

EXHIBIT 1



(12) **United States Patent**
Burnett

(10) **Patent No.:** US 7,246,058 B2
(45) **Date of Patent:** Jul. 17, 2007

(54) **DETECTING VOICED AND UNVOICED SPEECH USING BOTH ACOUSTIC AND NONACOUSTIC SENSORS**

(75) Inventor: **Gregory C. Burnett**, Livermore, CA (US)

(73) Assignee: **Aliph, Inc.**, San Francisco, CA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 688 days.

(21) Appl. No.: **10/159,770**

(22) Filed: **May 30, 2002**

(65) **Prior Publication Data**
US 2002/0198705 A1 Dec. 26, 2002

Related U.S. Application Data
(60) Provisional application No. 60/294,383, filed on May 30, 2001, provisional application No. 60/335,100, filed on Oct. 30, 2001, provisional application No. 60/332,202, filed on Nov. 21, 2001, provisional application No. 60/362,162, filed on Mar. 5, 2002, provisional application No. 60/362,103, filed on Mar. 5, 2002, provisional application No. 60/362,170, filed on Mar. 5, 2002, provisional application No. 60/361,981, filed on Mar. 5, 2002, provisional application No. 60/362,161, filed on Mar. 5, 2002, provisional application No. 60/368,209, filed on Mar. 27, 2002, provisional application No. 60/368,208, filed on Mar. 27, 2002, provisional application No. 60/368,343, filed on Mar. 27, 2002.

(51) **Int. Cl.**
G10L 11/06 (2006.01)
(52) **U.S. Cl.** **704/226; 704/214**
(58) **Field of Classification Search** None
See application file for complete search history.

(56) **References Cited**
U.S. PATENT DOCUMENTS

3,789,166 A 1/1974 Sebesta

(Continued)

FOREIGN PATENT DOCUMENTS

EP 0 637 187 A 2/1995

(Continued)

OTHER PUBLICATIONS

Gregory C. Burnett: "The Physiological Basis of Glottal Electromagnetic Micropower Sensors (GEMS) and Their Use in Defining an Excitation Function for the Human Vocal Tract", Dissertation, University of California at Davis, Jan. 1999, USA.

(Continued)

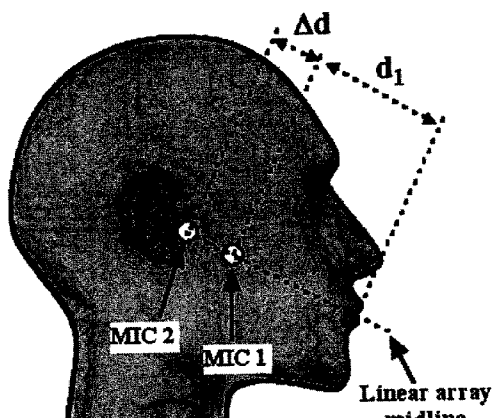
Primary Examiner—Abul K. Azad

(74) *Attorney, Agent, or Firm*—Courtney Staniford & Gregory LLP

(57) **ABSTRACT**

Systems and methods are provided for detecting voiced and unvoiced speech in acoustic signals having varying levels of background noise. The systems receive acoustic signals at two microphones, and generate difference parameters between the acoustic signals received at each of the two microphones. The difference parameters are representative of the relative difference in signal gain between portions of the received acoustic signals. The systems identify information of the acoustic signals as unvoiced speech when the difference parameters exceed a first threshold, and identify information of the acoustic signals as voiced speech when the difference parameters exceed a second threshold. Further, embodiments of the systems include non-acoustic sensors that receive physiological information to aid in identifying voiced speech.

5 Claims, 10 Drawing Sheets



US 7,246,058 B2

Page 2

U.S. PATENT DOCUMENTS

4,006,318 A 2/1977 Sebesta et al.
 4,591,668 A 5/1986 Iwata
 4,653,102 A * 3/1987 Hansen 381/92
 4,777,649 A * 10/1988 Carlson et al. 704/233
 4,901,354 A 2/1990 Gollmar et al.
 5,097,515 A 3/1992 Baba
 5,212,764 A 5/1993 Ariyoshi
 5,400,409 A 3/1995 Linhard
 5,406,622 A 4/1995 Silverberg et al.
 5,414,776 A 5/1995 Sims, Jr.
 5,473,702 A 12/1995 Yoshida et al.
 5,515,865 A 5/1996 Scanlon et al.
 5,517,435 A 5/1996 Sugiyama
 5,539,859 A 7/1996 Robbe et al.
 5,590,241 A * 12/1996 Park et al. 704/227
 5,633,935 A 5/1997 Kanamori et al.
 5,649,055 A 7/1997 Gupta et al.
 5,664,052 A * 9/1997 Nishiguchi et al. 704/214
 5,684,460 A 11/1997 Scanlon et al.
 5,729,694 A 3/1998 Holzrichter et al.
 5,754,665 A 5/1998 Hosoi et al.
 5,835,608 A 11/1998 Warnaka et al.
 5,853,005 A 12/1998 Scanlon
 5,917,921 A 6/1999 Sasaki et al.
 5,966,090 A 10/1999 McEwan
 5,986,600 A 11/1999 McEwan
 6,006,175 A * 12/1999 Holzrichter 704/208
 6,009,396 A 12/1999 Nagata
 6,069,963 A 5/2000 Martin et al.
 6,191,724 B1 2/2001 McEwan
 6,233,551 B1 * 5/2001 Cho et al. 704/208
 6,266,422 B1 7/2001 Ikeda
 6,430,295 B1 8/2002 Handel et al.

2002/0039425 A1 4/2002 Burnett et al.

FOREIGN PATENT DOCUMENTS

EP 0 795 851 A2 9/1997
 EP 0 984 660 A2 3/2000
 JP 2000 312 395 11/2000
 JP 2001 189 987 7/2001
 WO WO 02 07151 1/2002

OTHER PUBLICATIONS

Todd J. Gable et al.: "Speaker Verification Using Combined Acoustic and EM Sensor Signal Processing", IEEE Intl. Conf. on Acoustics, Speech & Signal Processing (ICASSP-2001), Salt Lake City, USA, 2001.

A. Hussain: "Intelligibility Assessment of a Multi-Band Speech Enhancement Scheme", Proceedings IEEE Intl. Conf. on Acoustics, Speech & Signal Processing (ICASSP-2000), Istanbul, Turkey, Jun. 2000.

Zhao Li et al.: "Robust Speech Coding Using Microphone Arrays", Signals Systems and Computers, 1997. Conf. record of 31st Asilomar Conf., Nov. 2-5, 1997, IEEE Comput. Soc. Nov. 2, 1997, USA.

L.C. Ng et al.: "Denoising of Human Speech Using Combined Acoustic and EM Sensor Signal Processing", 2000 IEEE Intl Conf on Acoustics Speech and Signal Processing. Proceedings (Cat. No. 00CH37100), Istanbul, Turkey, Jun. 5-9, 2000, XP002186255, ISBN 0-7803-6293-4.

S. Affes et al.: "A Signal Subspace Tracking Algorithm for Microphone Array Processing of Speech". IEEE Transactions on Speech and Audio Processing, N.Y, USA vol. 5, No. 5, Sep. 1, 1997, XP000774303, ISBN 1063-6676.

* cited by examiner

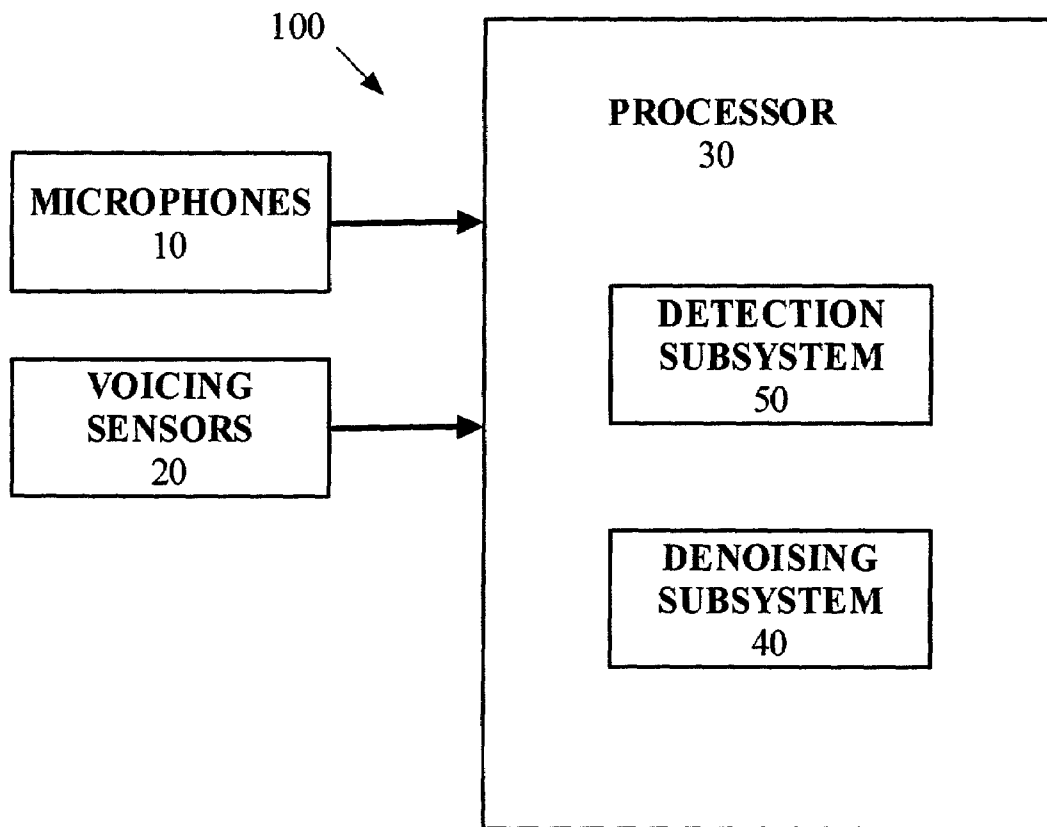


Figure 1

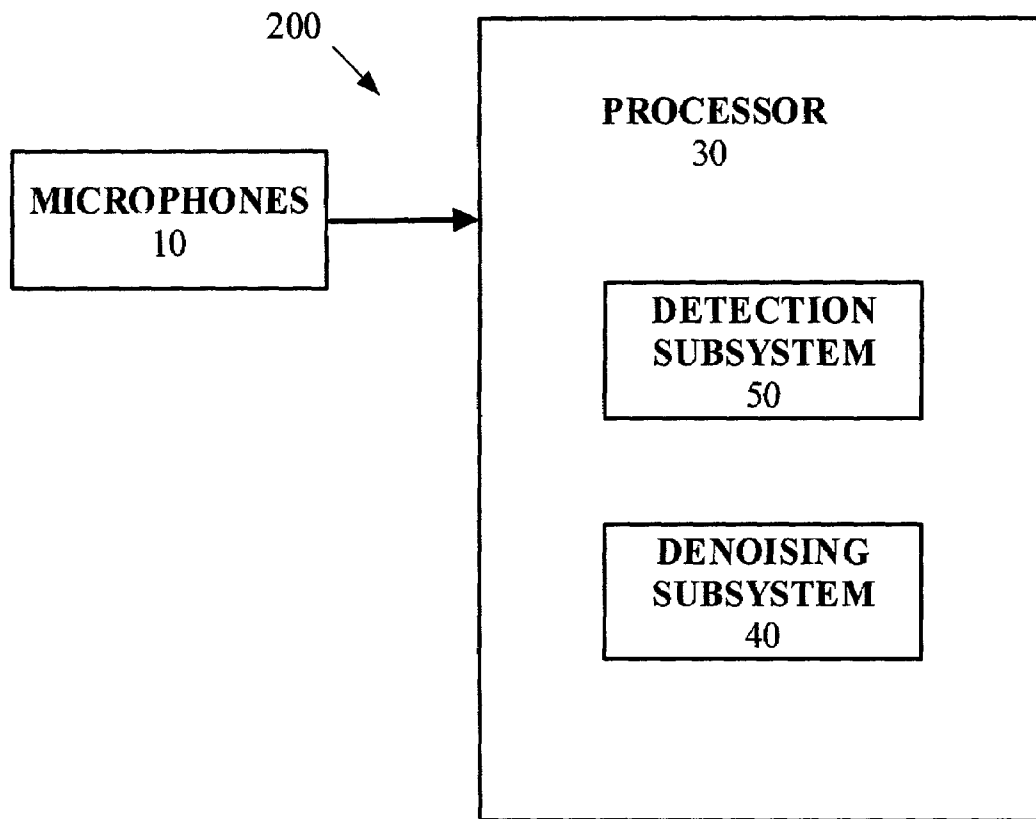


Figure 2

Explore Litigation Insights

Docket Alarm provides insights to develop a more informed litigation strategy and the peace of mind of knowing you're on top of things.

Real-Time Litigation Alerts



Keep your litigation team up-to-date with **real-time alerts** and advanced team management tools built for the enterprise, all while greatly reducing PACER spend.

Our comprehensive service means we can handle Federal, State, and Administrative courts across the country.

Advanced Docket Research



With over 230 million records, Docket Alarm's cloud-native docket research platform finds what other services can't. Coverage includes Federal, State, plus PTAB, TTAB, ITC and NLRB decisions, all in one place.

Identify arguments that have been successful in the past with full text, pinpoint searching. Link to case law cited within any court document via Fastcase.

Analytics At Your Fingertips



Learn what happened the last time a particular judge, opposing counsel or company faced cases similar to yours.

Advanced out-of-the-box PTAB and TTAB analytics are always at your fingertips.

API

Docket Alarm offers a powerful API (application programming interface) to developers that want to integrate case filings into their apps.

LAW FIRMS

Build custom dashboards for your attorneys and clients with live data direct from the court.

Automate many repetitive legal tasks like conflict checks, document management, and marketing.

FINANCIAL INSTITUTIONS

Litigation and bankruptcy checks for companies and debtors.

E-DISCOVERY AND LEGAL VENDORS

Sync your system to PACER to automate legal marketing.