF signal to a conventional dipole antenna having elements 660, which are oriented parallel to a longitudinal axis of stylus 110. As a further example, infrared transmitter 760 in stylus 710 couples digital modulation to a conventional solid state infrared emitter 770. Emitter 770 produces modulated infrared radiation, which passes out of stylus 710 through transparent aperture 775.

A receiver according to various aspects of present invention includes any suitable hardware and/or software for receiving information from a transmitter via a communications link. When a simple wired connection is utilized for a communications link, a receiver may consist of a circuit for amplifying and/or filtering the signal from a microphone. When a wireless connection is utilized, a receiver may include appropriate receiving, demodulation, and conversion circuitry, generally complementary to circuitry in a cooperating transmitter. For example, receiver 160 of tablet 150 includes a conventional receiver/demodulator for converting an analog signal transmitted by transmitter 122 and picked up by a suitable sensing device (*e.g.*, an antenna, not shown).

In a variation, a communications link may be of the type disclosed in U.S. Patent 4,969,180 issued November 6, 1990 to Watterson *et al.*, The disclosure found from column 5, line 19 through column 14, line 55 of the aforementioned patent, including drawing figures referenced therein, is incorporated herein by reference. In such a variation, an analog ultrasonic signal is employed in a communications link.

A stylus according to various aspects of the present invention includes any device having a pointer for conveying freehand input to a tablet interface. A pointer may be a portion of one end of a stylus that is suitably narrow for a user to convey freehand input (*e.g.*, gestures, editing commands, and handwriting). Typically, a pointer is a tapered portion toward the distal (*i.e.*, downward, in operation) end of a stylus. As may be better understood with reference to FIG. 6A, for example, stylus 110 includes a tapered pointer 610, which a user 240 may manually manipulate on or near surface 152 of tablet 150 to convey freehand input. As may be better understood with reference to FIG. 1A, exemplary stylus 110 further includes: a microphone 120; a proximity sensor 124; an activation circuit 126; an identification circuit 128; a transmitter 122;

control circuitry (not shown) such as a programmable logic device and/or a microcontroller; and suitable supporting hardware (*e.g.*, battery power supply).

By permitting alternating speech and pen input using stylus 110, text processing system 100 provides speech recognition with improved accuracy and editing convenience. To generate text by dictation, user 240 moves stylus 110 toward his or her mouth and begins speaking into microphone 120. To edit text, user 240 moves stylus 110 to tablet surface 152 and manually manipulates pointer 610 on surface 152. User 240 need not be tethered to a head-mounted microphone; he or she already has microphone 120 in hand when grasping stylus 110. When positioned near the mouth of user 240, microphone 120 is typically able to receive high quality voice input comparable to that received by a head-mounted microphone.

When employed for generating an editing an electronic document, tablet 150 may be used as an alternative to a paper document and can be expected to be positioned near the head of user 240. When tablet 150 is positioned for comfortable use, for example resting on the thigh portion of a crossed leg of user 240, the distance between tablet surface 152 and the head of user 240 may be only about twice the length of stylus 110. In such a configuration, alternating speech and freehand input using stylus 110 can be expected to be natural and intuitive. User 240 may find it natural and intuitive to move stylus 110 away from tablet surface 152, and toward his or her mouth, while reviewing displayed text and preparing to generate additional text by dictation. No significant change in the orientation of stylus 110 is necessary because microphone 120 typically remains aimed toward the mouth of user 240. User 240 may also find it natural and intuitive to edit the text he or she has generated, or to correct misrecognized dictation, by simply moving stylus 110 toward and onto tablet surface 152 to manipulate pointer 610 on surface 152.

Preferably, microphone 120 is disposed toward the proximal (*i.e.*, upward in operation) end of stylus 110 and is at least somewhat directional to improve quality of voice input when pointed toward the mouth of user 240. When directional, microphone 120 is responsive to sound impinging on stylus 110 from the direction of its proximal end with a greater sensitivity than from its distal end.

A stylus may include a proximity sensor and an activation circuit for activating a speech recognizer when the stylus is proximate a human head. A stylus may also include (alternatively or additionally) an identification circuit for identifying the owner of the stylus, for example to

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permit selection of an appropriate user message model, as described below. Exemplary stylus 110 further includes: proximity sensor 124; activation circuit 126; and identification circuit 128.

An activation circuit according to various aspects of the present invention includes any circuit housed in a stylus for activating speech recognition when the stylus is situated to receive voice input. Such a circuit may determine that the stylus is situated to receive voice input by sensing one or more conditions. Such conditions include, for example, the amplitude or angle of impingement of sound waves from the voice input and the proximity (*i.e.*, displacement and/or orientation) of the stylus with respect to the head of a user providing the voice input.

An activation circuit may employ any conventional selection or control system to activate speech recognition. In system 100, for example, activation circuit 126 provides a binary activation signal S_A to transmitter 122 while microphone 120 provides transmitter 122 an analog voice signal S_V. Transmitter 122 continuously conveys both activation signal S_A and voice signal S_V to receiver 160. Activation signal S_A includes an activation bit that is set to a true state by activation circuit 126 to activate speech recognition. Receiver 160 may be configured to convey voice signal S_V to speech recognizer 162 only when the activation bit is set to a true state. In a variation, speech recognizer 162 may be configured to generate text responsive to voice input only when the activation bit is in a true state. In another possible variation, activation signal S_A may selectively control the transmission of voice signal S_V by transmitter 122.

An activation circuit that senses angle of impingement of sound waves as a condition for activation may include a plurality (*e.g.*, two) of sound sensors that are responsive to sound impinging on the stylus from a plurality of respective angular ranges. Such a circuit also includes a comparator for comparing the amplitudes of sound from the sound sensors. When the relative amplitude indicates that the voice input is impinging on the stylus from within a predetermined angular range, the comparator makes a positive determination that causes activation of speech recognition.

When such an activation circuit is used, the function of a microphone may be easily incorporated into one of the sound sensors. Consequently, it may not be necessary for a stylus employing such an activation circuit to include a separate microphone. The activation circuit may include circuitry of the type disclosed in U.S. Patent 4,489,442, issued December 18, 1984 to Anderson *et al.* The disclosure found from column 2, line 42 through column 11, line 29 of

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this aforementioned patent, including drawing figures referenced therein, is incorporated herein by reference.

As may be better understood with reference to FIGS. 1A and 6A, activation circuit 126 is a preferred example of an activation circuit that senses proximity of stylus 110 with respect to the head of a user 240 providing voice input. Activation circuit 126 includes a proximity sensor 124.

A proximity sensor includes any device positioned proximate a microphone in a stylus, according to various aspects of the present invention, such that is able to sense proximity of a human head to the microphone. A proximity sensor may include a radiation sensor responsive to field radiation impinging on the stylus from a human head. For example, proximity sensor 124 includes radiation sensor 615. Alternatively, a proximity sensor may be a capacitive proximity sensor of the type disclosed in U.S. Patent 5,337,353, issued August 9, 1994 to Boie *et al.* The detailed description portion (including referenced drawing figures) of this aforementioned patent is incorporated herein by reference.

A radiation sensor according to various aspects of the present invention includes any device responsive to field radiation impinging on the stylus. As discussed above, field radiation includes acoustic radiation and electromagnetic radiation in the radio, infrared, or visible light spectrum. For example, radiation sensor 615 includes two infrared sensors 620 and 630. Sensors 620 and 630 provide respective sensing signals S1 and S2 with amplitudes proportional to the respective amounts of infrared field radiation sensed. Sensor 620 is positioned at the end of a wide aperture cone 622 such that it is responsive to infrared radiation impinging on stylus 110 within a wide angular range AR1. Sensor 630 is positioned at the end of a narrow aperture cone 632, behind sensor 620, such that it is responsive to infrared radiation impinging on stylus 110 within a narrow angular range AR2.

Proximity sensor 124 further includes a comparator 640 for comparing sensing signals S1 and S2. A comparator according various aspects of the present invention includes any circuit for making a determination that a stylus is situated to receive voice input based on one or more suitable conditions of signals provided by sensors. A comparator may perform mathematical functions on such signals, as well as any time-domain processing of the signals that may be desired to establish that the stylus has been properly situated for a given period of time. For example, comparator 640 performs subtraction and division operations to compute a residual

portion SR of signal S1 that is uniquely attributable to sensor 620. Comparator 640 also performs comparisons of residual portion SR and signal S2 to two predetermined thresholds T_1 and T_2, respectively. Comparator 640 thus makes a determination that stylus 110 is situated to receive voice input based on two conditions, which may be mathematically expressed as follows:

$$Condition\ \ A:\ \ S2 \geq T_1$$

$$Condition\ \ B:\ \ \frac{S2}{S2-S1} \geq T_2$$

When microphone 120 is at a desired proximity to the head of user 240, infrared radiation from the head of user 240 occupies most of angular range AR2. Sensor 630 collects a predetermined amount of infrared radiation, which causes the amplitude of signal S2 to reach the first predetermined threshold (condition A). At the desired proximity, infrared radiation from the head of user 240 occupies only that part of angular range AR1 also occupied by range AR2. The residual portion of signal S1 is thus relatively small, which causes the ratio between signal S2 and the residual portion to reach the second predetermined threshold (condition B).

It is possible for stylus 110 to be situated such that microphone 120 is displaced from the head of user 240 within a desired separation range but oriented away from the head (*i.e.*, having an orientation outside the desired angular range). When stylus 110 is so situated, sensor 630 may be close enough to the head to permit the amplitude of signal S2 to reach the first predetermined threshold (condition A) even though infrared radiation from the head only occupies a portion of angular range AR2. However, the residual portion of signal S1 will then be relatively large because a significant portion of the infrared radiation falls within angular range AR1 but outside range AR2. Consequently, the ratio between signal S1 and the residual portion will fall short of the second predetermined threshold and condition B will not be met.

In a variation, an infrared proximity sensor may be suitably adapted from the disclosure of U.S. Patent 5,330,226 issued July 19, 1994 to Gentry *et al.* The detailed description portion (including referenced drawing figures) of this aforementioned patent is incorporated herein by reference.

A proximity sensor according various aspects of a present invention may include a radiation sensor that is responsive to acoustic field radiation. For example, stylus 710 of FIG. 7A includes

a microphone 720 and an ultrasonic activation circuit 725, which suitably includes: an ultrasonic radiation transmitter/sensor 740; a signal processor 745; and a comparator 750. Transmitter/sensor 740 emits an ultrasonic (*e.g.*, having a center frequency of 50 kHz) pulse of acoustic field radiation from piezoelectric transducer 730. The radiation travels toward the head of user 780 and multiple echoes (depicted as E1, E2, and E3 for illustrative purposes) of the radiation reflect from its surface. Portions of the echoes return to transducer 730 where they are sensed over an interval to form a time-varying signal that is coupled to transmitter/sensor 740.

Transmitter/sensor 740 converts the time-varying signal to a suitable form (*e.g.*, Nyquist filtered discrete-time samples) and conveys the converted signal to signal processor 745. Signal processor 745 provides a distance profile of the sensed acoustic field radiation.

A distance profile is a characterization of the respective distances between an ultrasonic transducer and a scattering object that reflects echoes back to the transducer. For example, a distance profile may be a mathematical curve characterizing a sequential series of discrete-time samples. Each sample may represent amplitude of echoes received at a specific point within a time interval. Such a curve may be characterized by a width of the most prominent peak in the curve and a "center of mass" of the curve T_{cm}, which may be calculated as follows:

$$T_{cm} = \frac{\int_0^T t\, f(t)dt}{\int_0^T f(t)dt}$$

The center of mass of a distance profile curve moves to the left (*i.e.*, closer to $t = 0$) as the scattering object moves closer to the transducer, and to the right as the scattering object moves away. Such a curve has a pronounced peak if the scattering object is relatively flat (*e.g.*, a wall), because all echoes are received at about the same time. Scattering objects having irregular surfaces provide distance profile curves that are relatively distributed and irregular because echoes from different portions of the surface are received at different times and with varying amplitudes. A scattering object having a distinct surface shape (*e.g.*, a human face) can be expected to provide a distinct distance profile curve.

Comparator 750 compares the distance profile from signal processor 745 to an expected profile. The expected profile corresponds to acoustic field radiation expected to impinge on

transducer 730 of stylus 710 when microphone 720 is at a predetermined proximity to the head of user 780. The expected profile may be a curve formed from a sequential series of predetermined data values, each representing the expected amplitude of echoes received at a specific point within a time interval. Alternatively, the expected profile may simply be a collection of statistics (*e.g.*, center of mass and peak width) characterizing the expected distance profile when microphone 720 is at a predetermined proximity to the head of user 780. The distance profile may be compared to the expected profile by any suitable signal processing technique (*e.g.*, comparison of statistics or cross-correlation of data points).

A suitable expected profile may be generated by situating stylus 710 such that microphone 720 is at a desired proximity to the head of user 780. Then a programming mode may be entered by suitable user control (*e.g.*, depressing a button on the body of stylus 710) at which point the distance profile is recorded or statistically characterized. The recorded or characterized distance profile then becomes the expected profile, which may be employed for subsequent operation of stylus 710. A single expected profile (or a statistical aggregate using heads of multiple people as scattering objects) may be pre-programmed into multiple production copies of stylus 710.

In a variation, an ultrasonic proximity sensor may be suitably adapted from the disclosure of U.S. Patent 5,848,802 issued December 15, 1998 to Breed *et al.* The detailed description portion (including referenced drawing figures) of this aforementioned patent is incorporated herein by reference.

An identification circuit according to various aspects of the present invention includes any circuit housed in a stylus for identifying the stylus. Such a circuit may provide an identification signal that identifies an owner of the stylus by any suitable descriptive or uniquely characteristic content (*e.g.*, a digital code). A few examples of suitable identification circuits and identification signals that may be provided by such circuits are provided in TABLE I below.

TABLE I

Identification Circuit	Corresponding Identification Signal For Identifying Stylus
Microcontroller (possibly shared with transmitter and/or activation circuit)	Numeric or alphanumeric code, provided either periodically or upon request.
Dedicated non-volatile memory device (*e.g.*, 4-pin serial PROM)	Binary code (*e.g.*, 48-bit serial bitstream) provided upon request of control circuitry or transmitter.
Programmable logic device (possibly shared with transmitter and/or activation circuit)	Binary code (*e.g.*, 48-bit serial bitstream) provided either periodically or upon request.
Analog periodic signal source	Periodic modulation of signal from transmitter (*e.g.*, with one or more subcarriers containing characteristic periodic behavior or digitally modulated identification)

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In system 100 (FIG. 1A), identification circuit 128 is a four-pin serial PROM that identifies stylus 110 by providing, upon request by suitable controlling circuitry (not shown), identification signal S_{ID} as a 48-bit serial word to transmitter 122. Transmitter 122 incorporates identification signal S_{ID} with voice signal S_V from microphone 120 and transmits the combined signals to receiver 160 via communications link 115.

Depending on the type of identification circuit employed, a predetermined identification signal may be assigned during or after device fabrication. For example, identification circuit 128 is programmed to provide a 48-bit serial identification signal before being soldered to a printed circuit board along with other components of stylus 110. When a microcontroller is employed for control circuitry in stylus 110, the function of identification circuit 128 may be performed by the microcontroller. Dedicated circuitry for identification circuit 128 is not necessary in such a configuration. A microcontroller-based identification circuit may be programmed after device fabrication as desired, possibly many times. Conventional interface circuitry (*e.g.*, magnetic

sensor and cooperating receiver, miniature 3-pin connector and serial port) may be provided to facilitate such programming.

When personalized with an identification circuit, a stylus may be carried about by a user and treated as a personal accessory. For example, a stylus may be shaped and dimensioned to have a look and feel similar to that of a high quality pen. If desired, such a stylus and pen may be packaged and carried about by a user as a complementary set. A personalized stylus may include personalizing indicia on its outer surface such as a monogram or logo.

By facilitating identification, stylus 110 may be used in particularly advantageous applications. In system 200, for example, stylus 110 may be owned by a particular user and used with a tablet that is shared with a number of users. (The structure and operation of system 200 is discussed in greater detail below with reference to FIGS. 2-5.) As exemplified in system 200, a speech recognizer and/or handwriting recognizer may be responsive to identifying signal S_{ID} to select a particular user message model to use when generating text responsive to voice input conveyed via stylus 110. In a collaborative environment, an identification circuit may also enable text data generated by a particular user to be "stamped" with the user's identity. Text may be "stamped," for example, by displaying the text data in a particular color or with a hidden identifier that may be displayed upon user selection.

A user message model is a message model that is specific to a particular user. As discussed in greater detail below, a message model is a model used in recognition of a message. A message is any communication in writing, in speech, or by signals. A message model may include a language model as well as an acoustic and/or handwriting model.

A stylus having an identification circuit may be associated with a user by a suitable registration system. For example, a user may select an identification signal to program into the identification circuit. Alternatively, a registration system may assign an identification signal to the user, and an associate the user with that predetermined identification signal. When stylus 110 is assigned (*e.g.*, sold, loaned by an employer, etc.) to a user, for example, the user may register personal information for association with the predetermined identification signal. Such personal information may include the user's name and security authorizations, and the location (*e.g.*, Internet address) of the appropriate user message model on a wide area network.

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Transmission of voice signal S_V, identification signal S_{ID}, and activation signal S_A from stylus 110 to tablet 150 may be better understood with reference to FIG 8 (including FIGS. 8A-8D). In system 100, these signals are transmitted via communications link 115 as bursts of serial data. Each burst includes header bits and data bits. The header bits of any given bursts identify that burst as a portion of either signal S_V, S_{ID}, or S_A. In system 100, two header bits are used to distinguish the three signals. The data bits convey signals S_V, S_{ID}, or S_A as serial data. In system 100, voice signal S_V is conveyed with bursts of 16 data bits and identification signal S_{ID} is conveyed with bursts of 48 data bits. Activation signal S_A of system 100 is conveyed with a single data bit that indicates either an "activate" command or an "inactivate" command. Alternately, a standard number of data bits may be used, with unused bits left unspecified or in a default state.

In the time span depicted in FIG. 8, identification signal S_{ID} is asserted one time in burst 810. Signal S_{ID} may be asserted at a relatively low rate of repetition (*e.g.*, once every second), just often enough to be able to signal a newly used tablet of the identity of stylus 110 without perceptible delay by the user. In a variation, receiving circuitry (not shown) may be included in stylus 110 so that a new tablet may indicate its presence to stylus 110 and signal the need for a new assertion (*i.e.*, serial burst) of identification signal S_{ID}. In system 100, signal S_{ID} is conveyed with a large data word length (48 bits) to permit a large number (*e.g.*, 2^{32}) of pre-certified identification signals to be asserted with an even larger number (*e.g.*, $2^{48} - 2^{32}$) of invalid identification signals possible using random bit sequences. Consequently, stylus 110 may use signal S_{ID} to validate secured access to tablet 150. Signal S_{ID} may also be used as an encryption key, for example to facilitate secured transmission of a user message model on a wide area network. In identification circuits where security is not a concern, shorter word lengths (*e.g.*, 24 bits) may be used for an identification signal.

Voice signal S_V is asserted at regular intervals, for example in periodic bursts 820-825 of FIG. 8B. Signal S_V is comprised of periodic samples, which may be provided by a conventional A/D converter (not shown) at any desired point in the signal path from microphone 120 through transmitter 122. The A/D converter may be preceded by a suitable anti-aliasing filter (also not shown). If a delta-sigma A/D converter is used, only a single-pole RC anti-aliasing filter is needed. In system 100, signal S_V is a serial bitstream having bursts 820, 821, 822, 823, 824, and 825 of 16-bit samples, which are provided at a 8 kHz sample rate.

Activation signal S_A is asserted once, as burst 830, in the time span depicted in FIG. 8. Signal S_A may be asserted, with appropriate coding, whenever a change in the activation of speech recognition is desired. Signal S_A may be asserted with an "activate" code when stylus 110 initially becomes situated to receive voice input. For example, activation circuit 126 may so assert signal S_A when user 240 brings stylus 110 toward his or her mouth to begin generating text by voice input. Signal S_A may be again asserted (this time with an "inactivate" code) when stylus 110 is no longer situated to receive voice input. For example, activation circuit 126 may so assert signal S_A when user 240 moves stylus 110 away from his or her mouth and toward tablet 150 to begin editing text by freehand input. In system 100, signal S_A is a serial bitstream with bursts 830 having a single data bit, plus the two header bits.

Signals S_V, S_{ID}, and S_A are combined into a single signal 840. As may be better understood with reference to FIG. 8D, data bursts in signal 840 do not have identical timing to corresponding bursts in originating signals S_V, S_{ID}, and S_A. Bursts 820-825 from signal S_V do not need to be transmitted at constant intervals. Bursts 820-825 are merely numeric representations of signal samples that have been acquired and digitized at constant intervals. Bursts 820-825 need only to be transmitted at the same mean rate as the rate at which the signal samples were acquired. Speech recognizer 162 may process a series of digital samples (each conveyed by a respective data burst) for processing without concern for exactly when the samples were transmitted in digital form. In the event that timing of the digital samples is a concern, sample buffering (*e.g.*, using a FIFO) may be incorporated in receiver 160 to ensure that samples are passed along to speech recognizer 162 at substantially constant intervals.

Burst 810 from signal S_{ID} is passed on signal 840 as soon as it has been completed. Activation signal S_A takes high priority because it determines whether or not bursts from voice signal S_V are responded to. Consequently, burst 830 from signal S_A is passed on signal 840 immediately after burst 810, even though two bursts 821 and 822 of voice signal S_V are ready to be passed on as well. Bursts 821 and 822 are sent immediately after bursts 830, followed immediately by additional bursts 823, 824, and 825 from signal S_V.

In system 100, signal 840 is modulated into an electromagnetic signal suitable for transmission by transmitter 122. Receiver 160 demodulates the signal to provide signals

corresponding to signals S_V, S_{ID}, and S_A to speech recognizer 162. Receiver 160 may also provide some or all of these signals to other portions of tablet 150, as desired.

A tablet interface according to various aspects of the present invention (*e.g.*, tablet interface 164) includes (1) any tablet surface on which a stylus pointer may be manually manipulated and (2) suitable cooperating hardware (*e.g.*, stylus position indicator) and/or software (*e.g.*, for implementing handwriting recognition) that is responsive to freehand input communicated via the pointer. Any conventional tablet surface may be used, including, for example, a position sensitive membrane or an array of ultrasonic receivers for triangulating the position of a stylus pointer having a cooperating ultrasonic transmitter.

A tablet interface and stylus may include cooperating circuitry of the type disclosed in U.S. Patent 5,007,085, issued April 9, 1991 to Greanias *et al.* The detailed description portion (including referenced drawing figures) of this aforementioned patent is incorporated herein by reference. Further, the detailed description portion (including referenced drawing figures) of any U.S. patent or U.S. patent application incorporated by reference into this aforementioned patent is also specifically incorporated herein by reference.

Preferably, a conventional flat-panel display is integrated into the tablet surface. Such an integrated configuration is advantageous because, *inter alia*, visible "ink" may be displayed to show freehand input as if the stylus pointer were the actual tip of a pen. A display according to various aspects of the present invention may employ any conventional technology such as LCD. It is contemplated that newer display technologies such as IBM's "Roentgen," using aluminum and copper display materials, and "reversible paper" (*e.g.*, Xerox's "Gyricon") may also be integrated into a tablet surface in accordance with the invention.

In a variation, "reversible paper" may be overlaid on a tablet surface such that freehand input may be conveyed to the tablet surface through the "paper." In such a variation, the stylus may include an erasable writing marking medium to provide visible indicia of such freehand input on the "paper." Text generated, for example by voice input, may be displayed on a conventional display (*e.g.*, LCD, CRT, etc.) separate from the tablet surface. Color displays permits visible "ink" of different colors to be displayed. However, monochromatic displays may also be used, for example to save costs when incorporated into a number of tablets that are used as "scrap computers."

A tablet interface interprets editing commands responsive to freehand input and provides indicia of the editing commands to an editor. The tablet interface may also interpret handwriting responsive to freehand input and provide text data to the editor. Handwriting may be distinguished from editing commands by a subsystem of the type disclosed in U.S. Patent 5,862,256, issued Jan. 19, 1999 to Zetts *et al.* The detailed description portion (including referenced drawing figures) of this aforementioned patent is incorporated herein by reference. Further, the detailed description portion (including referenced drawing figures) of any U.S. patent or U.S. patent application incorporated by reference into this aforementioned patent is also specifically incorporated herein by reference. Tablet interface 164 of system 100, for example, suitably includes: tablet surface 152 having an integrated LCD display; conventional hardware (not shown) for determining the position of a stylus on surface 152; and a conventional CPU and memory (also not shown) having indicia of suitable software instructions for the CPU to implement, *inter alia*, handwriting and/or gesture recognition.

Editing commands include any commands for modifying text data that may be communicated by freehand input. A set of particularly advantageous editing commands is provided in TABLE II below.

TABLE II

Editing Command	**Corresponding Freehand Input**
Delete Text	Straight horizontal line through displayed text; or diagonal or wavy line through block of displayed text.
Underline Text	Straight horizontal line immediately below displayed text.
Capitalize Text	Two straight horizontal lines immediately below displayed text.
Lowercase character	Diagonal line through displayed character.
Bold Text	Straight horizontal lines immediately above and below displayed text.
Italicize Text	Diagonal slashes immediately before and after displayed text.

Editing Command	Corresponding Freehand Input
Correct Misrecognition of Text	Straight horizontal line through displayed text followed immediately by stylus tap somewhere on the text; or closed curve around block of displayed text followed immediately by stylus tap somewhere within the curve.
Indicate Text out of Present Context (without going through correction dialog)	Straight horizontal line through displayed text followed immediately by double stylus tap somewhere on the text
Indicate Text out of User Context (without going through correction dialog)	Straight horizontal line through displayed text followed immediately by another straight horizontal line back through the text, then by double stylus tap somewhere on the text, or
Copy Text	Closed curve around block of displayed text.
Paste Text	Double tap at desired insertion point on display of destination tablet (same or different from source tablet).
Move Insertion Point	Single tap at new insertion point on display of desired tablet (same or different from tablet having old insertion point).
Find Text	Question mark (?) drawn in isolated white space (e.g., margin) of display. Dictate text to find into provided text input dialog box.
Find Other Occurrences of Displayed Text	Closed curve around block of displayed text, immediately followed by question mark (?) drawn in isolated white space (e.g., margin) of display.

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In a variation of tablet 150, tablet interface 164 includes a conventional handwriting recognizer that responds to freehand input to generate text data in addition to, or as an alternative to, text data generated by voice input. In such a variation, tablet 150 performs two types of message recognition: speech recognition and handwriting recognition. As discussed below with reference to FIGS. 2, 3, and 5, an alternative system 200 includes a multi-input message recognizer 310. Message recognizer 310 performs both types of message recognition (speech and handwriting) in accordance with a unified message model. As discussed below, a unified message model according to various aspects of the present invention provides particular advantages.

A tablet according to various aspects of the present invention may include user controls for convenient navigation in an electronic document. For example, tablet 150 includes a "Page Up"

button 154 and a "Page Down" button 156 conveniently positioned together near the edge of tablet 150. User 240 may navigate through an electronic document using tablet 150 via depressing buttons 154 and 156 with his or her right thumb. When tablet 150 is positioned for comfortable use, for example resting on the thigh portion of a crossed leg of user 240, only one hand is needed for support and control of tablet 150. Typically, user 240 may then use an opposite hand to manipulate stylus 110 on surface 152 of tablet 150. If user 240 is right-handed, he or she may flip tablet 150 upside-down from the orientation shown in FIG. 1B to support and control tablet 150 with his or her left hand while manipulating stylus 110 with the right hand. If user 240 is one-handed, he or she may prefer to rest tablet 150 on a supporting surface and use stylus 110 for both freehand input and for depressing buttons 154 and 156.

Tablet surface 152 includes an integrated display for displaying an electronic document and any additional user controls that may be desired. Preferably, the display is configured to preserve clarity at a wide range of viewing angles and under varied lighting conditions. When tablet surface 152 is integrated with a color display, additional user controls may include a displayed group of software-based mode controls ("inkwells") at the bottom of tablet surface 152 for changing the behavior of freehand input. For example, user 240 may "dip" pointer 610 of stylus 110 in a red inkwell 157 to begin modifying text data using editing commands such as those in TABLE II. A yellow inkwell 158 may be provided to initiate highlighting and/or annotating of text data, a black inkwell 159 may be provided to initiate freehand input of new text data, and a white inkwell 153 may be provided to initiate erasure (*i.e.*, deletion) of text data. In a variation, touch-sensitive pads (each responsive to contact with pointer 610) may be provided below tablet surface 152 in red, yellow, black, and/or white colors to serve as such "inkwells."

An editor (*e.g.*, editor 168) according to various aspects of the present invention includes any suitable hardware and/or software for modifying text data as specified by editing commands. Examples of suitable editing commands are provided in TABLE II above. As discussed above, text data is any indicia of text that may be stored in conveyed numerically, including numerical codes representing individual units of text.

In one computing model, text data may be considered to be generated by a source other than an editor. In such a model, text data may be stored in a global memory segment that is

accessible to both a speech recognizer and an editor. In another computing model, text data may be considered to be generated by an editor that is responsive to external sources of text input. For example, text data may be stored in a local memory segment that is controlled by an editor. External sources of text (*e.g.*, a keyboard interface or speech/handwriting recognizer) may have access to such a local memory segment only through the editor that controls it. In either computing model, an editor has access to text data to both read and modify the text data. For example, editor 168 of tablet 150 (FIG. 1A) performs any desired modifications to text data generated by speech recognizer 162 in accordance with editing commands communicated by freehand input and interpreted by tablet interface 164.

A stylus according to various aspects of the present invention may be advantageously used with a tablet interface and editor of the type disclosed in U.S. Patent 5,855,000, issued December 29, 1998 to Waibel *et al.* The detailed description portion (including referenced drawing figures) of this aforementioned patent is incorporated herein by reference. Further, the detailed description portion (including referenced drawing figures) of any U.S. patent or U.S. patent application incorporated by reference into this aforementioned patent is also specifically incorporated herein by reference. For example, stylus 110 may be used to convey freehand input (*e.g.*, cursive handwriting, gestures) and voice input via the input device (*e.g.*, a tablet surface) and microphone, respectively, that are disclosed in U.S. Patent 5,855,000 to Waibel *et al.*

When suitably constructed (*e.g.*, with miniaturized electronics, lightweight materials, a thin, flat form factor, etc.), a tablet according to various aspects of a present invention may be made to have the look and feel of an "electronic notepad," which may be stacked and laid on a desk like a conventional paper document. When so constructed, a tablet such as tablets 150, 252, 254, and/or 256 may be used as a "scrap computer," analogous to scrap paper and having limited individualized identity and importance. Several such tablets may be used together in a network (preferably wireless) such that any one may be picked up and used anywhere in a work environment to display an electronic document and receive freehand input with a stylus. Instead of constantly opening and closing applications in the on-screen windows of a single desktop computer, a user may stack the tablets around an office and have several of them in use for various tasks at the same time.

A networked text processing system according to various aspects of the present invention includes any plurality of tablets networked together to permit exchange of data between them. Such networking provides particular advantages. For example, text data may be transferred between tablets. A document may be displayed in multiple views on displays of multiple tablets. A stylus including a microphone and identification circuit according to various aspects of the present invention may be used to generate text data in accordance with a message model associated with a particular owner of the stylus. Tablets may be networked together through a domain controller, or by peer-to-peer communication.

A network of tablets may be of the type disclosed in U.S. Patent 5,812,865, issued September 22, 1998 to Theimer *et al.* The detailed description portion (including referenced drawing figures) of this aforementioned patent is incorporated herein by reference. Further, the detailed description portion (including referenced drawing figures) of any U.S. patent or U.S. patent application incorporated by reference into this aforementioned patent is also specifically incorporated herein by reference.

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A preferred example of a text processing system including a network of tablets may be better understood with reference to FIGS. 2-5. Networked text processing system 200 suitably includes: a domain controller 220; a plurality (*e.g.*, three) of tablets 252, 254, and 256, each linked via wireless communications links 225 to domain controller 220; a first stylus 210 for conveying message input from a first user 242; and a second stylus 212 for conveying message input from a second user 244. Styluses 210 and 212 are linked to domain controller 220 via wireless communications links 235. System 200 further includes suitable wireless nodes 227 and 230 for establishing communications links 225 and 235, respectively.

A networked text processing system according to various aspects of the present invention may include only a single stylus. When multiple styluses are included, they need not be of the same type so long as they are all compatible with the system. For example, stylus 210 and stylus 212 may both be of the type of stylus 110 (FIGS. 1A, 1B, 6A, 6B). Alternatively, stylus 210 and stylus 212 may be of different types. For example, stylus 210 may be of the type of stylus 110 and stylus 212 may be of the type of stylus 710 (FIGS. 7A and 7B). In variations where the benefit of styluses having microphones is not required, conventional styluses without microphones may be used.

A networked text processing system according to various aspects of the present invention may include a node to a wide area network (*e.g.*, the Internet). A network connection permits one or more local message models that are internal to the system to be initialized to be in conformance with one or more user message models that are remote from the system (and possibly from each other). For example, system 200 includes a network node 232 for establishing a network connection link 237 between a plurality (*e.g.*, two) of user message models 264 and 262. When link 237 is established, local message model 316 may be initialized to be in conformance with message model 264 and/or message model 262, as discussed below.

Wireless nodes 227 and 230 include any suitable transmitter(s) and/or receiver(s) for establishing respective communications links 225 and 235. Transmitter 122 and receiver 160, discussed above with reference to FIG. 1A, are examples of suitable transmitters and receivers, respectively. Node 227 establishes bidirectional communications between domain controller 220 and each tablet 252, 254, and 256. Because communications link 225 is bidirectional, node 227 includes both a transmitter and receiver. Node 230 establishes unidirectional communications between domain controller 220 and styluses 210 and 212. Typically, only a unidirectional communications link is needed to a stylus, because the stylus typically only sends information.

Particular types of communications may be employed in communications links 225 and 235 in particular situations. For example, when tablets 252, 254, and 256 are in close proximity to each other and to domain controller 220 (*e.g.*, on a single work surface in a room), wired connections or infrared field radiation may be employed. When tablets 252, 254, and 256 are located in separate rooms from each other and/or from domain controller 220, suitable RF field radiation (*e.g.*, 1 GHz carrier frequency) may be employed.

A domain controller according to various aspects of the present invention includes any suitable hardware and/or software for controlling the interconnection of networked tablets to each other and to any styluses being used with the tablets. Advantageously, a domain controller may centrally implement functions of a message recognizer so that individual message recognizers are not needed in the networked tablets. In variations where the benefits of a domain controller are not required, networked tablets may each include a message recognizer and a receiver for establishing a communication link with one or more styluses.

As discussed in greater detail with reference to FIG. 3, exemplary domain controller 220 implements functional blocks including: message recognizer 310; stylus interface 320; and domain interface 330, which is coupled to message recognizer 310 as well as to a transfer buffer 340. As discussed above, interconnection between functional blocks may include hardware connections (*e.g.*, analog connections, digital signals, etc.) and/or software connections (*e.g.*, passing of pointers to functions, conventional object-oriented techniques, etc.). This interconnection is depicted in FIGS. 3A and 3B by signal lines for clarity.

Stylus interface 320 receives electromagnetic signals from one or more styluses (*e.g.*, styluses 210 and 212) and, responsive to the electromagnetic signal(s), couples one or more sets of signals to message recognizer 310. Each set includes a respective activation signal S_A, identification signal S_{ID}, and voice signal S_V.

Respective activation signals S_A activate message recognizer 310 (particularly speech recognizer 312) to provide text data responsive to voice input provided by a user of one particular stylus (*e.g.*, user 242 of stylus 210). In the event that activation signals from multiple styluses are received at once (indicating simultaneous voice input from multiple users), message recognizer 310 may provide respective portions of text data responsive to each voice input, for example by multitasking. Each portion of text may be conveyed to a different tablet for display. For example, text data provided responsive to voice (or handwriting) input from users 242 and 244 may be displayed separately (*e.g.*, as alphanumeric characters, kanji, etc.) on respective tablets 252 and 256. Alternatively, a hierarchy of styluses may be established such that message input conveyed by a low-ranking stylus may be preempted by message input conveyed by a high-ranking stylus. When multiple styluses are in wireless communication with a domain controller, electromagnetic signals from two or more styluses may be multiplexed by any suitable multiple access scheme (*e.g.*, spread spectrum, FDMA, TDMA, etc.).

Respective identification signals S_{ID} permit message recognizer 310 to associate message input conveyed by a particular stylus with a user message model of the user of a stylus. An identification signal according to various aspects of the present invention may include an encryption key to permit message recognizer 310 to interpret a user message model that has been encrypted for secure transmission across a wide area network. Message recognition in accordance with a user message model is described in greater detail below.

Domain interface 330 couples message recognizer 310 to tablets 252, 254, and 256 through wireless node 227 using any suitable multiple access and/or control protocol. Domain interface 330 conveys text data provided by speech recognizer 312 or handwriting recognizer 314 to a desired one of tablets 252, 254, and 256. Domain interface 330 also conveys respective stylus position signals S_P from tablet interfaces of tablets 252, 254, and 256 to handwriting recognizer 314.

Stylus position signal S_P communicates freehand input (conveyed to a tablet interface by a stylus) to handwriting recognizer 314 via domain interface 330. A stylus position signal conveys indicia of the position of the stylus on a tablet surface in any suitable format (*e.g.*, multiplexed binary words representing X, Y coordinates). When a stylus is aimed at, but does not contact, a particular point on a surface, a stylus position signal may convey indicia of the particular point aimed at.

An editor according to various aspects of the present invention may be implemented as part of a domain interface. For example, domain interface 330 may perform the same functions for networked tablets 252, 254, and 256 that editor 168 performs for tablet 150. When a domain controller performs functions of a message recognizer and editor for a plurality of networked tablets, hardware and/or software in the networked tablets may be simplified.

A domain controller may include a transfer buffer (*e.g.*, a portion of memory) to facilitate transmission of data from one networked tablet to another. For example, user 242 may cause text data to be copied from tablet 252 into transfer buffer 340 through domain interface 330. With an editing command from the set provided in TABLE II above, for example, the user may cause a block of displayed text data to be copied by using stylus 210 to draw a closed curve around the block. User 242 may then caused text data to be pasted from transfer buffer 340 to tablet 252. Again using an editing command from the set provided in TABLE II, the user may cause a block of displayed text data to be pasted by using stylus 210 to double-tap at the desired insertion point on the display of tablet 254. When tablets are interconnected in a peer-to-peer network (omitting a domain controller), text data that is copied from the display of a tablet may be stored in a transfer buffer in the tablet until the text data is pasted at a desired insertion point.

A domain controller may include a housing, supporting and/or control circuitry (*e.g.*, power supply, operator controls, etc.), and a conventional CPU and memory (not shown) having indicia

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of suitable software instructions for the CPU to implement, *inter alia*, functional blocks of FIG. 3. A "desktop" domain controller may be placed on a work surface as a semi-permanent fixture in a work area. Suitable variations of domain controllers include, for example, unobtrusive (perhaps hidden for aesthetic reasons) wall panels and electronic "white boards" (*e.g.* "Boards" of the type disclosed in U.S. Patent 5,812,865 to Theimer et al., incorporated by reference above). A domain controller may also be incorporated into one tablet of a plurality of networked tablets.

A message recognizer according to various aspects of present invention includes any suitable hardware and/or software for recognizing a message of at least one type to provide text data. A message includes any communication in writing, in speech, or by signals. As may be better understood with reference to TABLE III below, examples of types of messages to be recognized include voice input (for speech recognition), freehand input (for handwriting recognition), and visual input (for optical character recognition).

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TABLE III

Type of Message Recognizer	**Associated Type(s) of Message Input**	**Associated Type(s) of Message Model**
Generic: Message Recognizer	Generic: any communication in writing, in speech, or by signals	Generic: Message Model
Speech recognizer	Voice input (speech)	Acoustic model, language model
Handwriting recognizer	Freehand input (handwriting)	Handwriting model, language model
Visual character recognizer	Visual input (printed or handwritten characters that are scanned for OCR)	Character model, language model
Sign language recognizer	Visual input (CCD image of signing hands) or tactile input (glove with sensors)	Gesture model, language model

A message recognizer may include multiple subordinate message recognizers of different types within it. A message recognizer may include, for example, a speech recognizer or a handwriting recognizer, or both. A speech recognizer according to various aspects of the present invention includes any suitable hardware and software for providing text data responsive to voice

input. A concise summary of the operation of a conventional speech recognizer is provided in U.S. Patent 5,839,106 to Bellegarda (incorporated by reference below), particularly from column 3, line 46 through column 4, line 43. A handwriting recognizer according to various aspects of the present invention includes any suitable hardware and software for providing text data responsive to freehand input. A handwriting recognizer may be of the type disclosed in U.S. Patent 5,903,668, issued May 11, 1999 to Beernink, incorporated by reference above.

A message recognizer may include a visual handwriting recognizer for generating text data from scanned handwriting, which may be of the type disclosed in U.S. Patent 5,862,251, issued Jan. 19, 1999 to Al-Karmi *et al.* The detailed description portion (including referenced drawing figures) of this aforementioned patent is incorporated herein by reference. Further, the detailed description portion (including referenced drawing figures) of any U.S. patent or U.S. patent application incorporated by reference into this aforementioned patent is also specifically incorporated herein by reference.

A message recognizer including both a speech and handwriting recognizer may be adapted from the disclosure of U.S. Patent 5,502,774, issued March 26, 1996 to Bellegarda. The detailed description portion (including referenced drawing figures) of this aforementioned patent is incorporated herein by reference. This aforementioned patent cites a number of technical papers that may be reviewed for further guidance on the structure, training, and operation of conventional speech recognizers and handwriting recognizers. In a variation, a message recognizer may include a speech recognizer and handwriting recognizer of the type disclosed in U.S. Patent 5,855,000, issued December 29, 1998 to Waibel *et al.*, incorporated above by reference. In domain controller 220, message recognizer 310 includes both a speech recognizer 312 and handwriting recognizer 314 for recognizing voice and handwriting types of message input, respectively.

A message model according to various aspects of present invention includes any model (*e.g.*, algorithm, mathematical expression, set of rules, etc.) for defining operation of a message recognizer to provide text data responsive to message input. Conventionally, a message model includes a language model and a model specific to one type of message recognition. For example, a conventional speech recognizer operates in accordance with a type-specific message model consisting of a language model and an acoustic model. As a further example, a

conventional handwriting recognizer operates in accordance with its own type-specific message model that consists of a language model and a handwriting model.

A unified message model according to various aspects of the present invention provides particular advantages over a conventional message model. A unified message model is a message model that includes a shared language model and models specific to at least two types of message recognition. As may be better understood with reference to FIG. 9, a unified message model may suitably include, *inter alia*, a language model, an acoustic model, and/or a handwriting model.

A message recognizer may include two or more types of subordinate message recognizers, each of which may operate in accordance with a shared language model. Advantageously, the accuracy of each subordinate message recognizer may be improved by user correction of misrecognition by any of the message recognizers. For example, the syntactic language model in a shared language model may be trained by user correction of any type of erroneous message recognition performed by the message recognizer. An exemplary correction process 1400 is described below with reference to FIG. 14.

A shared language model according to various aspects of the present invention is any language model that may be shared between two types of subordinate message recognizers included within a message recognizer. A message recognizer of a first type may provide text data responsive to a first type of message input (*e.g.*, voice input) in accordance with the shared language model and a first type-specific model (*e.g.*, an acoustic model). A message recognizer of a second type may provide text data responsive to a second type of message input (*e.g.*, freehand input) in accordance with the shared language model and a first type-specific model (*e.g.*, a handwriting model). A language model may be of a conventional type, for example consisting of an N-gram syntactic model.

An example of a unified message model may be better understood with reference to FIG. 3B. Local message model 316 includes a language model 350, an acoustic model 356, and a handwriting model 358. An acoustic model is any model that may be used to determine basic units of speech (*e.g.*, phonemes, allophones, etc.) responsive to suitably transformed voice input (*e.g.*, by a conventional acoustic feature extractor). A handwriting model is any model that may be used to determine basic units of handwriting conveyed by freehand input (*e.g.*, strokes of

printed characters or cursive words) responsive to suitably transformed freehand input, for example as disclosed in U.S. Patent 5,903,668 to Beernink (incorporated by reference above).

Speech recognizer 312 generates text data in accordance with acoustic model 356 and shared language model 350. Handwriting recognizer 314 generates text data in accordance with handwriting model 358 and shared language model 350. Advantageously, user training of language model 350 can improve accuracy of both speech recognizer 312 and handwriting recognizer 314. For example, user correction of misrecognition by speech recognizer 312 adapts syntactic model 352 of shared language model 350. Both speech recognizer 312 and handwriting recognizer 314 then operate in accordance with the adapted syntactic model.

A local message model according to various aspects of the present invention is any message model that is local to a message recognizer operating in accordance with the message model. A message model is said to be local to a message recognizer when the message recognizer may operate in accordance with the message model without the necessity of communications outside its local processing environment. For example, a message model implemented in the same memory space, virtual machine, or CPU as a message recognizer is said to be local to the message recognizer.

A user message model according to various aspects of the present invention is any message model that is specific to a particular user. In variations where the benefits of a unified message model are not required, a user message model may be of a conventional type. A message model is said to be specific to a particular user when the message model may be adapted by training input from the user. Such adaptation provides improved recognition.

Training input includes corrections of misrecognized message input by any suitable form of user input. For example, a tablet (*e.g.*, tablet 252) according to various aspects of the present invention may include a character interface for user correction of misrecognition. A character interface is any user interface (*e.g.*, conventional keyboard or software user interface simulating a keyboard on a display) that is responsive to character input. Character input is a selection of specific characters using a character interface, for example by using a stylus to depress keys on a miniature keyboard or to tap areas of a display that represent keys of a simulated keyboard.

When a character interface (not shown) is provided (*e.g.*, on a display of tablet 252), a language model according to various aspects of the present invention may be adapted by a

correction process using (at least in part) character input. An exemplary correction process 1400 may be better understood with reference to FIG. 14. Process 1400 begins at step 1410 with a user specifying, typically by freehand input, a selection of text that has been generated (erroneously) by a message recognizer. At step 1420, a correction mode is initiated for modifying the selection.

A user may specify text and initiate a correction mode by communicating any appropriate editing command (*e.g.*, with freehand input, voice input, etc.). With an editing command from the set provided in TABLE II above, for example, the user may cause steps 1410 and 1420 to be carried out by using a stylus to draw a straight horizontal line through a displayed text segment, then immediately tapping the stylus somewhere on the text segment. As alternatively specified in TABLE II, a user may also specify a selection of text by drawing a closed curve around a block of displayed text (*e.g.*, a phrase of several words), then immediately tapping the stylus somewhere within the curve.

At step 1430, a list of alternative text comparable to the selection is provided. The list includes text segments that each received a high score (but not the maximum score) during hypothesis testing of the message recognizer. Two lists of alternative text of the type that may be produced at step 1430 are shown by way of example in TABLE IV and TABLE V below. As discussed below, the lists of TABLE IV and TABLE V were displayed in a correction mode of a conventional computer configured as a speech recognizer by executing conventional speech recognition software, marketed as NATURALLY SPEAKING, Preferred Edition, version 3.01, by Dragon Systems, Inc.

At step 1440, the list of alternative text is updated, based on character data communicated after initiation of the correction mode. In a conventional speech recognizer such as a computer executing the NATURALLY SPEAKING software, the displayed list of alternative text changes as different characters are entered by a user using character input.

At step 1450, the selected text segment is modified responsive to the character input. Step 1450 is carried out when the user indicates that the text segment as modified accurately reflects the message input provided by the user. In a conventional speech recognizer such as a computer executing the NATURALLY SPEAKING software, the modifications to the selected text segment are entered when the user selects an "OK" control of a displayed user interface dialog.

At step 1460, the syntactic model is conventionally adapted in accordance with the user's modification to the selected text segment.

When a language model includes a semantic model according to various aspects of the present invention, training input also includes user identification of a present context or a user context. User identification of context may be performed in addition to, or alternatively to, correction of misrecognized message input.

Local message model 316 may be initialized to be in conformance with one or more user message models (*e.g.*, user message model 262 or 264). A local model is said to be in conformance with a user model when a message recognizer operating in accordance with the local model behaves substantially as if it were actually operating in accordance with the user message model.

Initialization of a model entails creation of a new model or modification of a model from a previous configuration to a new configuration. A local model may be initialized by any suitable hardware and/or software technique. For example, a local model may be initialized by programming of blank memory space with digital indicia of a user model that the local model is to conform with. Alternatively, a local model may be initialized by overriding of memory space containing digital indicia of a previous configuration with indicia of digital indicia of a new configuration. The previous configuration of the local model is in conformance with a previous local model (*i.e.*, of a previous user). The new configuration is in conformance with a new local model (*i.e.*, of a new user).

In system 200, local message model 316 may be initialized to be in conformance with, for example, user message model 262. During this initialization, digital indicia of user message model 262 is transferred to the local processing environment of message recognizer 310 via network connection 237 and digital signal S_N.

Message recognizer 310 may retrieve a selected user message model from a remote database via, for example, an Internet connection. Identifying signal S_{ID} may specify an Internet address (*e.g.*, URL) from which the stylus owner's model may be retrieved. Local message model 316 may then be initialized to conform to the remotely located user model. When security is a concern, the user message model may be transmitted in an encrypted format, to be decrypted in accordance with a key that may be provided, for example, in identifying signal S_{ID}.

After a message recognition session, a local message model may have been adapted by user training, preferably including both correction of misrecognition and user identification of a user context. Advantageously, a user message model may be initialized to be in conformance with an adapted local message model. For example, message recognizer 310 may transfer digital indicia of local message model 316 (after user training) from its local processing environment to a remote database where user message model 262 is stored. User message model 262 may thus be initialized to be in conformance with adapted local message model 316. Accordingly, in message recognizer according to various aspects of the present invention provides a user with the opportunity to adapt and modify his or her user message model over time, regardless of the particular system in which he or she employs it for message recognition. A user of such a message recognizer may develop a highly adapted message model by, and for, use of the model in many different message recognition systems.

User training may include adaptation of an acoustic model in the message model. Advantageously, the acoustic model may be adapted over time using a single stylus-mounted microphone. Use of the same stylus for user training provides acoustic consistency, even when the stylus is used with many different message recognition systems.

In variations where the benefits of a user message model are not required, a message recognizer may operate in accordance with a number of generic local message models, each generally tailored to portions of an expected user population. When so configured, domain controller 220 may include a local database in non-volatile memory (not shown) for storing such models.

As discussed above, a message recognizer according to various aspects of the present invention may be responsive to message input from a plurality of users to provide respective portions of text data. Such a message recognizer may operate in accordance with a plurality of respective local message models. Each respective local message model may be initialized to be in conformance with a user message model of a particular user. For example, message recognizer 310 may operate at times in accordance with a second local message model (not shown). This second model may be initialized to be in conformance with a second user message model, for example user message model 264.

A language model is any model that may be used to determine units of language responsive to input sequences of text segments. Such input sequences may be derived, for example, from voice input and/or freehand input in accordance with a respective acoustic model or handwriting model. In message recognizer 310, for example, speech recognizer 312 first derives units of speech responsive to feature vectors (which are conventionally derived from voice signal S_V) in accordance with acoustic model 356. (Acoustic model 356 is part of unified message model 316.) Speech recognizer 312 then derives units of language (here, strings of text data) from the units of speech in accordance with language model 350. Speech recognizer 312 provides the derived units of language as text data to domain interface 330. Handwriting recognizer 314 first derives units of handwriting responsive to feature vectors (which are conventionally derived from stylus position signal S_P) in accordance with handwriting model 358. Handwriting recognizer 314 then derives units of language (again, strings of text data) from the units of handwriting in accordance with language model 350. Handwriting recognizer 314 provides the derived units of language as text data to domain interface 330. Handwriting recognizer 314 also provides (to domain interface 330 and ultimately to an editor) indicia of any editing commands conveyed by freehand input, as communicated by stylus position signal S_P.

Language model 350 includes a syntactic model 352 and a semantic model 354. Syntactic model 352 provides a set of *a priori* probabilities based on a local word context, and may be a conventional N-gram model. Semantic model 354 provides probabilities based on semantic relationships without regard to the particular syntax used to express those semantic relationships. As described below, semantic model 354 may be adapted according to various aspects of the present invention for accurate identification of a present context or a user context. In a variation where the benefits of user context identification are not required, semantic model 354 may be of the type disclosed in U.S. patent 5,828,999 to Bellegarda et al. (incorporated by reference below). In a further variation where the benefits of semantic analysis are not required, language model 350 may omit semantic model 354.

As discussed above, a language model may include a syntactic model, a semantic model having a plurality of semantic clusters, or both. For example, a language model may be of the type disclosed in U.S. patent 5,839,106, issued November 17, 1998 to Bellegarda and U.S. patent 5,828,999, issued October 27, 1998 to Bellegarda *et al.* The detailed description portion (including referenced drawing figures) of each of these two aforementioned patents is

incorporated herein by reference. Further, the detailed description portion (including referenced drawing figures) of any U.S. patent or U.S. patent application incorporated by reference into either of these two aforementioned patents is also specifically incorporated herein by reference.

A semantic model may be adapted, according to various aspects of the present invention, for accurate identification of a present context, *i.e.*, the context of text currently being presently generated or a user context, *i.e.*, the type of text that may be expected to be generated by the user. A system and method according to various aspects of the invention provides the user with an opportunity to identify text segments that are not expected to occur in the present context of the text currently being generated, or in the user context. Such text segments are referred to herein as "stop segments," and may include more or less text than a single word. Semantic clusters associated with user-identified stop segments may be expected, in accordance with the inventive semantic model, to be outside the present context.

The semantic model may be part of a shared language model of the invention. In message recognizer 310, for example, semantic model 354 is part of shared language model 350. A message recognizer may include two or more subordinate message recognizers, each of which may operate in accordance with the semantic model in the shared language model. Advantageously, the accuracy of each subordinate message recognizer sharing a language model that includes a semantic model model according to various aspects of the present invention may be improved by user identification of context.

A message recognizer (*e.g.*, speech recognizer 162 of system 100 or message recognizer 310 of system 200) may perform a context-sensitive hypothesis test of text segments against message input in accordance with an adapted semantic model. In cooperation with the message recognizer, the adapted semantic model biases against those tested segments that have a high probability of occurrence in clusters considered to be outside the present context. Advantageously, the model may cause such biasing by simply applying a negative bias against those text segments having a high probability of shared cluster occurrence with stop segments. A semantic model is said to bias against a tested segment when a message recognizer scores the tested segment less favorably in a hypothesis test due to the operation of the semantic model.

In the discussion below of semantic models according to the invention, two examples of semantic model operation are provided to illustrate the benefit of user context identification in

particular situations. The first of these two examples illustrates how certain text segments can be expected to be especially useful for indicating context as stop segments. The second example illustrates how certain text segments are less useful for indicating context.

The first example of semantic model operation is referred to herein as the "Coors Uncle" example. In the "Coors Uncle" example, the phrase "straight *horizontal* line through" was dictated (*i.e.*, communicated by voice input) to a conventional speech recognizer, which was a computer executing the NATURALLY SPEAKING software discussed above. The speech recognizer provided the text data "straight *Coors Uncle* line through" in response to the voice input. The dictated phrase and the speech recognizer's alternative text segments are listed below in TABLE IV.

TABLE IV

Dictated Phrase: Straight [Coors Uncle] horizontal line through	
Ranking	**Alternative Text**
1	Coors Uncle
2	cores Uncle
3	core is Uncle
4	Coors uncle
5	Cora's uncle
6	core his uncle
7	or his uncle
8	core as Uncle
9	corps is Uncle
10	quarters Uncle

The phrase "straight horizontal line through" was dictated by the Applicant during preparation of the present patent application. The text data "straight *Coors Uncle* line through," generated by the conventional speech recognizer (a computer executing the NATURALLY SPEAKING software) in response, was clearly out of the context of such a document. Because it would be very unusual for the Applicant to write a document relating to the consumption of alcoholic beverages, words relating to alcohol consumption (e.g., beer, brewing, etc.) are

unlikely to appear in any document the Applicant generates. If a message recognizer operating in accordance with the semantic model of the invention were used, the word COORS (a registered trademark of the Coors Brewing Company) would likely have been designated as a stop word outside the user context.

As discussed below, a user may identify stop segments by any suitable system or method. In the "Coors Uncle" example, the user may identify the word COORS as being outside the user context by drawing a double line through it, for example in the first alternative text listing "Coors Uncle." Double lines may then appear drawn through each occurrence of the word COORS, since the word has been identified as a "user context" stop segment.

A nontechnical word that appears in a technical document such as a patent application may be designated as a stop word outside the present context, regardless of the author's overall writing habits. For example, words relating to familial relationships (including the word UNCLE) are not typically used in patent applications. In the "horizontal" example, a user may identify the word UNCLE as being outside the present context (but not the user context) by drawing a single line through it, for example in the first alternative text listing "cores Uncle." Double lines may then appear drawn through each occurrence of the word UNCLE, since the word has been identified as a "present context" stop segment.

A user context is the context of all documents generated by a particular user. A user context may also be viewed as a context of all documents generated by a group of users, such as members of a particular collaborative group. Examples of collaborative groups include project teams, institutions, corporations, and departments. Members of a collaborative group may share a common pool of stop segments. A stop segment designated by any member of the group as being outside his or her user context is then considered to be outside the user context of each group member. In one variation, a leader of the group may review a list of pooled stop segments and edit the list. In another variation, each group member may remove pooled user stop segments (at least from operation of message recognition responsive to his or her message input) that the member considers to be inside his or her particular user context.

Advantageously, a user context may exclude words not consistent with the writing style of a particular user (or collaborative group). For example, a user who writes only technical documents may appreciate the opportunity to designate profanities and slang terms as being

outside the user context. The designation of a profanity or slang term as a stop word outside the user context may cause a semantic model of the invention to bias against other profanities or slang terms. Alternatively, a fiction writer may appreciate the opportunity to designate technical terms as being outside the user context.

The second example of semantic model operation is referred to herein as the "words on" example. In the "words on" example, the phrase "straight *horizontal* line through" was again dictated (*i.e.*, communicated by voice input) to a conventional speech recognizer, which was again a computer executing the NATURALLY SPEAKING software. The speech recognizer provided the text data "straight *words on a* line through" in response to the voice input. The dictated phrase and the speech recognizer's alternative text segments are listed below in TABLE V.

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TABLE V

Dictated Phrase: Straight [words on a] horizontal line	
Ranking	**Alternative Text**
1	words on a
2	words on
3	for his all

The phrase "straight horizontal line through" was dictated the second time by the Applicant during preparation of the present patent application. The text data "straight *words on a* line through," generated by the conventional speech recognizer (a computer executing the NATURALLY SPEAKING software) in response, was not clearly out of the context of such a document. The text segments "words," "on," and "a" are common words that appear frequently in many different types of documents including the present patent application. If a message recognizer operating in accordance with the semantic model of the invention were used, none of the alternative text segments listed in TABLE V would be useful to designate as stop segments.

A semantic cluster includes any semantic association of text in a language model. In a first exemplary semantic model of the present invention, a semantic cluster is of a first type. The first type of semantic cluster is a mathematically derived group of vectors representing text segments (*e.g.*, words). The vectors may lie in a word-document vector space defined by a word-

document matrix, which tabulates the number of times each word of a suitable training corpus occurs in each of a plurality of documents (or paragraphs, sections, chapters, etc.) in the corpus. The vectors may be clustered, for example, based on a distance measure between the word vectors in the vector space after a singular value decomposition of the word-document matrix. Such a technique is taught in U.S. patent 5,828,999 to Bellegarda *et al.*, incorporated by reference above. The disclosure found from column 4, lines 8-54; from column 5, line 35 through column 7, line 35; and column 8, lines 3-24 of the aforementioned patent is considered particularly instructive for the identification of semantic clusters of this first type.

In a second exemplary semantic model of the present invention, a semantic cluster is of a second type. The second type of semantic cluster is a discrete grouping of text that may be expected to have a particular context, *e.g.*, discussing a particular topic. Examples of semantic clusters of this type include documents within a document collection (*e.g.*, an article within the standard Wall Street Journal training corpus), paragraphs within a document, and sections of text separated by headings in a document.

Additional types of semantic clusters include, for example, a third type of semantic cluster, which is defined with respect to an individual reference word that is considered to be indicative of a particular context. For example, a semantic cluster of this type may include all words found within a given number (*e.g.*, 50) of a particular reference word in a training corpus. Such a semantic cluster may be given indefinite boundaries by applying words further from the reference word may given a lower semantic association than text close to the reference point.

A method 1000 for the identification of semantic clusters of the second type (for the second exemplary semantic model) may be better understood with reference to FIG. 10. Method 1000 begins with a suitable training corpus, which is partitioned into discrete semantic clusters at step 1010. Discrete semantic clusters are semantic clusters of the second type discussed above. A commonly used corpus is the standard Wall Street Journal corpus. Another corpus, referred to as TDT-2, is available from Linguistic Data Consortium (LDC). The TDT-2 corpus consists of about 60,000 stories collected over a six-month period from both newswire and audio sources. When the TDT-2 corpus is employed in process 1000, each story is preferably partitioned into a discrete semantic cluster at step 1010.

At step 1020, each semantic cluster is analyzed. Text segments occurring in each cluster are counted and tabulated into a two-dimensional matrix Z. This matrix is used at steps 1030 and 1050 to compute probabilities of global and shared cluster occurrence, respectively.

An exemplary process 1100 for carrying out step 1020 may be better understood with reference to FIG. 11. At step 1110, process 1100 begins by setting pointers i and k both to zero for counting of the first text segment w_0 in the first cluster C_0. At step 1120, a count is made of the number of occurrences of one text segment w_i of the corpus in one cluster C_k of the corpus. When step 1120 is first carried out after step 1110, the count is made of the number of occurrences of the first text segment w_0 in the first cluster C_0. Each count is tabulated in a respective element $Z_{i,k}$ of matrix Z, starting with element $Z_{0,0}$.

After each occurrence of step 1120, a determination is made at decision step 1130 as to whether or text segments of the corpus are still to be counted in the present cluster. If so, pointer i is incremented at step 1135 and step 1120 is repeated to count the number of occurrences of the next text segment of the corpus in the present cluster. If no text segments remain to be counted in the present cluster, process 1100 continues at decision step 1140.

At decision step 1140, a determination is made as to whether or semantic clusters of the corpus are still to be analyzed. If so, pointer k is incremented at step 1145 and step 1120 is repeated to count the number of occurrences of the first text segment of the corpus in the next cluster. If no clusters remain to be analyzed, process 1100 is complete and method 1000 continues at 1030 (FIG. 10).

At step 1030, the probability of global cluster occurrence is computed for most (or all) text segments in the corpus. In the second exemplary semantic model, the probability of global cluster occurrence may be expressed as $Pr(w_i|V)$. "V" indicates "given the entire vocabulary (*i.e.*, corpus)." $Pr(w_i|V)$ is the probability that a given text segment w_i of the corpus will appear in a random sample (adjusting for sample size) of text segments chosen from the corpus. $Pr(w_i|V)$ may also be viewed as the probability that a randomly chosen text segment of the corpus (globally, *i.e.*, without regard to any particular semantic cluster) will be a given text segment w_i. The more times a given text segment w_i appears in the corpus, no matter how distributed, the higher probability $Pr(w_i|V)$ will be.

Probability $Pr(w_i|V)$ may be computed (at least as an estimate) by any suitable statistical technique. For example, probability $Pr(w_i|V)$ may be computed for a given text segment wi based on the total number of occurrence of segment wi in matrix Z, divided by the total number of occurrences of all segments in matrix Z. Determination of probability $Pr(w_i|V)$ may be expressed by the following equation:

$$\Pr(w_i|V) \cong \frac{\sum_{k=0}^{N} Z_{i,k}}{\sum_{j=0}^{L}\sum_{k=0}^{M} Z_{j,k}}$$

At step 1040, a subset of text segments is selected for further analysis. The subset excludes text segments having a very high probability of global cluster occurrence. In the second exemplary semantic model, text segments that appear often are less likely to receive a negative bias, even though they may appear often in the same semantic clusters as stop words. The expectation is that commonly occurring text segments can be expected to occur in many different contexts, and that the present context is less likely to exclude such text segments.

By selecting text segments having a probability of global cluster occurrence $Pr(w_i|V) < P_1$, where P_1 is a predetermined upper limit of "commonness," words likely to be biased against may be omitted from consideration in the second exemplary semantic model. In the "Coors Uncle" example, the word BAR may be expected to appear in semantic clusters where consumption of alcohol may be discussed and could thus receive some negative bias when the word COORS is identified as a stop segment. However, the word BAR also has many synonymous meanings (e.g., "sand bar," "metal bar," "patent bar," etc.) and would have relatively high probability of global cluster occurrence in most corpora, thus limiting the negative bias. By omitting words such as BAR that are likely to be biased against less severely, the second exemplary semantic model may be simplified.

At step 1050, the probability of shared cluster occurrence is computed for the selected text segments. In the second exemplary semantic model, the probability of shared cluster occurrence may be expressed as $Pr(w_i w_j|V)$. $Pr(w_i w_j|V)$ is the probability that two given text segments w_i and w_j of the corpus will appear together in a random sample (adjusting for sample size) of text

segments chosen from the corpus. The more times two given text segments w_i and w_j appear together in semantic clusters of the corpus, the higher probability $Pr(w_i w_j |V)$ will be.

Probability $Pr(w_i w_j |V)$ may be computed (at least as an estimate) by any suitable statistical technique. For example, probability $Pr(w_i w_j |V)$ may be computed for a given combination of text segments w_i and w_j based on the total number of occurrence of segment wi in matrix Z, divided by the total number of occurrences of all segments in matrix Z. The probability of shared cluster occurrence of text segments w_i and w_j may be estimated as the ratio between (1) the number of times text segments w_i and w_j can be paired together within semantic clusters of the corpus and (2) the total number of text segments in the corpus. Such an estimation of probability $Pr(w_i |V)$ may be expressed by the following equation:

$$\Pr(w_i w_j | V) \cong \frac{\sum_{k=0}^{N} Min\{Z_{i,k}, Z_{j,k}\}}{\sum_{m=0}^{M}\sum_{k=0}^{N} Z_{m,k}}$$

Step 1060, probabilities $Pr(w_i |V)$ and $Pr(w_i w_j |V)$ are tabulated for each text segment in the subset and method 1000 is completed. An exemplary data structure 1200 for the tabulation of these probabilities may be better understood with reference to FIG. 12. Data structure 1200 includes tabulations of probabilities relating to three example words UNCLE, COORS, and BEACH of an exemplary subset. As discussed above, these words are used to illustrate two examples of message recognition in accordance with a semantic model of the present invention. As illustrated in data structure 1200, for example, the word UNCLE may be expected to have a high probability of shared cluster occurrence with other words related to familial relationships. By way of example (and not intended to be a report of actual results), words AUNT, NEPHEW, RELATIVE, and BROTHER are shown in data structure 1200 as secondary text segments under the primary text segment UNCLE. (In data structure 1200, a text segment that forms the heading of a listing is said to be a primary text segment and a text segment listed under the heading is said to be a secondary text segment.) In a tabulation performed at step 1060 of method 1000, using a training corpus described above, it is expected that the secondary text segments shown in

FIG. 12 would be listed with relatively high probabilities $Pr(w_i w_j |V)$ under each primary text segment shown.

In a variation, step 1060 may include manual editing of a tabulation such as that of data structure 1200. Primary text segments known to be poor indicators of context as stop segments may be manually identified and purged from the tabulation of data structure 1200, along with text segments listed under the purged text segments. For example, a manual (i.e., human) editor may know, based on his or her knowledge of linguistics and human intelligence, that certain secondary text segments have a closer semantic association with a given primary text segment than the probabilities otherwise generated by method 1000 would indicate. Accordingly, the manual editor may adjust the probability $Pr(w_i w_j |V)$ for each of those secondary text segments. In a further variation, step 1060 may include refinement of a tabulation such as that of data structure 1200 in an iterative design process. Such a design process may include manual and/or computer controlled editing of such a tabulation. For example, the design process could add and purge various secondary text segments, and modify probability $Pr(w_i w_j |V)$ for various secondary text segments, with the goal of minimizing an error constraint. A suitable error constraint may be the perplexity of message recognition, which may be (using a suitable test corpus) performed in accordance with each semantic model resulting from each iteration of the tabulation.

As discussed above, a stop segment is any text segment (*e.g.*, word, phrase, portion of a compound word) that has been identified by a user as being expected to be outside the present context or the user context. Stop segments may be identified by a user in a context definition mode. For example, a context definition mode may present the user with (1) a maximum likelihood text segment and (2) alternative text segments that the user could identify as being outside the present context or user context. The user may select alternative text segments to identify them as stop segments, for example by freehand input.

A user may identify stop segments by any suitable system or method. Stop segments may be identified in a context definition mode, which may be initiated whenever the identification of stop segments may be useful to determine context. The context definition mode may be initiated during a message recognition session, or prior to it. (An example of a message recognition session is the dictating of a document by voice input, with editing of the document by freehand

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input.) A context definition mode may be initiated automatically when alternative text segments are located (*e.g.*, during hypothesis testing) that may be expected to be especially useful for indicating context as stop segments. Alternatively or in addition, a context definition mode may be initiated manually (*i.e.*, by the user).

An exemplary method 1300 for user identification of stop segments during message recognition may be better understood with reference to FIG. 13. Method 1300 begins at step 1310 with a segment of message input provided by a user. Such a segment may include, for example, a sentence dictated by the user with voice input or a handwritten phrase conveyed by the user with freehand input.

At step 1320, a message recognizer (*e.g.*, speech recognizer 162, message recognizer 310) performs hypothesis testing to identify text segments that each receive a high score in accordance with a message model. The text segment receiving the highest score (*i.e.*, the maximum likelihood text segment) is conventionally provided as the message recognizer's "best guess" of the text data corresponding to the message input. Text segments receiving high scores (*e.g.*, in the top 10) but not the highest are considered alternative text segments.

Although method 1300 is for the preparation of a semantic model according to various aspects of the present invention, the hypothesis testing of step 1320 may be performed in accordance with only a syntactic model. No semantic model may be used at step 1320 in certain situations, for example at the beginning of a message recognition session when the semantic model may not be considered ready for use.

At decision step 1330, a determination is made as to whether context definition is to be activated. If no context definition is initiated automatically or manually, message recognition proceeds at step 1310. If context definition is to be initiated, a context definition mode is entered for user identification of one or more stop segments.

In method 1300, a context definition mode is activated at step 1340. At step 1340, alternative text segments are listed for possible identification as stop segments by the user. At step 1350, text segments (if any) considered to be outside the present or user context are identified as stop segments.

A user may initiate a context definition mode manually. The context definition mode may be initiated when the user initiates a correction mode to correct a misrecognition by the message recognizer. Alternatively, a user may communicate an appropriate editing command to indicate, without initiating a correction process, that a text segment provided by a message recognizer is out of either the present context or the user context. With an editing command from the set provided in TABLE II above, for example, the user may indicate that a displayed text segment is out of the present context by using a stylus to draw a straight horizontal line through the text segment, then immediately double-tapping the stylus (*i.e.*, tapping the stylus twice, rapidly) somewhere on the text segment. The user may indicate that the text segment is out of the user context by using a stylus to draw a straight horizontal line through the segment, followed immediately by another straight horizontal line back through the segment, then immediately double-tapping the stylus somewhere on the segment.

A message recognizer may also have the ability to initiate a context definition mode automatically. A context definition mode may be automatically initiated when the message recognizer determines that one or more alternative text segments (*e.g.*, text segments receiving a high score during hypothesis testing) may be expected to be especially useful for indicating context as stop segments. A text segment may be expected to be especially useful for indicating context when it has a relatively high probability of global cluster occurrence and a relatively low probability of shared cluster occurrence with text segments in a document being generated (*e.g.*, other alternative text segments or the "best guess" of the message recognizer).

A context definition mode that is initiated automatically a present the user with a list of alternative text segments in addition to the message recognizer's "best guess." Alternatively, the user may be present with a simple question that may be quickly answered. For example, if the user dictates the sentence "Can you recognize speech?", the message recognizer may determine that the word BEACH could be especially useful for indicating context as a stop segment. If the message recognizer is configured to initiate a context definition mode automatically, the user might be presented with a dialog box containing the statement "You dictated the phrase RECOGNIZE SPEECH. Is the word BEACH of context?" and three "radio buttons" labeled "No," "Yes, this time," and "Always." If the word BEACH is not out of context, the user could select (or say) "No." If the word BEACH is outside the present context, the user could select or

say "Yes, this time." If the word BEACH is outside the user context, the user could select or say "Always."

For optimal configuration of a message recognizer to automatically initiate a context definition mode, a number of factors should be considered and weighed. Text segments that rarely occur in any context (*i.e.*, low probability of global cluster occurrence) are less useful as stop segments because they can be expected to have a high probability of shared cluster occurrence with only a limited number of other text segments. However, text segments that occur in very many contexts (*i.e.*, very high probability of global cluster occurrence) are of limited usefulness as stop segments because they could be expected to cause negative bias to many alternative text segments, in some cases a majority. Text segments that occur frequently in many contexts (*i.e.*, high probability of shared cluster occurrence with many text segments) are also of limited usefulness as stop segments because they can be expected to cause significant negative bias with only a limited number of other text segments. Text segments that have been generated previously in a document (or by a user) may be excluded from consideration as stop segments, since it may be presumed that the user has previously considered such text segments to be in the present (or user) context.

A message recognizer may initiate a context definition mode at the beginning of a message recognition session. For example, a list of text segments that are known to be especially useful as stop segments may be presented to a user. With a conventional dialog user interface, the user may check boxes appropriately labeled (e.g., "User" and "Present") next to listed text segments to identify them as stop segments being outside of the user or present context, respectively. Several lists may be presented interactively to the user to refine the definition of context as user input is processed. For example, if the user identifies the word UNCLE in a first list as being outside the present context (because it relates to familial relationships), a second list of possible stop segments may include the word FRIEND to determine whether the present context excludes discussions of all interpersonal relationships.

Identification of semantic clusters (e.g., by method 1000) may be performed as a nonrecurring software engineering process. Identification of stop segments (e.g., by method 1300) is typically performed as a user interaction process. After identification of semantic

clusters and one or more stop segments, a message recognizer may operate in accordance with a semantic model according to various aspects of the present invention.

As discussed above, a semantic model according to various aspects of the present invention biases against those tested segments that have a high probability of occurrence in clusters considered to be outside the present context. Such a model applies a negative bias against those text segments having a high probability of shared cluster occurrence with one or more stop segments identified by a user.

Negative bias may be applied by any suitable technique or combination of techniques. Examples of techniques for biasing against a tested text segment include: providing one or more suitable mathematical terms in one or more model equations to reduce the hypothesis score of the text segment; subtracting a computed value from the hypothesis score of the text segment; multiplying the hypothesis score of the text segment by a computed value (*e.g.*, a fractional coefficient); and selecting only text segments for further consideration, from within a range of hypothesis scores, that have not received a bias.

The negative biasing in the model may be proportional to the probability of shared cluster occurrence between each tested text segment and the identified stop segment(s). With proportional biasing, the adapted model applies a more negative bias against text segments that can be expected to appear frequently in semantic clusters together with a stop segment. In a variation, the negative biasing may also be inversely proportional to the probability of global cluster occurrence of each tested text segment. The semantic model then does not apply as negative a bias against a text segment that can be expected to appear in many semantic clusters as it would against a text segment that can be expected to appear in only a few semantic clusters, all other factors being equal.

The first exemplary semantic model is a modification of the semantic model disclosed in U.S. Patent 5,828,999 to Bellegarda, incorporated by reference above. The "mixture language model" disclosed in the '999 patent expresses probability of a word (*i.e.*, text segment) as the sum of *products* between (1) probability of the word, given each semantic cluster in the summation, and (2) probability of each respective semantic cluster, given a contextual history. The first exemplary semantic model, according to the present invention, departs from the model of the '999 patent by expressing probability of a text segment as the sum of *ratios* between (1)

probability of the text segment, given each semantic cluster in the summation, and (2). the combined probability of stop words sharing each semantic cluster.

The approach taken in the '999 patent is to determine probability of a tested text segment as a *positive* function of its probability of occurrence in a history of prior words. The inventive approach, generally speaking, is to determine probability of the tested text segment as a *negative* function of its probability of occurrence with user identified stop segments. The former approach calls for the message recognition system to guide itself *toward* a relevant context by looking backward to a history of prior words. The latter approach, generally speaking, asks the user to guide the message recognition system *away* from irrelevant contexts by looking forward to his or her goals for a particular document (present context) and as a writer (user context). In variations, it may be desirable for both approaches to be used in a combined language model, or combined in one semantic model.

The first exemplary semantic model, adapted with M stop segments, may be implemented mathematically, using the following equation:

$$\Pr(w_i) = \sum_{k=1}^{M} \left[\frac{\Pr(w_i | C_k)}{A + \sum_{j=1}^{L} B_j \Pr(s_j | C_k)} \right]$$

During message recognition in accordance with the first exemplary semantic model, when implemented by the equation above, a ratio is computed for each semantic cluster $C_1 \ldots C_M$ in the model. The probability of the tested text segment w_i occurring in each semantic cluster is divided by the combined probability of user identified stop segments $s_1 \ldots s_L$ occurring in the same semantic cluster. The combined probability may be computed in any suitable fashion. In the equation above, the individual probabilities of each stop segment s_j occurring in a given semantic cluster C_k are simply summed together. Although such a summation could result in a combined probability greater than 1.00, the combined probability permits multiple stop segments to contribute to an overall negative bias.

In a variation of the first exemplary semantic model, the combined probability may be computed as the inverse of the product of negative probabilities. (A negative probability in this example is considered the probability of a stop segment *not* occurring in a given semantic cluster.) In this variation, a high probability of any one stop segment occurring in a given semantic cluster will cause one low negative probability to be included in the product. Consequently, the inverse of the product, which in this variation is the combined probability, will be relatively high. The ratio computed in the first exemplary semantic model will thus be relatively low, effecting a negative bias based on the high probability of a single stop segment occurring in a given semantic cluster with the tested text segment.

The negative bias incurred by identified stop segments may be tempered in the second exemplary semantic model by the inclusion of suitable mathematical terms. In the equation above, for example, a constant term A is included in the denominator of the ratio to limit the effect of the combined probability. The value of the constant term A may be selected in accordance with design or user preference.

The second exemplary semantic model, according to the present invention, expresses probability of a tested text segment as the product of negative biasing terms. A negative biasing term in this example is any term that varies between zero and one based on probability of shared cluster occurrence between the tested text segment and a stop segment. The closer such a negative biasing term is to zero, the more it will reduce the product of biasing terms, and the more negative a bias it will cause in the second exemplary semantic model. In the second exemplary semantic model, the product may include one negative biasing term for each identified stop segment.

The second exemplary semantic model, adapted with M stop segments, may be implemented mathematically, using the following equation:

$$\Pr(w_i) = \prod_{j=1}^{M} \left[1 - \frac{B_j \Pr(w_i s_j | \mathrm{V})}{\Pr(w_i | \mathrm{V})} \right]$$

In the equation above, each negative biasing term is computed as the ratio between (1) the probability of shared cluster occurrence $\Pr(w_i s_j | V)$ between the tested text segment w_i and a stop

segment s_j, and (2) the probability of global cluster occurrence $Pr(w_i|V)$ of the tested text segment w_i.

During message recognition in accordance with the second exemplary semantic model, when implemented by the equation above, a high probability of any one stop segment occurring in the same semantic cluster as the tested text segment will cause one small negative biasing term to be included in the product. Consequently, the probability (here, the score) assigned to the tested text segment during hypothesis testing will be relatively low, effecting a negative bias based on the high probability of a single stop segment occurring in the same semantic cluster as the tested text segment.

In a semantic model according to various aspects of the present invention, the severity of negative bias effected by a particular stop segment may be varied depending on one or more factors. For example, a stop segment that has been identified as being outside a present context may be "downgraded with age" with the passage of time following the identification. As another example, the severity of negative bias may be downgraded (*i.e.*, less negative bias) with the generation of additional text following the identification. In the exemplary equation above, a bias limiting coefficient B_j is included to limit the negative effect of each biasing term, as desired.

A semantic model may be combined with a syntactic model using any conventional technique. Suitable combination techniques may include maximum entropy, backoff, linear interpolation, and linear combination. By way of example, a maximum entropy language model integrating N-gram (*i.e.*, syntactic) and topic dependencies is disclosed in a paper entitled "A Maximum Entropy Language Model Integrating N-Grams And Topic Dependencies For Conversational Speech Recognition," by Sanjeev Khudanpur and Jun Wu (Proceedings of ICASSP '99), incorporated herein by reference. By way of a further example, combination of models by linear interpolation and, alternatively, by backoff is disclosed in a paper entitled "A Class-Based Language Model For Large-Vocabulary Speech Recognition Extracted From Part-Of-Speech Statistics" by Christer Samuelsson and Wolfgang Reichl (Proceedings of ICASSP '99), incorporated herein by reference.

In a variation, a semantic model may be integrated with a syntactic model in a single, hybrid language model of the type disclosed in U.S. Patent 5,839,106 to Bellegarda, incorporated by reference above.

In a further variation, the second exemplary semantic model may be combined with a conventional syntactic model by treating the semantic model as a negative biasing factor to the syntactic model. In the combination, the semantic model may be appropriately limited such that even a text segment that is a stop word may be selected as the message recognizer's "best guess" if the segment is a very strong fit in the syntactic model. Such a combination may be implemented mathematically, using the equation below. In the equation, the left-hand product term $Pr(w_i|LM_{syn})$ is the probability assigned to the tested text segment by the conventional syntactic model.

$$\Pr(w_i) = \Pr(w_i|LM_{syn}) \prod_{j=1}^{M} \left[1 - \frac{B_j \Pr(w_i s_j|V)}{\Pr(w_i|V)} \right]$$

An example of the operation of system 200 may be better understood with reference to the data flow diagrams of FIGS. 4 and 5. Exemplary processes, described below with reference to these data flow diagrams, may be variously implemented with and without user intervention, in hardware and/or software. The example provided below illustrates the benefits of various aspects of the present invention when these aspects are employed in an exemplary embodiment and operation example. However, benefits of certain aspects may be obtained even when various other aspects are omitted. Thus, the example below should not be considered as limiting the scope of the invention in any way.

The operation of stylus 210, in the example, may be better understood with reference to the data flow diagram of FIG. 4. Process 410 determines activation status of stylus 210. When user 242 moves stylus 210 toward his or her head to begin dictation, process 410 positively asserts an activation signal to process 420. Process 420 provides a voice signal responsive to voice input from user 242. Process 420 provides an enabled voice signal to process 430 upon two conditions. The first condition is that the activation signal from process 410 has been positively

asserted to indicate that stylus 210 is situated to receive voice input from user 242. The second condition is that user 242 has provided voice input by speaking into the microphone of stylus 210.

Process 440 provides an identification signal based on a 48-bit stylus identification code 442. (A longer code may be used when the identification signal is employed for decryption.) Process 430 responds to the identification signal and to the enabled voice signal from process 420 to provide an electromagnetic signal. The electromagnetic signal suitably combines the identification signal and the voice signal. The electromagnetic signal is transmitted from stylus 210 to domain controller 220 (communications link 235).

The operation of domain controller 220, in the example, may be better understood with reference to the data flow diagram of FIG. 5. Process 510 extracts signal components from the electromagnetic signal provided by process 430. The identification signal identifies the source of the electromagnetic signal as stylus 210 and, consequently, the source of the voice signal as user 242.

Process 520 initializes local message model 316 in domain controller 220 to be in conformance with user message model 262. (Process 520 may employ any appropriate network protocol to transfer digital indicia of user message model 262.) Not shown in FIG. 5 is a process for initializing user message model 262 to be in conformance with local message model 316 after adaptation of local message model 316.

Process 530 performs speech recognition in accordance with initialized message model 316 to generate text data responsive to the voice signal. Process 540 performs handwriting recognition, also in accordance with initialized message model 316, to generate text data responsive to freehand input from user 242. Process 540 further interprets editing commands from user 242 responsive to freehand input. User 242 conveys freehand input by manipulating stylus 210 on a tablet surface (not specifically shown) of tablet 252.

Process 550 edits text generated by process 530 and process 540 responsive to editing commands interpreted by process 540. Editing may include user modification of text that has been correctly generated by processes 530 and 540, but which the user desires to modify. Editing may further include user training, conveyed by freehand input, voice input, and/or character input. User training may include correction of misrecognition by processes 530 and

540, which is conveyed back to processes 530 and 544 for adaptation of local message model 316. Correction conveyed back to either process adapts local message model 316. Process 550 provides text output for display on tablet 252.

The processes illustrated in the data flow diagrams of FIGS. 4 and 5 continue as user 242 continues providing voice and/or freehand input for generation and editing of text data.

Multiple displays, for example integrated with tablet surfaces of tablets, may be advantageously used to display multiple views of a single document in accordance with various aspects of the present invention. A first view of the document may be provided on a first display (*e.g.*, of a first tablet), while a second view of the document may be provided on a second display (*e.g.*, of a second tablet). Upon modification of the document, the first and second views are modified as needed to reflect the modification to the document.

When first and second tablets are networked together, modification made to the document by user input to the first tablet is communicated to the second tablet to modify the second view as needed to reflect the modification. Similarly, modification made to the document by user input to the second tablet is communicated to the first tablet to modify the first view as needed to reflect the modification.

An example of the use of multiple displays to provide multiple views of a single document may be better understood with reference to FIG. 15 (including FIGS. 15A and 15B). Tablet 252 is illustrated in FIG. 15A as displaying a first view of a graphical document 1500. The first view shows a circle 1510 and a rectangle 1520. A portion of the circle having a cutout 1512 is enclosed by a bounding box 1530.

Tablet 254 is illustrated in FIG. 15B as displaying a second view of document 1500. The second view shows a different portion of document 1500, namely the portion inside bounding box 1530. Cutout 1512 takes up most of the display of tablet 254.

Advantageously, modifications made to a portion of document 1500 inside bounding box 1530 (e.g., filling in of notch 1512) are displayed on both tablet 252 and tablet 254. The first view of document 1500, displayed on tablet 252, is updated according to various aspects of the invention to reflect modification made by user input to tablet 254. Modifications to the document may be centrally registered in a single data store, for example in domain controller

220. Alternatively, each tablet displaying a view of the document may update a complete copy of the document in a data store local to the tablet.

While the present invention has been described in terms of preferred embodiments and generally associated methods, it is contemplated that alterations and permutations thereof will become apparent to those skilled in the art upon a reading of the specification and study of the drawings. The present invention is not intended to be defined by the above description of preferred exemplary embodiments, nor by any of the material incorporated herein by reference. Rather, the present invention is defined variously by the issued claims. Each variation of the present invention is intended to be limited only by the recited limitations of its respective claim, and equivalents thereof, without limitation by terms not present therein.

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~~The claims below are provided in the present provisional application to particularly point out some, but not all, of the subject matter described above that the Applicant regards as his invention.~~

What is claimed is:

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1 **1.** A system responsive to voice input and freehand input to generate and edit text, the system
2 comprising:

3 (a) a stylus comprising:

4 (1) a pointer for communicating freehand input; and

5 (2) a microphone for receiving voice input;

6 (b) a speech recognizer responsive to voice input to provide text data;

7 (c) a first tablet interface including a first tablet surface, the first tablet interface being
8 responsive to freehand input to provide indicia of editing commands; and

9 (d) an editor having access to the text data, responsive to the indicia of editing commands to
10 modify the text data as specified by the editing commands.

1 **2.** The system of claim 1 wherein:

2 (a) the stylus has a proximal end and a distal end;

3 (b) the pointer is toward the distal end; and

4 (c) the microphone is toward the proximal end.

1 **3.** The system of claim 1 wherein the microphone is responsive to sound impinging on the
2 stylus from the direction of the proximal end with a first sensitivity and from the direction of the

distal end with a second sensitivity, the first sensitivity being significantly greater than the second sensitivity.

4. The system of claim 1 further comprising a first display integrated into the first tablet surface.

5. The system of claim 4 further comprising:

(a) a second tablet interface including a second tablet surface; and

(b) a second display integrated into the second tablet surface.

6. The system of claim 5 further comprising:

(a) a communications link interconnecting the displays; and

(b) a command interpreter for controlling the communications link, the command interpreter being responsive to the indicia of editing commands to transfer text data between the displays as specified by the editing commands.

7. The system of claim 1 wherein the speech recognizer is part of a message recognizer that further comprises a handwriting recognizer, the handwriting recognizer being responsive to freehand input to further provide text data.

8. The system of claim 7 wherein:

(c) the speech recognizer generates text data in accordance with an acoustic model and a shared language model; and

(d) the handwriting recognizer generates text data in accordance with a handwriting model and the shared language model; and

(e) the message recognizer is responsive to the indicia of editing commands to adapt at least the shared language model.

9. The system of claim 8 further comprising a character interface responsive to character input communicated via the pointing interface to provide character data, wherein the shared language model is adaptable by a correction process comprising:

specifying, responsive to freehand input, a selection of text generated by the message recognizer;

initiating a correction mode for modifying the selection;

providing a list of alternative text comparable to the selection;

updating the list based on character data communicated after initiation of the correction mode;

modifying the selection responsive to character data; and

adapting the shared language model in accordance with the modification to the selection.

10. The system of claim 1 wherein:

(a) the speech recognizer provides text data in accordance with at least one model; and

(b) the speech recognizer is responsive to the indicia of editing commands to adapt the model.

11. The system of claim 10 further comprising a character interface responsive to character input communicated via the pointing interface to provide character data, wherein the speech recognizer provides text data in accordance with at least a syntactic model that is adaptable by a correction process comprising:

specifying, responsive to freehand input, a selection of text generated by the speech recognizer;

initiating a correction mode for modifying the selection;

providing a list of alternative text comparable to the selection;

updating the list based on character data communicated after initiation of the correction mode;

modifying the selection responsive to character data; and

adapting the model in accordance with the modification to the selection.

12. The system of claim 10 wherein:

(c) the speech recognizer provides text data in accordance with at least a semantic model, the model comprising a plurality of semantic clusters; and

(d) the semantic model is adaptable by a process comprising:

listing a plurality of text segments having a low probability of shared cluster occurrence;

selecting, responsive to freehand input, at least one text segment of the plurality; and

adapting the semantic model to bias against text segments having a high probability of

shared cluster occurrence with each selected text segment.

13. The system of claim 10 wherein:

(a) the speech recognizer provides text data in accordance with at least a semantic model, the semantic model comprising a plurality of semantic clusters; and

(b) the semantic model is adaptable by a process comprising:

generating a maximum likelihood text segment responsive to voice input;

listing at least one alternative text segment, the maximum likelihood text segment and each alternative text segment forming a plurality of text segments, each text segment of the plurality having a high probability of global cluster occurrence and a low probability of shared cluster occurrence;

selecting, responsive to freehand input, at least one text segment of the plurality; and

adapting the semantic model to apply a negative bias against a tested text segment, the severity of the bias being proportional to the probability of shared cluster occurrence between the tested text segment and the selected text segment or segments.

14. The system of claim 13 wherein the bias is inversely proportional to the probability of global cluster occurrence of the tested text segment.

15. The system of claim 13 wherein the bias is inversely proportional to the amount of text data separating the tested text segment and the selected text segment or segments.

16. The system of claim 1 wherein the stylus further comprises an identification circuit for

providing, to the speech recognizer, an identification of an owner of the stylus.

17. The system of claim 1 wherein the stylus further comprises an activation circuit for automatically activating the speech recognizer.

18. The system of claim 17 wherein the activation circuit comprises:

(a) a first sound sensor responsive to sound impinging on the stylus within a first angular range to provide a first sensing signal;

(b) a second sound sensor responsive to sound impinging on the stylus outside the first angular range to provide a second sensing signal; and

(c) a comparator for comparing the first and second sensing signals.

19. The system of claim 17 wherein the activation circuit comprises a proximity sensor, responsive to proximity of the microphone to a human head, for controlling activation of the speech recognizer by the activation circuit.

20. The system of claim 19 wherein the proximity sensor comprises a radiation sensor responsive to field radiation impinging on the stylus.

21. The system of claim 20 wherein the radiation sensor is responsive to electromagnetic field radiation in the infrared spectrum.

22. The system of claim 20 wherein:

(a) the radiation sensor is responsive to field radiation impinging on the stylus within a first angular range to provide a first sensing signal and within a second angular range to provide a second sensing signal; and

(b) the proximity sensor further comprises a comparator for comparing the first and second sensing signals.

23. The system of claim 22 wherein:

(a) the activation circuit is configured to activate the speech recognizer when the microphone is at a predetermined proximity to the human head, wherein the microphone is:

(1) oriented toward the human head within a predetermined angular range; and

(2) displaced from the human head within a predetermined separation range;

(b) the second angular range falls completely within the first angular range; and

(c) the predetermined proximity is determined by all of at least two conditions being true, wherein the conditions are:

(1) the amplitude of the second sensing signal reaching a first predetermined threshold; and

(2) the ratio between the amplitude of the second sensing signal and the amplitude difference between the first and second sensing signals reaching a second predetermined threshold.

24. The system of claim 20 wherein the radiation sensor is responsive to acoustic field radiation, the system further comprising:

(a) an ultrasonic transmitter for sending acoustic field radiation to the human head, such that the radiation sensor provides a time-varying signal descriptive of reflected acoustic field radiation impinging on the stylus from the human head;

(b) a signal processor responsive to the time-varying signal so as to provide a distance profile of the acoustic field radiation; and

(c) a comparator for comparing the distance profile to an expected profile, the expected profile corresponding to acoustic field radiation expected to impinge on the stylus from the human head when the microphone is at a predetermined proximity to the human head.

25. A system responsive to voice input and freehand input to generate and edit text, the system comprising:

(a) a stylus comprising:

(1) a pointer for communicating freehand input; and

(2) a microphone for receiving voice input;

(b) at least one speech recognizer responsive to voice input to provide text data;

(c) a plurality of tablet interfaces, each including a respective tablet surface and being responsive to freehand input to provide indicia of editing commands;

(d) a plurality of displays, each being integrated into a respective tablet surface; and

(e) at least one editor having access to the text data, responsive to the indicia of editing commands to modify the text data as specified by the editing commands.

26. The system of claim 25 further comprising:

(a) a communications link interconnecting the displays; and

(b) a command interpreter for controlling the communications link, the command interpreter being responsive to the indicia of editing commands to transfer text data between the displays as specified by the editing commands.

27. A method for processing text, the method comprising:

providing a stylus comprising a pointing interface and a microphone;

providing a tablet responsive to the pointing interface;

generating text by dictating into the microphone; and

editing text by manually manipulating the pointing interface on the tablet.

28. The method of claim 27 further comprising:

moving the stylus across visual indicia of dictated text that has been erroneously generated to specify a selection from the text; and

correcting the selection.

29. The method of claim 28 further comprising:

generating text in accordance with an adaptable language model; and

adapting the language model responsive to the correction of the selection.

30. The method of claim 29 further comprising:

providing a character interface responsive to the pointing interface;

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providing a list of alternative text comparable to the selection;

updating the list based on character input communicated after specification of the selection;

modifying the selection responsive to character input communicated via the pointing interface; and

adapting the language model in accordance with the modification to the selection.

31. The method of claim 29 wherein the language model comprises a syntactic model and a semantic model, the semantic model comprising a plurality of semantic clusters, the method further comprising:

listing a plurality of text segments having a low probability of shared cluster occurrence;

selecting, responsive to freehand input, at least one text segment of the plurality; and

adapting the semantic model to bias against text segments having a high probability of shared cluster occurrence with each selected text segment.

32. The method of claim 29 wherein the language model comprises a syntactic model and a semantic model, the semantic model comprising a plurality of semantic clusters, the method further comprising:

generating a maximum likelihood text segment responsive to voice input;

listing at least one alternative text segment, the maximum likelihood text segment and each alternative text segment forming a plurality of text segments, each text segment of the plurality having a high probability of global cluster occurrence and a low probability of shared cluster occurrence;

selecting, responsive to freehand input, at least one text segment of the plurality; and

adapting the semantic model to apply a negative bias against a tested text segment, the severity of the bias being proportional to the probability of shared cluster occurrence between the tested text segment and the selected text segment or segments.

33. The method of claim 32 wherein the bias is inversely proportional to the probability of global cluster occurrence of the tested text segment.

34. The method of claim 32 wherein the bias is inversely proportional to the amount of text data separating the tested text segment and the selected text segment or segments.

35. The method of claim 27 further comprising sending an identification signal to the speech recognizer to identify the stylus.

36. The method of claim 27 further comprising activating the speech recognizer by moving the stylus within a predetermined proximity of a human head.

37. A stylus comprising:

(a) a stylus body having a proximal end and a distal end;

(b) a pointing interface toward the distal end;

(c) an identification circuit for providing an identification signal; and

(d) a wireless transmitter for transmitting an electromagnetic signal comprising the voice signal and the identification signal.

38. The stylus of claim 37 further comprising a microphone toward the proximal end for providing a voice signal responsive to voice input, wherein the electromagnetic signal further comprises the voice signal.

39. The stylus of claim 38 wherein the identification signal and the voice signal are time-division multiplexed on the electromagnetic signal.

40. The stylus of claim 37 wherein the microphone is responsive to sound impinging on the stylus from the direction of the proximal end with a first sensitivity and from the direction of the distal end with a second sensitivity, the first sensitivity being significantly greater than the second sensitivity.

41. The stylus of claim 37 further comprising an activation circuit for automatically enabling the voice signal.

42. The stylus of claim 41 wherein the activation circuit comprises a proximity sensor, responsive to proximity of the microphone to a human head, for controlling enabling of the voice signal by the activation circuit.

43. A stylus comprising:

(a) a stylus body having a proximal end and a distal end;

(b) a pointing interface toward the distal end;

(c) a microphone toward the proximal end for providing a voice signal responsive to voice

input;

(d) an activation circuit for automatically enabling the voice signal; and

(e) a wireless transmitter for transmitting an electromagnetic signal comprising the voice signal.

44. The system of claim 43 wherein the activation circuit comprises:

(a) a first sound sensor responsive to sound impinging on the stylus within a first angular range to provide a first sensing signal;

(b) a second sound sensor responsive to sound impinging on the stylus outside the first angular range to provide a second sensing signal; and

(c) a comparator for comparing the first and second sensing signals.

45. The system of claim 43 wherein the activation circuit comprises a proximity sensor, responsive to proximity of the microphone to a human head, for controlling the enabling of the voice signal.

46. The system of claim 45 wherein the proximity sensor comprises a radiation sensor responsive to field radiation impinging on the stylus.

47. The system of claim 46 wherein the radiation sensor is responsive to electromagnetic field radiation in the infrared spectrum.

48. The system of claim 46 wherein:

(a) the radiation sensor is responsive to field radiation impinging on the stylus within a first angular range to provide a first sensing signal and within a second angular range to provide a second sensing signal; and

(b) the proximity sensor further comprises a comparator for comparing the first and second sensing signals.

49. The system of claim 48 wherein:

(a) the activation circuit is configured to enable the voice signal when the microphone is at a predetermined proximity to the human head, wherein the microphone is:

(1) oriented toward the human head within a predetermined angular range; and

(2) displaced from the human head within a predetermined separation range;

(b) the second angular range falls completely within the first angular range; and

(c) the predetermined proximity is determined by all of at least two conditions being true, wherein the conditions are:

(1) the amplitude of the second sensing signal reaching a first predetermined threshold; and

(2) the ratio between the amplitude of the second sensing signal and the amplitude difference between the first and second sensing signals reaching a second predetermined threshold.

50. The system of claim 46 wherein the radiation sensor is responsive to acoustic field radiation, the system further comprising:

(a) an ultrasonic transmitter for sending acoustic field radiation to the human head, such that the radiation sensor provides a time-varying signal descriptive of reflected acoustic field radiation impinging on the stylus from the human head;

(b) a signal processor responsive to the time-varying signal so as to provide a distance profile of the acoustic field radiation; and

(c) a comparator for comparing the distance profile to an expected profile, the expected profile corresponding to acoustic field radiation expected to impinge on the stylus from the human head when the microphone is at a predetermined proximity to the human head.

51. A method for message recognition in accordance with at least a semantic language model, the method comprising performing a plurality of hypothesis tests between a plurality of text segments and at least one stop segment, each hypothesis test including computing a probability according to the equation:

$$\Pr(w_i) = \sum_{k=1}^{M} \left[\frac{\Pr(w_i|C_k)}{A + \sum_{j=1}^{L} B_j \Pr(s_j|C_k)} \right]$$

wherein w_i is the text segment being tested, C_k is a semantic cluster from a plurality of semantic clusters, and B_j is a weighting factor for a respective stop segment.

The system of claim 25 wherein the speech includes a semantic language model comprising a plurality of semantic clusters, the language model being adaptable by a process comprising the steps of:

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52. ~~In a message~~ recognizer,

(a) listing a plurality of text segments;

(b) selecting, ~~responsive to a first type of input,~~ at least one text segment of the plurality; and

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(c) adapting the semantic model to bias against text segments having a high probability of shared cluster occurrence with each selected text segment.

53. The language model of claim 52 wherein the listed text segments have a low probability of shared cluster occurrence.

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54. The language model of claim ~~52~~ wherein:

the context identification further comprises generating a maximum likelihood text segment responsive to a second type of input;

said step (a) further comprises listing at least one alternative text segment, the maximum likelihood text segment and each alternative text segment forming a plurality of text segments, each text segment of the plurality having a high probability of global cluster occurrence and a low probability of shared cluster occurrence;

said step (b) further comprises selecting, responsive to the first type of input, at least one text segment of the plurality; and

said step (c) further comprises adapting the semantic model to apply a negative bias against a tested text segment, the severity of the bias being proportional to the probability of shared cluster occurrence between the tested text segment and the selected text segment or segments.

55. The language model of claim 54 wherein:

(a) the first type of input is frechand input; and

(b) the second type of input is voice input.

56. The language model of claim 54 wherein the bias is inversely proportional to the probability of global cluster occurrence of the tested text segment.

57. The language model of claim 54 wherein the bias is inversely proportional to the amount of text data separating the tested text segment and the selected text segment or segments.

58. A method for adapting a semantic language model comprising a plurality of semantic clusters, the method comprising the steps of:

(a) listing a plurality of text segments having a low probability of shared cluster occurrence;

(b) selecting ~~responsive to frechand input~~ at least one text segment of the plurality; and

(c) adapting the semantic model to bias against text segments having a high probability of shared cluster occurrence with each selected text segment.

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59. The method of claim 58 wherein:

the context identification further comprises generating a maximum likelihood text segment responsive to voice input;

said step (a) further comprises listing at least one alternative text segment, the maximum likelihood text segment and each alternative text segment forming a plurality of text segments, each text segment of the plurality having a high probability of global cluster occurrence and a low probability of shared cluster occurrence;

said step (b) further comprises selecting, responsive to freehand input, at least one text segment of the plurality; and

said step (c) further comprises adapting the semantic model to apply a negative bias against a tested text segment, the severity of the bias being proportional to the probability of shared cluster occurrence between the tested text segment and the selected text segment or segments.

60. The method of claim 59 wherein the bias is inversely proportional to the probability of global cluster occurrence of the tested text segment.

61. The method of claim 59 wherein the bias is inversely proportional to the amount of text data separating the tested text segment and the selected text segment or segments.

62. A system for generating text responsive to message input of a first type and a second type, the system comprising:

(a) a unified message model including:

(1) a shared language model;

(2) a first model specific to a first type of message recognition; and

(3) a second model specific to a second type of message recognition;

(b) a first message recognizer, responsive to the first type of message input to provide text data in accordance with both the shared language model and the first model; and

(c) a second message recognizer, responsive to the second type of message input to provide

text data in accordance with both the shared language model and the second model.

63. The system of claim 62 wherein:

(a) the first message recognizer is a speech recognizer, the first type of message input is voice input, and the first model is an acoustic model; and

(b) the second message recognizer is a handwriting recognizer, the second type of message input is freehand input, and the second model is a handwriting model.

64. The system of claim 62 wherein the shared language model comprises a syntactic model and a semantic model.

65. The system of claim 62 wherein the message model is a local message model, and wherein the system further comprises a network node for establishing a network connection to a user message model such that the local message model may be initialized to be in conformance with the user message model.

66. The system of claim 65 wherein the network node connects to a wide area network.

67. A method for recognizing a message input from a specific user, the method comprising:

providing:

(1) a local message model responsive to initialization by a user message model;

(2) a network including a first node and a second node, the first node being proximate the user and the second node being proximate the user message model; and

identifying the specific user to establish a connection on the network between the local message model and the user message model;

transferring data on the connection to modify the local message model to be in conformance with the user message model; and

recognizing message input from the user in accordance with the initialized local message model.

68. The method of claim 67 further comprising:

after modifying the local message model to be in conformance with the user message model, adapting the local message model in accordance with editing commands from the user; and

transferring data on the connection to modify the user message model to be in conformance with the adapted local message model.

69. The method of claim 67 wherein the local message model is implemented in a speech recognizer that is proximate the first node.

70. The method of claim 67 wherein:

(a) the message input comprises voice input; and

(b) the local message model comprises a language model and an acoustic model.

71. The method of claim 67 wherein:

(a) the message input comprises freehand input; and

(b) the local message model comprises a language model and a handwriting model.

72. The method of claim 67 wherein:

(a) the message input comprises voice input and freehand input; and

(b) the local message model comprises a language model, an acoustic model, and a handwriting model.

73. The system of claim 67 wherein the specific user is identified by an identification circuit in a stylus employed by the user to convey message input.

74. The system of claim 67 wherein the network is a wide area network.

75. A system responsive to voice input and freehand input to generate and edit text, the system comprising:

(a) a stylus comprising:

(1) a pointer for communicating freehand input; and

(2) a microphone for receiving voice input;

(b) means for generating text data responsive to voice input; and

(c) means for editing the text data responsive to freehand input.

76. A method for displaying a document, the method comprising:

displaying a first view of the document on a first display;

displaying a second view of the document on a second display; and

upon modification of the document, modifying the first and second views as needed to reflect the modification.

77. The method of claim 76 wherein:

(a) the first display is integrated into a tablet surface of a first tablet;

(b) the second display is integrated into a tablet surface of a second tablet; and

(c) the first and second tablets are coupled together such that:

(1) modification made to the document by user input to the first tablet is communicated to the second tablet to modify the second view as needed to reflect the modification; and

(2) modification made to the document by user input to the second tablet is communicated to the first tablet to modify the first view as needed to reflect the modification.

78. A text processing system comprising:

(a) a stylus having a proximal end and a distal end, the stylus comprising:

(1) a pointer toward the distal end for communicating freehand input;

(2) a microphone toward the proximal end for receiving voice input;

(3) an activation circuit for automatically activating the speech recognizer; and

(4) an identification circuit for providing, to the speech recognizer, an identification of the stylus;

(b) a tablet interface, responsive to freehand input, comprising a plurality of tablet surfaces;

(c) a plurality of self-contained enclosures, each of the enclosures comprising:

(1) a front face having a height and a width, the front face comprising a respective one of the tablet surfaces; and

(2) a back face, separated from the front face by a depth, the depth being significantly less than either the height or the width;

(d) a display comprising a plurality of displays, each of the displays being integrated into a respective tablet surface;

(e) a wireless transmitter and a wireless receiver for effecting a communications link to interconnect the displays;

(f) a command interpreter for controlling the communications link, the command interpreter being responsive to command indicia communicated via freehand input to transfer text between the displays; and

(g) a speech recognizer responsive to voice input to generate text in accordance with a language model specific to an owner of the stylus, for display on the display.

79. The method of claim 52 wherein selecting at least one text segment of the plurality is performed responsive to a first type of input.

80. The method of claim 58 wherein selecting at least one text segment of the plurality is performed responsive to freehand input.

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DECLARATION FOR UTILITY OR DESIGN PATENT APPLICATION (37 CFR 1.63)

☑ Declaration Submitted with Initial Filing **OR** ☐ Declaration Submitted after Initial Filing (surcharge (37 CFR 1.16 (e)) required)

Attorney Docket Number	
First Named Inventor	Edwin A. Suominen
COMPLETE IF KNOWN	
Application Number	
Filing Date	01/28/2002
Art Unit	2641*
Examiner Name	Nolan, D.* **in parent app.*

As the below named inventor, I hereby declare that:

My residence, mailing address, and citizenship are as stated below next to my name.

I believe I am the original and first inventor of the subject matter which is claimed and for which a patent is sought on the invention entitled:

Text Processing System

No power of attorney granted in this application, which is a Continuation of U.S. Application No. 09/616,157 filed July 14, 2000.

(Title of the Invention)

the specification of which

☑ is attached hereto

OR

☐ was filed on (MM/DD/YYYY) ☐ as United States Application Number or PCT International Application Number ☐ and was amended on (MM/DD/YYYY) ☐ (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 specifically referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR 1.56, including for continuation-in-part applications, material information which became available between the filing date of the prior application and the national or PCT international filing date of the continuation-in-part application.

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

Prior Foreign Application Number(s)	Country	Foreign Filing Date (MM/DD/YYYY)	Priority Not Claimed	Certified Copy Attached? YES	NO
			☐	☐	☐
			☐	☐	☐
			☐	☐	☐
			☐	☐	☐

☐ Additional foreign application numbers are listed on a supplemental priority data sheet PTO/SB/02B attached hereto:

Burden Hour Statement: This form is estimated to take 21 minutes to complete. Time will vary depending upon the needs of the individual case. Any comments on the amount of time you are required to complete this form should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, Washington, DC 20231. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Assistant Commissioner for Patents, Washington, DC 20231.

PTO/SB/01 (10-01)
Approved for use through 10/31/2002. OMB 0651-0032
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.

DECLARATION — Utility or Design Patent Application

Direct all correspondence to: ☐ Customer Number or Bar Code Label [ ] OR ☑ Correspondence address below

Edwin A. Suominen
Name

14614 North Kierland Boulevard, Suite 300
Address

Scottsdale	Arizona	85254
City	**State**	**ZIP**

USA	(480) 948-3295	(480) 948-3387
Country	**Telephone**	**Fax**

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 with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S.C. 1001 and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

NAME OF SOLE OR FIRST INVENTOR : ☐ A petition has been filed for this unsigned inventor

Given Name (first and middle [if any]): Edwin A.	Family Name or Surname: Suominen

Inventor's Signature	Date: Jan. 28, 2002

Valley	Washington	USA	USA
Residence: City	**State**	**Country**	**Citizenship**

3355 East Jump Off Joe Road
Mailing Address

Valley	Washington	99181	USA
City	**State**	**ZIP**	**Country**

NAME OF SECOND INVENTOR: ☐ A petition has been filed for this unsigned inventor

Given Name (first and middle [if any])	Family Name or Surname

Inventor's Signature	Date

Residence: City	State	Country	Citizenship

Mailing Address

City	State	ZIP	Country

☐ Additional inventors are being named on the ____supplemental Additional Inventor(s) sheet(s) PTO/SB/02A attached hereto.

[Page 2 of 2]

UNITED STATES PATENT AND TRADEMARK OFFICE

Commissioner for Patents
Washington, DC 20231
www.uspto.gov

Bib Data Sheet

CONFIRMATION NO. 5352

SERIAL NUMBER	FILING DATE / RULE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
10/061,052	01/28/2002	704	2641	

APPLICANTS

Edwin A. Suominen, Valley, WA;

**** CONTINUING DATA ***************************

This application is a CON of 09/616,157 07/14/2000 ABN which claims benefit of 60/144,481 07/17/1999

**** FOREIGN APPLICATIONS ********************

IF REQUIRED, FOREIGN FILING LICENSE GRANTED ** SMALL ENTITY **
** 04/01/2002

Foreign Priority claimed	35 USC 119 (a-d) conditions met	Verified and Acknowledged	STATE OR COUNTRY	SHEETS DRAWING	TOTAL CLAIMS	INDEPENDENT CLAIMS
☐ yes ☒ no	☐ yes ☐ no ☐ Met after Allowance	Examiner's Signature Initials	WA	17	7	4

ADDRESS

Edwin A. Suominen
Suite 300
14614 North Kierland Boulevard
Scottsdale ,AR 85254

TITLE

Text processing system

FILING FEE RECEIVED	FEES: Authority has been given in Paper	
370	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

PATENT APPLICATION SERIAL NO. _____

U.S. DEPARTMENT OF COMMERCE
PATENT AND TRADEMARK OFFICE
FEE RECORD SHEET

02/06/2002 TBESHAH1 00000034 10061052
01 FC:201 370.00 OP

PTO-1556
(5/87)

*U.S. GPO: 2000-468-987/39595

PATENT APPLICATION FEE DETERMINATION RECORD
Effective October 1, 2001

Application or Docket Number: 10/061052

CLAIMS AS FILED - PART I

	(Column 1)	(Column 2)
TOTAL CLAIMS	2	
FOR	NUMBER FILED	NUMBER EXTRA
TOTAL CHARGEABLE CLAIMS	20 minus 20=	* 0
INDEPENDENT CLAIMS	2 minus 3 =	* 0
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	370.00	OR	BASIC FEE	740.00
X$ 9=		OR	X$18=	
X42=		OR	X84=	
+140=		OR	+280=	
TOTAL	370	OR	TOTAL	

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	* 2	Minus	**	=
Independent	* 2	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	* 8	Minus	**	=
Independent	* 4	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.

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NOTICE OF FILING / CLAIM FEE(S) DUE (CALCULATION SHEET)

APPLICATION NUMBER: _____

Total Fee Calculation

	Fee Code Sm./Lg.	Total # Claims		Number Extra	X	Fee Sm. Entity	Fee Lg. Entity	=	Total
Basic Filing Fee	201/101							=	
Total Claims >20	203/103		-20 =		X			=	
Independent Claims >3	202/102		-3 =	1	X	42		=	
Mult. Dep Claim Present	204/104							=	
Surcharge	205/105							=	
English Translation	139								

TOTAL FEE CALCULATION

Fees due upon filing the application:

Total Filing Fees Due = $ 42

Less Filing Fees Submitted - $ _____

BALANCE DUE = $ _____

_____
Office of Initial Patent Examination

FORM OIPE-RAM-01 (Rev. 12/97)

CLAIMS ONLY

SERIAL NO.	FILING DATE
APPLICANT(S)	

CLAIMS

	AS FILED		AFTER 1st AMENDMENT		AFTER 2nd AMENDMENT	
	IND.	DEP.	IND.	DEP.	IND.	DEP.
1	1					
2						
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37	1					
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43	1					
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46						
47						
48						
49						
50						
TOTAL IND.	12	⬇		⬇		⬇
TOTAL DEP.	68					
TOTAL CLAIMS	80					

	*		*		*	
	IND.	DEP.	IND.	DEP.	IND.	DEP.
51	1					
52						
53						
54						
55						
56						
57						
58	1		1			
59						
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62	1		1			
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83			1			
84				1		
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86			1			
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98						
99						
100						
TOTAL IND.	24	⬇	4	⬇		⬇
TOTAL DEP.	8		4			
TOTAL CLAIMS	32		8			

*MAY BE USED FOR ADDITIONAL CLAIMS OR ADMENDMENTS

FORM PTO-2022 (1-98)

U.S.DEPARTMENT OF COMMERCE
Patent and Trademark Office

*U.S. Government Printing Office: 1998 - 433-214/70303

#3A
1/30/03
DH

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant	:	Edwin A. Suominen	Art Unit:	:	2641*
Serial No.	:	10/_____	Examiner:	:	Nolan, D.*
Filing Date	:	January 28, 2002	* *In parent application*		
Title	:	Text Processing System			

BOX PATENT APPLICATION
Assistant Commissioner for Patents
Washington, DC 20231

Express Mail Label No.: EK739151725US

PRELIMINARY AMENDMENT

Dear Sir:

Applicant submits the following amendments and remarks prior to examination of this Continuation Application. Upon entry of this amendment, claims 58 and 62 are pending in the application, both of which are independent.

Amendments

Beginning on the next page are instructions identifying locations for deletion, replacement, or addition of paragraphs and claims, with clean versions thereof. Marked-up versions of any replacement paragraphs or amended claims are provided at the end of this amendment in a section entitled Version with Markings to Show Changes Made. Please note that the marked-up version does not include any added or deleted claims or paragraphs.

10065052.042902

NEW OR REPLACEMENT PARAGRAPHS OF SPECIFICATION:

PLEASE INSERT the specification paragraph below immediately below the title:

A1 This application is a continuation of U.S. Patent Application No. 09/616,157, filed July 14, 2000, now abandoned, which claims the benefit of U.S. Provisional Patent Application No. 60/144,481, filed July 17, 1999. Both prior applications are incorporated herein by reference.

PLEASE REPLACE the specification paragraph identified below with the following replacement paragraph:

PAGE 27, PARAGRAPH 2:

A2 Wireless nodes 227 and 230 include any suitable transmitter(s) and/or receiver(s) for establishing respective communications links 225 and 235. Transmitter 122 and receiver 160, discussed above with reference to FIG. 1A, are examples of suitable transmitters and receivers, respectively. Node 227 establishes bi-directional communications between domain controller 220 and each tablet 252, 254, and 256. Because communications link 225 is bi-directional, node 227 includes both a transmitter and receiver. Node 230 establishes unidirectional communications between domain controller 220 and styluses 210 and 212. Typically, only a unidirectional communications link is needed to a stylus, because the stylus typically only sends information.

PAGE 38, PARAGRAPH 3:

A3 The semantic model may be part of a shared language model of the invention. In message recognizer 310, for example, semantic model 354 is part of shared language model 350. A message recognizer may include two or more subordinate message recognizers, each of which may operate in accordance with the semantic model in the shared language model. Advantageously, the accuracy of each subordinate message recognizer sharing a language model that includes a semantic model according to

a3 various aspects of the present invention may be improved by user identification of context.

PAGE 40, PARAGRAPH 3:

A non-technical word that appears in a technical document such as a patent application may be designated as a stop word outside the present context, regardless of the author's overall writing habits. For example, words relating to familial relationships (including the word UNCLE) are not typically used in patent applications. a4 In the "horizontal" example, a user may identify the word UNCLE as being outside the present context (but not the user context) by drawing a single line through it, for example in the first alternative text listing "cores Uncle." Single lines may then appear drawn through each occurrence of the word UNCLE, since the word has been identified as a "present context" stop segment.

60605.0502

PAGE 48, PARAGRAPH 3:

A context definition mode that is initiated automatically can present the user with a list of alternative text segments in addition to the message recognizer's "best guess." Alternatively, the user may be presented with a simple question that may be quickly answered. For example, if the user dictates the sentence "Can you recognize speech?", the message recognizer may determine that the word BEACH could be especially useful for indicating context as a stop segment. a5 If the message recognizer is configured to initiate a context definition mode automatically, the user might be presented with a dialog box containing the statement "You dictated the phrase RECOGNIZE SPEECH. Is the word BEACH of context?" and three "radio buttons" labeled "No," "Yes, this time," and "Always." If the word BEACH is not out of context, the user could select (or say) "No." If the word BEACH is outside the present context, the user could select or say "Yes, this time. " If the word BEACH is outside the user context, the user could select or say "Always."

IN THE CLAIMS:

PLEASE CANCEL claims 1-57, 59-61, and 63-80.

Remarks

The specification is amended to conform with amendments made to the parent application, which the Examiner applied with a resultant withdrawal of objections.

All claims except 58 and 62 are cancelled, without prejudice, to limit excess claim fees.

In the '157 parent application, all pending claims were rejected under 35 U.S.C. § 103 as being obvious over various references. A supplemental preliminary amendment with applicant's response to the rejections and reinstatement of various claims is forthcoming.

Please feel free to telephone the undersigned (who is also the applicant) if it would in any way advance prosecution of this application.

Respectfully submitted,

Dated: January 28, 2002

By: _____

Edwin A. Suominen
Reg. No. 43,174

14614 North Kierland Boulevard
Suite 300
Scottsdale, Arizona 85254
(480) 948-3295

10656052.010202

MARKED-UP COPY OF AMENDED PARAGRAPHS AND CLAIMS

PAGE 27, PARAGRAPH 2:

Wireless nodes 227 and 230 include any suitable transmitter(s) and/or receiver(s) for establishing respective communications links 225 and 235. Transmitter 122 and receiver 160, discussed above with reference to FIG. 1A, are examples of suitable transmitters and receivers, respectively. Node 227 establishes [*bidirectional*] bi-directional communications between domain controller 220 and each tablet 252, 254, and 256. Because communications link 225 is [*bidirectional*] bi-directional, node 227 includes both a transmitter and receiver. Node 230 establishes unidirectional communications between domain controller 220 and styluses 210 and 212. Typically, only a unidirectional communications link is needed to a stylus, because the stylus typically only sends information.

PAGE 38, PARAGRAPH 3:

The semantic model may be part of a shared language model of the invention. In message recognizer 310, for example, semantic model 354 is part of shared language model 350. A message recognizer may include two or more subordinate message recognizers, each of which may operate in accordance with the semantic model in the shared language model. Advantageously, the accuracy of each subordinate message recognizer sharing a language model that includes a semantic model [*model*] according to various aspects of the present invention may be improved by user identification of context.

PAGE 40, PARAGRAPH 3:

A [*nontechnical*] non-technical word that appears in a technical document such as a patent application may be designated as a stop word outside the present context, regardless of the author's overall writing habits. For example, words relating to familial relationships (including the word UNCLE) are not typically used in patent applications. In the "horizontal" example, a user may identify the word UNCLE as being outside the

present context (but not the user context) by drawing a single line through it, for example in the first alternative text listing "cores Uncle." [*Double*] Single lines may then appear drawn through each occurrence of the word UNCLE, since the word has been identified as a "present context" stop segment.

PAGE 48, PARAGRAPH 3:

A context definition mode that is initiated automatically [*a*] can present the user with a list of alternative text segments in addition to the message recognizer's "best guess." Alternatively, the user may be [*present*] presented with a simple question that may be quickly answered. For example, if the user dictates the sentence "Can you recognize speech?", the message recognizer may determine that the word BEACH could be especially useful for indicating context as a stop segment. If the message recognizer is configured to initiate a context definition mode automatically, the user might be presented with a dialog box containing the statement "You dictated the phrase RECOGNIZE SPEECH. Is the word BEACH of context?" and three "radio buttons" labeled "No," "Yes, this time," and "Always." If the word BEACH is not out of context, the user could select (or say) "No." If the word BEACH is outside the present context, the user could select or say "Yes, this time. " If the word BEACH is outside the user context, the user could select or say "Always."

4005,052,0150

ABSTRACT

Certain disclosed methods and systems perform multiple different types of message recognition using a shared language model. Message recognition of a first type is performed responsive to a first type of message input (e.g., speech), to provide text data in accordance with both the shared language model and a first model specific to the first type of message recognition (e.g., an acoustic model). Message recognition of a second type is performed responsive to a second type of message input (e.g., handwriting), to provide text data in accordance with both the shared language model and a second model specific to the second type of message recognition (e.g., a model that determines basic units of handwriting conveyed by freehand input). Accuracy of both such message recognizers can be improved by user correction of misrecognition by either one of them. Numerous other methods and systems are also disclosed.

MSFT 2052 - 0050502