

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

HARMAN INTERNATIONAL INDUSTRIES, INC.
Petitioner

v.

ST CASESTECH, LLC,
Patent Owner

Case IPR2024-01300

U.S. Patent No. 11,589,329

**DECLARATION OF DR. SAYFE KIAEI
IN SUPPORT OF PETITION FOR *INTER PARTES* REVIEW OF
U.S. PATENT NO. 11,589,329**

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I. INTRODUCTION

1. I have been retained by Harman International Industries, Inc., which I will refer to as “Harman” throughout this Declaration, to provide my opinions on certain issues related to U.S. Patent No. 11,589,329 (the “’329 patent,” which I understand has been designated as Exhibit 1001) in connection with the above-captioned *inter partes* review (IPR) proceeding. I have been asked to provide my insights, analysis, and opinions regarding whether claims 1-11 of the ’329 patent (“Challenged Claims”) are obvious over the prior art references identified below.

2. I understand the ’329 patent is titled “Information Processing Using a Population of Data Acquisition Devices,” identifies as its named inventor Steven W. Goldstein, and is currently owned by ST CasesTech, LLC. I have considered the ’329 patent.

3. I understand that the file history of the ’329 patent has been designated as Exhibit 1002. I have considered this file history, and I will refer to it as the “’329 File History” or by its exhibit number.

4. I understand that the ’329 patent was filed as U.S. Patent Application 17/235,130 on April 20, 2021.

5. I have considered the following non-exhaustive list of references in preparing my declaration. I have been instructed to assume that each of these references qualifies as prior art.

- **U.S. Patent No. 7,570,158** to Michael S. Denny et al. (“Denny”), titled “Collaborative Incident Media Recording System and Related Methods,” filed on August 17, 2006 and issued August 4, 2009. I understand that a copy of this reference has been designated as Exhibit 1004.
- **U.S. Patent Application Publication No. 2008/0132199** to Kazuko Hirata (“Hirata”), titled “Portable Radio Device Having Emergency Notifying Function, Emergency Notification Apparatus, and Emergency Notification System,” filed December 27, 2005 and published June 5, 2008. I understand that a copy of this reference has been designated as Exhibit 1005.
- **U.S. Patent Application Publication No. 2007/0038395** to David John Green et al. (“Green”), titled “Sensor Apparatus and System,” filed September 2, 2004 and published February 15, 2007. I understand that a copy of this reference has been designated as Exhibit 1006.
- **Japanese Patent Application Publication No. 2004-212544** to Yoshiyuki Murata (“Murata”), titled “Vocalization Analysis Result Transmitting Device, Animal Terminal Device, Vocalization Analysis Result Display Device, and Program,” filed December 27, 2002 and published July 29, 2004. I understand that a copy of this reference has been designated as Exhibit 1008, and a certified English translation has been designated as Exhibit 1007. Throughout my declaration, references to Murata are to Exhibit 1007.
- **U.S. Patent No. 6,219,645** to Charles Calvin Byers (“Byers”), titled “Enhanced Automatic Speech Recognition Using Multiple Directional Microphones,” filed on December 2, 1999 and issued April 17, 2001. I understand that a copy of this reference has been designated as Exhibit 1009.

6. I understand that there is a pending district court litigation between Petitioner and ST CasesTech, LLC (“Harman Litigation”) involving the ’329 patent.

7. I am being compensated by Harman at my standard hourly consulting rate of \$475 for my time on this matter. My compensation is not dependent on the outcome of this proceeding.

8. In forming my opinions, I relied on the documents cited in this declaration and the documents identified in the attached Appendix B. These documents comprise patents, file histories, printed publications, and other related documents. As discussed below, each document is a type that experts in my field would have reasonably relied upon when forming their opinions. Further, experts in my field would have had access to each document either through the applicable patent offices and/or well-known libraries, conferences, or publications in the field. My opinions are also based upon my personal and professional experience.

II. QUALIFICATIONS

9. I am qualified by education and experience to testify as an expert in the field of signal or acoustic data processing systems. Attached as Appendix A to this declaration is a copy of my curriculum vitae detailing my education and experience. Additionally, the following overview of my background pertains to my qualifications for providing expert testimony in this matter.

10. I earned a Ph.D. in 1987 from Washington State University in Electrical, Computer, and Energy Engineering. My M.S. and Ph.D. dissertation was in signal processing, digital signal processing, adaptive signal processing, video & audio and acoustic signal processing, adaptive audio array processing, audio and acoustic & speech processing.

11. From 1985 through 1987, while working toward my Ph.D., I worked with Boeing on the development of signal processing and control systems.

12. From 1987 through 1993, I was a tenured Professor at Oregon State University in the Electrical and Computer Engineering Department. During this time, I taught courses in audio and signal processing and performed research on the integration of signal processing algorithms on integrated VLSI.

13. From 1993 to 2002, I was a Senior Member of Technical Staff with the Wireless Technology Center and Broadband Operations at Motorola Inc. With the Wireless Integrated Technology Center (WITC) group of Motorola, I was responsible for the development of the “digital audio filtering IC” DAFIC at the LMPS 2-way radio group. Later, I joined the Broadband Operation and worked with the team on the development of OFDM Motorola Digital Subscriber Lines (DSL) transceivers named COPPERGOLD™. This chip performed FFT, OFDM and DSL parameter measurement for audio and multi-media system. I worked on the

development of broadband transceivers for MODEMS including DSL, SDSL, VDSL, and Optical communication systems. I also represented Motorola in the T1E1 and ETSI, and cable MODEM DOCSIS standards. I later work with the Motorola Wireless Integrated Technology center on the development of baseband audio and signal processing, RF and communication modules for cellular applications.

14. Since 2001, I have held the position of Motorola Endowed Chair Professor in Analog and Radio Frequency Integrated Circuitry at the School of Electrical, Computer, and Energy Engineering at Arizona State University in Tempe, Arizona. I am also the Director of the National Science Foundation Center, Connection One. Connection One is an industry/university cooperative research center with focus on communication systems. The center has over thirty industrial members and five university members focused on developing communication systems, audio and acoustic sensors, electronics, bio-electronics, and networking technologies.

15. At Arizona State University, I have developed and taught courses on Communications, digital signal and audio processing, Wirelines and Wireless Transceivers, Electronics, VLSI, Analog IC design, RFIC, communications, and related areas. In my over thirty years of academic experience, I have taught

university courses and done research in audio and acoustic processing, electronics, RF and wireless system, bio-electronics, networking, communication systems, and sensors. I have graduated over 100 M.S. and Ph.D. students working under my supervision on their thesis, and many of them are professors in academia, or have senior positions in the industry. My research is funded by various sources, including industry, federal agencies including NSF, DARPA, ONR, DOE, and other, with an average total research funding of \$1M per year.

16. I have been conducting research, publishing papers, and supervising graduate students working on communication system, signal processing, acoustic and audio processing, and communication transceivers for the past 40 years. I have published over two hundred journal and conference papers covering topics such as wireless systems, power management, low-power electronics, sensors, radio frequency, integrated circuits (IC), filter design, and related areas. A list of my publications can be found in my CV, attached as Appendix A. I also have over 10 patents and patent applications in electronics, RF, and low-power bio-electronics.

17. I have received a number of research grants from the national science foundations, DARPA, DOD, and other federal agencies for research related to sensors, audio and acoustic sensors, hearing aid, bio-sensors, audio and acoustic amplifiers. These include the following grants:

- A grant from the National Science Foundation including projects related to adaptive audio and acoustic, glucose amp-meter and impedeometer (totaling \$400K); and
- A grant from the National Science Foundation, including projects related to MEMS implanted hearing aid and bio-sensors, micro-power multi-phase on-chip MEMS hearing aid, and adaptive hearing aid audio processors (totaling \$500K from 2007-2011).

18. I am an IEEE Fellow, a distinction and the highest level of IEEE membership awarded by the IEEE directors to recognize a high level of demonstrated extraordinary accomplishments. The IEEE is the Institute of Electrical and Electronics Engineers, the world's largest association of technical professionals whose objectives include the educational and technical advancement of electrical and electronic engineering, telecommunications, computer engineering, and related disciplines.

19. I am a member of the IEEE Signal Processing Society, IEEE Circuits and Systems Society, IEEE Solid State Circuits Society, and IEEE Communication Society, IEEE RF and Microwave committees, IEEE International Symposium on Low Power Electronics and Design (ISLPED), IEEE Fellow Selection Committee, and many other International Electrical Engineering societies. I was one of the key organizers to establish the IEEE Radio Frequency Integrated Circuits (RFIC) symposium in 1995, and IEEE International Symposium on Low Power Electronics and Design (ISLPED) in 1997. I have been on the executive committee, and

technical committee of ICASSP (IEEE International Conference on Acoustics, Speech and Signal Processing), RFIC and ISLPED for the last 16 years. The ICASSP, RFIC and ISLPED Symposia have grown and are now the premier international symposia in the world where the latest RF, low-power electronics, wireless, and bio-electronic circuits and components are presented.

20. I have received several awards including the Carter Best Teacher Award, the IEEE Darlington Award (which is given for the best technical paper on circuits and systems in the IEEE Circuits and Systems Society), and the Motorola 10X Rapid Design Cycle Reduction Award.

21. I have been one of the key organizers of the IEEE International Symposium on Low Power Electronics and Design (ISLPED) since 1997. I have published papers and organized sessions on techniques for low-power cellular phones at ISLPED. I have published a number of papers on the design and development of low-power RF, wireless transceivers, sensors, and low-power bioelectronics.

22. I have also been a consultant on various projects with Motorola, Intel (designing 2G, 3G mobile telephone transceivers, Internet-of-Things (IOT), and sensors), Texas Instrument (developing 3G cellular and Bluetooth technologies), Sony Wireless (developing GPS technologies), Tektronics (designing wireless

systems), and various other consultancies. During my work in industry, I have designed and contributed to the design of many wireless systems for commercial products. Many of my designs are still in use today in products manufactured by the companies I have worked for, including Motorola, Intel, Sony, and more.

III. LEGAL UNDERSTANDING

A. My Understanding of Claim Construction

23. I am not an attorney and offer no legal opinions, but in the course of my work, I have had experience studying and analyzing patents and patent claims from the perspective of a person skilled in the art.

24. I have been informed that patent claims are construed from the viewpoint of a person of ordinary skill in the art of the patent at the time of the invention. I have been informed that patent claims generally should be interpreted consistent with their plain and ordinary meaning as understood by a person of ordinary skill in the art in the relevant time period (*i.e.*, at the time of the purported invention, or the so called “effective filing date” of the patent application), after reviewing the patent claim language, the specification, and the prosecution history (*i.e.*, the intrinsic record).

25. I have further been informed that a person of ordinary skill in the art must read the claim terms in the context of the claim itself, as well as in the context

of the entire patent specification. I understand that in the specification and prosecution history, the patentee may specifically define a claim term in a way that differs from the plain and ordinary meaning. I understand that the prosecution history of the patent is a record of the proceedings before the U.S. Patent and Trademark Office and may contain explicit representations or definitions made during prosecution that affect the scope of the patent claims. I understand that an applicant may, during the course of prosecuting the patent application, limit the scope of the claims to overcome prior art or to overcome an examiner's rejection, by clearly and unambiguously arguing to overcome or distinguish a prior art reference, or clearly and unambiguously disavowing claim coverage.

26. In interpreting the meaning of the claim language, I understand that a person of ordinary skill in the art may also consider "extrinsic" evidence, including expert testimony, inventor testimony, dictionaries, technical treatises, other patents, and scholarly publications. I understand this evidence is considered to ensure that a claim is construed in a way that is consistent with the understanding of those of ordinary skill in the art at the time of the claimed invention. For example, this can be useful for a technical term whose meaning may differ from its ordinary English meaning. I understand that extrinsic evidence may not be relied on if it contradicts

or varies the meaning of claim language provided by the intrinsic evidence, particularly if the applicant has explicitly defined a term in the intrinsic record.

B. My Understanding of Anticipation

27. I understand that a patent claim is invalid as “anticipated” if all the limitations of the claim are present, either expressly or inherently, in a single prior art publication or patent.

28. I also understand that a prior art reference can disclose a claimed feature because the feature is expressly described or because the feature is inherent in the disclosure. I understand that something is inherent in a prior art reference if the missing descriptive matter must necessarily be present, not merely probably or possibly present, and it would be so recognized by a person of ordinary skill in the art as of the priority date of the patent. I understand that it is acceptable to examine evidence outside of the prior art reference (i.e., extrinsic evidence) in determining whether a feature, while not expressly discussed in the reference, is necessarily present in it.

C. My Understanding of Obviousness

29. I understand that a claim may be invalid if the subject matter described by the claim as a whole would have been obvious to a hypothetical person of ordinary skill in the art in view of a prior art reference or in view of a combination

of references at the time the claimed invention was made. Therefore, I understand that obviousness is determined from the perspective of a hypothetical person of ordinary skill in the art and that the asserted claims of the patent should be read from the point of view of such a person at the time the claimed invention was made. I further understand that a hypothetical person of ordinary skill in the art is assumed to know and to have all relevant prior art in the field of endeavor covered by the patent in suit.

30. I have been informed that there are two criteria for determining whether prior art is analogous and thus can be considered prior art: (1) whether the art is from the same field of endeavor, regardless of the problem addressed, and (2) if the reference is not within the field of the patentee's endeavor, whether the reference still is reasonably pertinent to the particular problem with which the patentee is involved. I have also been informed that the field of endeavor of a patent is not limited to the specific point of novelty, the narrowest possible conception of the field, or the particular focus within a given field. I have also been informed that a reference is reasonably pertinent if, even though it may be in a different field from that of the patentee's endeavor, it is one which, because of the matter with which it deals, logically would have commended itself to a patentee's attention in considering their problem.

31. I have also been advised that an analysis of whether a claimed invention would have been obvious should be considered in light of the scope and content of the prior art, the differences (if any) between the prior art and the claimed invention, and the level of ordinary skill in the pertinent art involved. I understand as well that a prior art reference should be viewed as a whole.

32. I have also been advised that in considering whether a claimed invention would have been obvious over a combination of prior art references, I may assess whether there are apparent reasons to combine known elements in the prior art in the manner claimed in view of interrelated teachings of multiple prior art references, the effects of demands known to the design community or present in the marketplace, and/or the background knowledge possessed by a person of ordinary skill in the art. I understand that other principles may be relied on in evaluating whether a claimed invention would have been obvious, and that these principles include the following:

- A combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results;
- When a device or technology is available in one field of endeavor, design incentives and other market forces can prompt variations of it, either in the same field or in a different one, so that if a person of ordinary skill can implement a predictable variation, the variation is likely obvious;
- If a technique has been used to improve one device, and a person of ordinary skill in the art would recognize that it would improve similar

devices in the same way, using the technique is obvious unless its actual application is beyond their skill;

- An explicit or implicit teaching, suggestion, or motivation to combine two prior art references to form the claimed combination may demonstrate obviousness, but proof of obviousness does not depend on or require showing a teaching, suggestion, or motivation to combine;
- Market demand, rather than scientific literature, can drive design trends and may show obviousness;
- In determining whether the subject matter of a patent claim would have been obvious, neither the particular motivation nor the avowed purpose of the named inventor controls whether the claim is obvious;
- One of the ways in which a patent's subject can be proved obvious is by noting that there existed at the time of invention a known problem for which there was an obvious solution encompassed by the patent's claims;
- Any need or problem known in the field of endeavor at the time of invention and addressed by the patent can provide a reason for combining the elements in the manner claimed;
- "Common sense" teaches that familiar items may have obvious uses beyond their primary purposes, and in many cases a person of ordinary skill will be able to fit the teachings of multiple patents together like pieces of a puzzle;
- A person of ordinary skill in the art is also a person of ordinary creativity, and is not an automaton;
- A patent claim can be proved obvious by showing that the claimed combination of elements was "obvious to try," particularly when there is a design need or market pressure to solve a problem and there are a finite number of identified, predictable solutions such that a person of ordinary skill in the art would have had good reason to pursue the known options within his or her technical grasp; and
- One should be cautious of using hindsight in evaluating whether a claimed invention would have been obvious.

33. I further understand that, in making a determination as to whether the claimed invention would have been obvious to a person of ordinary skill, the Board may consider certain objective factors if they are present, such as: commercial success of products practicing the claimed invention; long-felt but unsolved need; teaching away; unexpected results; copying; and praise by others in the field. These factors are generally referred to as “secondary considerations” or “objective indicia” of nonobviousness. I understand, however, that for such objective evidence to be relevant to the obviousness of a claim, there must be a causal relationship (called a “nexus”) between the claim and the evidence, and that this nexus must be based on a novel element of the claim rather than something in the prior art. I also understand that even when they are present, secondary considerations may be unable to overcome primary evidence of obviousness (such as motivation to combine with predictable results) that is sufficiently strong.

IV. BACKGROUND OF THE TECHNOLOGY

34. The '329 patent is generally directed to a system of acoustic devices that communicate information to one another, whereby one of the acoustic devices assumes control, receives data from the other acoustic devices and performs speech detection. *See, e.g.*, '329 patent, 23:30-24:3 (cl. 1).

35. There were no rejections of the claims issued during prosecution of the '329 patent. See Ex. 1002 ('329 File History). During prosecution, the applicant filed a preliminary amendment to add that the acoustic devices are configured to interchange “data over a communication link” and that the controller acoustic device analyzes the received data “to identify if speech is present.” Ex. 1002 ('329 File History), 76-78. The claims were subsequently allowed. Ex. 1002 ('329 File History), 324-330.

36. Based on my experience in the field, however, these concepts were already known in the art prior to the '329 patent's priority date. For example, Denny (Ex. 1004) discloses one such incident reporting system comprising remote sensing units (“RSUs”). Denny, Abstract, 5:35-38, Figure 3. The remote sensing units **communicate with one another, such as via Bluetooth**, and upon detection of an incident (e.g., a car accident), **one of the RSUs** assumes control. Denny, 9:65-10:17, 10:53-58, 13:57-14:4, Figures 3, 4. That **RSU** identifies **other RSUs** in the vicinity that may have collected audio **data**, requests and collects their **data**, and analyzes the received data to confirm the incident occurred, such as by detecting fearful screaming. Denny, 5:55-60, 9:44-57, 10:18-22, 11:3-40, 16:61-17:10, Figures 3, 4.

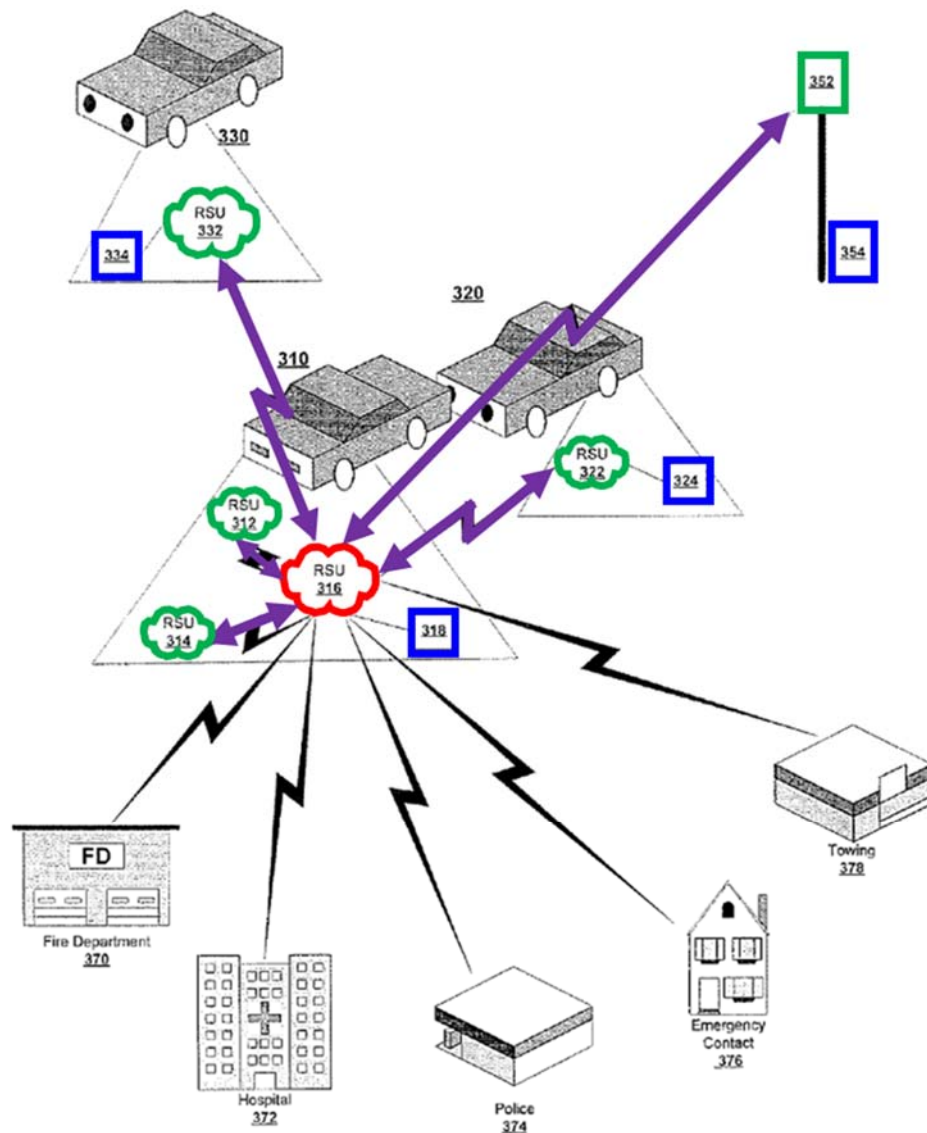


Figure 3

Denny, Figure 3.

37. As I discuss below, the claims of the '329 patent are anticipated and/or obvious over the prior art. Further, there were no technological barriers to combining these teachings from the prior art and a person of ordinary skill in the art

would have been motivated to combine these teachings and would have understood that the combination would have yielded predictable results.

V. THE '329 PATENT

A. '329 Patent Overview

38. The '329 patent “relates to processing of information from a population of data acquisition devices, and in some examples, relates to processing of audio or multimedia data acquired from an adaptively selectable population of personal wireless devices.” '329 patent, 1:25-29.

39. The '329 patent describes a “system 100” that “include[s] one or more distributed **devices 120** (also referred to herein as devices 120)¹ and **device 120'** (also referred to as **controller 120'**) in an environment.” '329 patent, 3:48-53. **Devices 120** and **controller 120'** “may be capable of direct communication with each other, via **communication link 154**.” '329 patent, 4:3-12. **Devices 120** include an “acoustic analysis module . . . for analyzing audio information (such as from one or more microphones 222),” including “speech, music as well as environmental sounds (such as an approaching train)” generated by “a user of device 120, as well as by other individuals proximate to device 120.” '329 patent, 6:49-57.

¹ Throughout my declaration, if I use colored font in the text of my declaration, this aligns with coloring I have had added to annotations in corresponding figures.

40. **Controller 120'** selects some of the **devices 120** and “combine[s] the sensor information and/or locally analyzed information from among the **selected devices**, in order to determine at least one characteristic of audio scene 130 (or the environment, in general).” ’329 patent, 8:12-19. **Controller 120'** “act as a controller for selectively acquiring sensor information from among **devices 120**” and “may be configured to acquire information relating to audio scene 130,” such as an “urban environment, for example, with the **devices 120**, **120'** being present on city streets, in office buildings, or in homes of the users.” ’329 patent, 3:53-59, 4:16-19. **Controller 120'** acquires sensor information such as “**the device** owner’s own speech even when not carrying out a telephone call, other sounds made by the owner (such as coughing), the speech of others in proximity to the user and environmental sounds in proximity to the user (such as sirens, gunshots, etc.).” ’329 patent, 4:42-49.

41. Figure 1 of the ’329 patent is reproduced below, and I added annotations illustrating various aspects of the system described above. I also added text from Claim 1 of the ’329 patent:

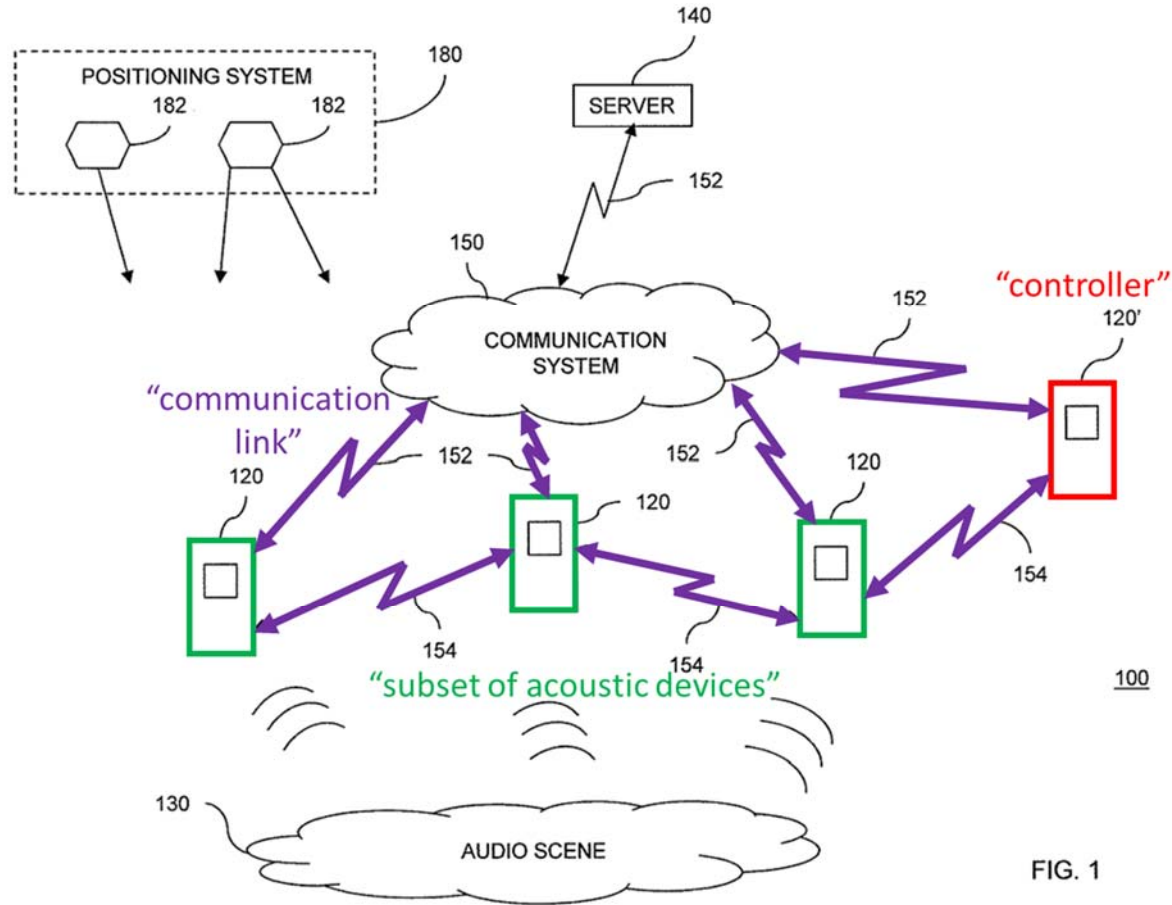


FIG. 1

'329 patent, Figure 1 (annotated).

B. Prosecution History of the '329 Patent

42. In formulating my opinions, I considered the contents of the prosecution history of the '329 patent and its ancestors. *See* Ex. 1002; Exs. 1016-1018. The prosecution history shows the Challenged Claims of the '329 patent were allowed after a preliminary amendment added Claims 2-11 and amended Claim 1 to recite that the received data is analyzed “to identify if speech is present” and remove the limitation that the “acoustic devices” are “distributed in an environment.” Ex.

1002, 76-78. The Examiner provided no reasons for allowance. Ex. 1002, 324-330. The claims were allowed again after applicant subsequently filed an IDS. Ex. 1002, 406-413, 666-672.

43. I understand that the '329 patent is continuation of a chain of 3 continuation applications, and all of those applications issued as patents. See '329 patent, 1-2 ("Related U.S. Application Data"). In my review of the earlier applications in the priority chain, I have seen substantive discussion of prior art only in two instances, which occurred during prosecution of related U.S. Patent Nos. 10,602,474 and 10,045,321, which issued from continuation applications of the '329. Exs. 1016-1018. However, those discussions were directed to different claim features that do not appear in or otherwise impact any of the Challenged Claims. In particular, the discussion during prosecution of U.S. Patent No. 10,602,474 was directed to limitations related to, e.g., "adjusting a manner in which the subset of devices operate based on the characteristic of the environment, a context associated with the characteristic of the environment, and the information." See, e.g., Ex. 1017, 121-124. The discussion during prosecution of U.S. Patent No. 10,045,321 was directed to limitations related to, e.g., "adjusting a manner in which the subset of devices operate based on the characteristic of the environment and the information aggregated from the at least one microphone and the at least one non-acoustic

sensor.” *See, e.g.*, Ex. 1018, 512-520. Neither of these limitations appear in the claims of the ’329 patent.

VI. THE ’329 PATENT PRIORITY DATE

44. I understand the ’329 patent was filed on April 20, 2021. I have not formulated any opinion about the correct priority date for the ’329 patent. For purposes of this declaration, I was asked to assume, with respect to each of the prior art Grounds discussed in this declaration, that the ’329 patent is entitled to the earliest claimed priority date of December 30, 2010. I have been instructed to consider the patent and the prior art from the perspective of a person having ordinary skill in the art as of December 30, 2010.

VII. LEVEL OF ORDINARY SKILL IN THE ART

45. In rendering the opinions set forth in this declaration, I was asked to consider the patent claims and the prior art through the eyes of a person of ordinary skill in the art at the time of the alleged invention. I understand that the factors considered in determining the ordinary level of skill in a field of art include the level of education and experience of persons working in the field; the types of problems encountered in the field, the teachings of the prior art, and the sophistication of the technology at the time of the alleged invention. I understand that a person of ordinary skill in the art is not a specific real individual, but rather is a hypothetical

individual having the qualities reflected by the factors above. I understand that a person of ordinary skill in the art would also have knowledge from the teachings of the prior art, including the art cited below.

46. With respect to all of the Grounds, I have been asked to assume that the '329 patent is entitled to the priority date of December 30, 2010. Upon consideration of these factors, in my opinion, on or before this priority date, a person of ordinary skill in the art relating to the technology of the '329 patent would have had a bachelor's degree in electrical or computer engineering, computer science, or a similar field, and at least two years of experience with signal or acoustic data processing systems. Additional graduate education could substitute for professional experience, or significant experience in the field could substitute for formal education.

47. I am qualified to opine concerning what a person of ordinary skill in the art would have known and understood during that time. Well before December 30, 2010, my level of skill in the art was at least that of a person of ordinary skill. I am qualified to opine concerning what a person of ordinary skill in the art would have known and understood at the time of the '329 patent's purported invention. My analysis and conclusions herein are from the perspective of a person of ordinary skill in the art as of December 30, 2010.

VIII. CLAIM CONSTRUCTION

48. I have been instructed that the Challenged Claims of the '329 patent are to be given their ordinary and customary meaning as understood by one of ordinary skill in the art at the time of the alleged invention in light of the specification and the prosecution history pertaining to the patent. I have followed these principles in my analysis set forth in this document.

49. I understand that the parties have not proposed constructions for the '329 patent in the Harman Litigation.

IX. GROUNDS OF UNPATENTABILITY

50. As I explain above in Section IV, signal or acoustic data processing systems that detect speech and respond thereto were well-known in the art.

51. In this section, I will explain why the teachings or combinations of teachings from the following references either anticipate and/or render obvious each of the Challenged Claims:

Name	Ex.	Publication/Title	Published/Issued
Denny	1004	US7,570,158	8/4/2009
Hirata	1005	US2008/0132199	6/5/2008
Green	1006	US2007/0038395	2/15/2007
Murata	1007-1008	JP2004/212544	7/29/2004
Byers	1009	US6,219,645	4/17/2001

I have been instructed to assume that each of these references qualifies as prior art.

52. As I explain below, the Challenged Claims are invalid based upon the following prior art grounds:

- **Ground 1:** Challenged Claims 1, 5, and 7-9 of the '329 patent are anticipated, and at minimum rendered obvious, by Denny.
- **Ground 2:** Challenged Claims 1-9 of the '329 patent are rendered obvious by Denny in view of Hirata.
- **Grounds 3:** Challenged Claims 1-11 of the '329 patent are rendered obvious by Denny in view of Byers.
- **Grounds 4-5:** Challenged Claim 4 of the '329 patent is rendered obvious by Ground 2 (Denny in view of Hirata) further in view of Green and Ground 3 (Denny in view of Byers) further in view of Green.
- **Grounds 6-8:** Challenged Claim 8 of the '329 patent is rendered obvious by Ground 1 (Denny) in view of Murata, Ground 2 (Denny in view of Hirata) further in view of Murata, and Ground 3 (Denny in view of Byers) further in view of Murata.

53. It is my opinion that Challenged Claims of the '329 patent are unpatentable as explained below. I note that in this discussion, I may focus on the particular language in the specific claims, but it should be understood that my analysis applies to the corresponding elements of all Challenged Claims containing identical or substantially identical language.

A. Ground 1: Denny (Claims 1, 5, and 7-9)

1. Overview of Denny

54. Denny is directed to “[i]mproved methods and systems for responding to incidents . . . to enhance the collection of data regarding the incident and/or to

more quickly and efficiently initiate responsive actions that may be desirable in light of the incident.” Denny, 1:44-48. Denny recognizes that “[i]n response to many incidents today, little or no data relating to the incident may be collected in real time and/or in near real time,” and “the response to many common incidents is often formed in a piecemeal fashion and may be heavily dependent on individuals recognizing the actions that need to be taken and then initiating those actions.” Denny, 1:39-48.

55. Denny discloses “systems and methods” that “use a plurality of distributed sensing units, referred to herein as ‘remote sensing units’, to collect data over a localized or wide geographic area.” Denny, 5:35-38. Consistent with Denny’s disclosure, I will refer to “remote sensing units” throughout this declaration as “RSUs.” Denny, 10:18-20 (“remote sensing units (RSUs)”).

56. Denny further discloses that each RSU “includes one or more sensors that intermittently or continuously collect data regarding what is occurring in the vicinity of the remote sensing unit.” Denny, 5:53-55. Exemplary sensors of the RSUs include “a noise meter, an audio recorder, an accelerometer, a speedometer, a clock, a video camera, a global positioning satellite receiver, a thermometer, a breathalyzer, a wind gauge, a seat belt sensor, etc.” Denny, 5:55-60. These sensors are “used to sense and identify a wide variety of . . . incidents,” including to

“automatically” identify “automobile accidents,” “fires in homes, offices or automobiles, gunshot detection, plane or boat crashes, fearful screaming, suspicious behavior, muggings, bombings, war, running out of gas, etc.” Denny, 16:61-17:10.

57. Below, I discuss the disclosures of Denny in the context of Figures 3 and 4, and I added annotations illustrating various aspects of Denny’s disclosed system. Figure 3 “is a schematic diagram illustrating several remote sensing units that are in the vicinity of an automobile accident (i.e., an exemplary incident),” such as “an automobile accident occurs between a first vehicle 310 and a second vehicle 320.” Denny, 9:36-38, 9:43-44. Figure 4 “is a flow chart illustrating operations that may be performed at, for example, the remote sensing unit 316 of FIG. 3 to identify that the automobile accident has occurred and to coordinate an appropriate response thereto.” Denny, 9:38-42.

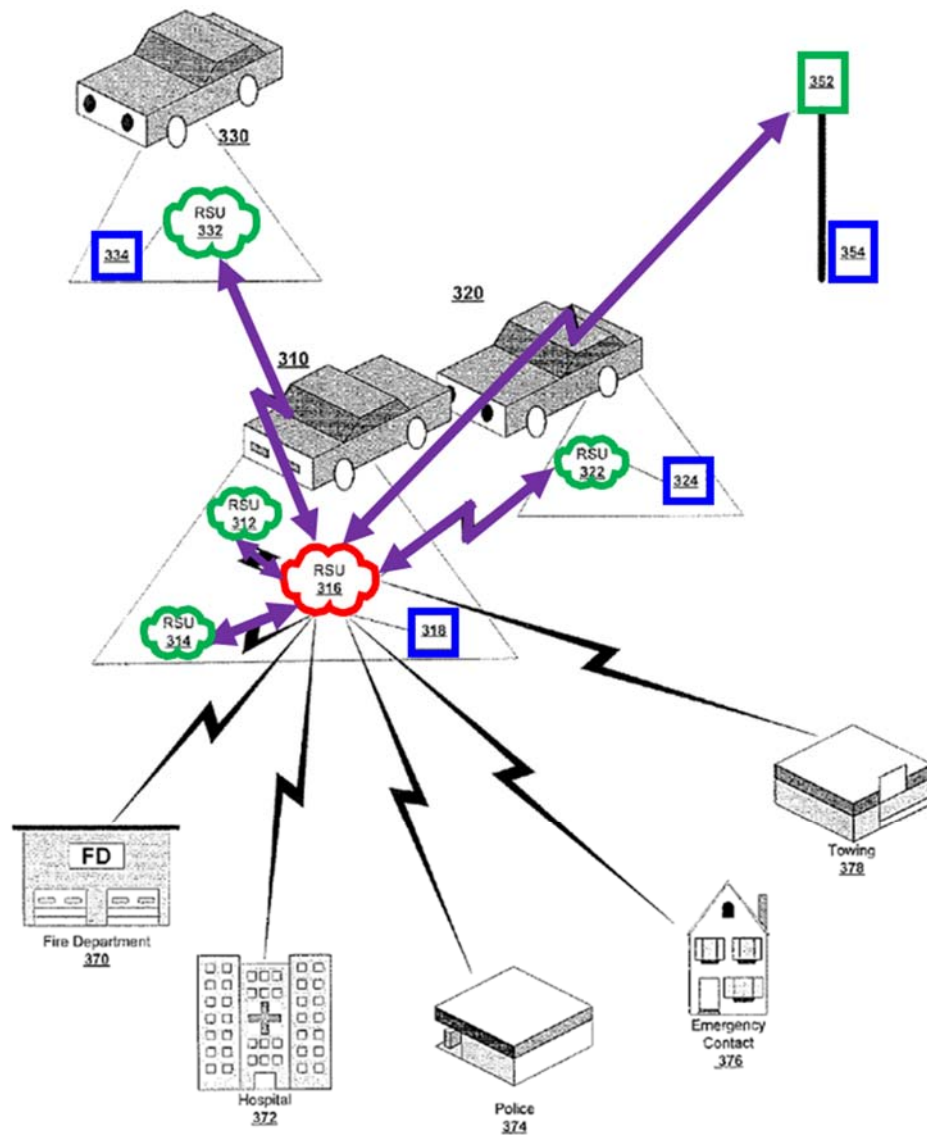


Figure 3

Denny, Figure 3 (annotated).

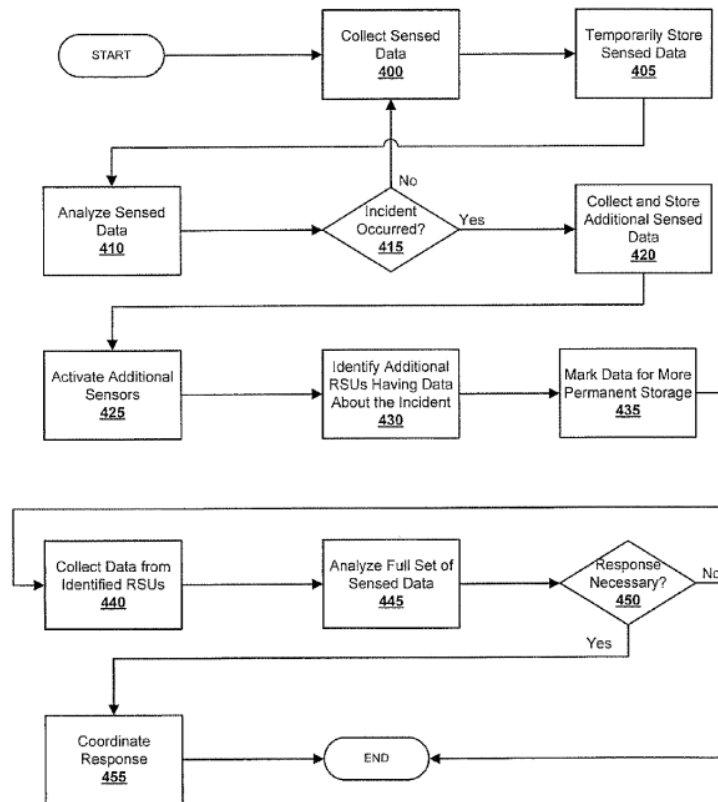


Figure 4

Denny, Figure 4.

58. In connection with these figures, Denny discloses “[t]he first vehicle 310 involved in the automobile accident has two passengers (not shown), each of whom is carrying a personal **remote sensing unit 312, 314**, and the first vehicle 310 also has a built-in **remote sensing unit 316**. The second vehicle 320 has a single passenger (not shown) who is carrying a **remote sensing unit 322**. A third vehicle 330 that contains an embedded **remote sensing unit 332** is also in the vicinity at the

time of the accident, and a fixed **remote sensing unit 352** is also located nearby. When the first vehicle 310 collides with the second vehicle 320, each of the remote sensing units **312, 314, 316, 322, 332, 352** may collect sensor data that provides information about the collision. This collected sensor data is depicted in FIG. 3 as **data sets 318, 324, 334, 354.**” Denny, 9:44-57. I added the annotations to this passage from Denny.

59. In connection with Figure 4, “operations begin at block 400 with the **remote sensing unit 316** collecting sensed data using its sensors.” Denny, 9:65-67. As discussed above, one such sensor includes an “audio recorder.” Denny, 5:55-60. The collected data is stored, and **RSU 316** “either periodically or continuously analyze the collected sensed data to determine if an incident has occurred.” Denny, 9:67-10:7. If an incident is not detected, “operations return from block 415 to block 400.” Denny, 10:9-11. If an incident is detected, **RSU 316** “continues to collect and store additional sensed data” and “activate[s] additional sensors, such as sensors that are normally in standby mode due to power consumption constraints, cost concerns, memory storage limitations, wear concerns, etc.” Denny, 10:11-17.

60. If an incident is detected, **RSU 316** “also proceed[s] to identify additional remote sensing units (RSUs) that may have collected data about the incident (and/or which could be activated to start collecting data about the incident).”

Denny, 10:18-22. Denny discloses that “every remote sensing unit could continuously or periodically broadcast its identification (e.g., via an ultrawideband system) and perhaps other information, such as its location, which could then be used by a remote sensing unit to identify the other remote sensing units in the vicinity of the incident.” Denny, 10:53-58. For example, Denny teaches that RSUs 312, 314, 316, 322, 332, 352 broadcast their identification and location to each other, which is then used by a controller RSU (e.g., RSU 316) to identify which of the other RSUs are in the controller RSU’s vicinity that, for example, may have collected information related to an incident.

61. RSU 316 then “ask[s]” the identified RSUs, such as RSUs 312, 314, 322, 332, 352, to “tag” the data for “more permanent storage” and “then proceed[s] to collect data from each of the other identified remote sensing units.” Denny, 11:3-12. RSU 316 then “perform[s] a second analysis (block 445), this time on the more complete data set that includes data from additional remote sensing units and perhaps additional data collected subsequent to the identification of the incident at block 415.” Denny, 11:12-17. Based on this analysis, RSU 316 “determine whether a response is necessary to the identified incident (block 450)” and “coordinates such a response, if necessary.” Denny, 11:17-26. Such a response “may be preprogrammed,” such as “automatically notify[ing] the local fire department 370,

the nearest hospital 372 (or emergency response unit) to the site of the collision, and/or the closest police substation 374.” Denny, 11:27-40.

62. Figure 6 of Denny is “a block diagram that illustrates an exemplary embodiment of a remote sensing unit 600 according to certain embodiments of the present invention. Any one of, or all of, the remote sensing units illustrated in FIG. 1, 3 and/or 5 could be implemented using the remote sensing unit 600 of FIG. 6.” Denny, 13:48-52. RSU 600 includes “a communications unit 610, a storage unit 620, a processor 630, stored standards 640, a sensor bank 650, a clock 660 and stored personal and/or environmental information 670.” Denny, 13:53-56. The “communications unit 610” is “used to transmit and receive information between the remote sensing unit 600 and other remote sensing units as in the embodiments of FIGS. 1 and 3” and comprises, for example, “a cellular telephone, an internet protocol or other packet switched wireless communications device, a Bluetooth or WiMax connection, a landline telephone, a wired internet connection, a combination thereof, or any of a wide variety of other communications systems.” Denny, 13:57-14:1.

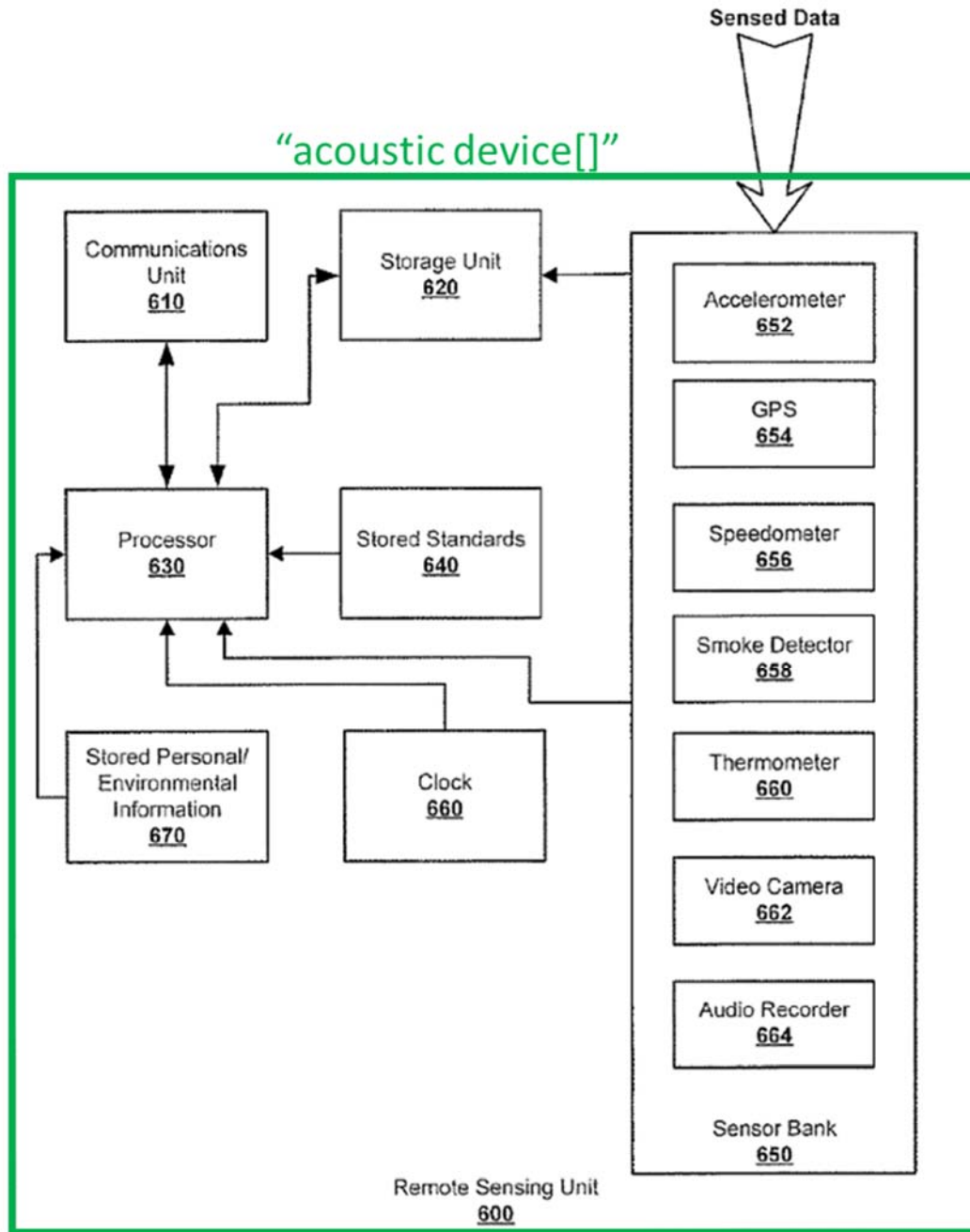


Figure 6

Denny, Figure 6 (annotated). I added annotations illustrating various aspects of Denny’s disclosed RSUs and added text from Claim 1 of the ’329 patent.

2. Invalidity of Claims 1, 5, and 7-9 Over Denny

63. As I discuss below, the Challenged Claims are anticipated, and at least rendered obvious, by **Denny**. In addition to my discussion Section IX.A.1, the following discussion identifies example disclosures followed by bulleted excerpts that each disclose, and at least render obvious, the Challenged Claims.

(a) Element [1.pre]

64. **Element [1.pre]** recites “**A system comprising.**” This element is met by Denny.

65. To the extent the preamble is limiting, Denny discloses a system (*e.g.*, “systems . . . for gathering information relating to a specific incident”). *See, e.g.*, Denny, 1:7-9, 3:31-34.

66. Denny discloses that present invention relates to . . . systems and methods for gathering information relating to a specific incident.” Denny, 1:7-9. Denny also discloses, in connection with Figure 3, “a system for identifying and responding to such an incident.” Denny, 3:31-34.

- **1:7-9:** “The present invention relates to information gathering and, more particularly, to **systems** and methods ***for gathering information relating to a specific incident.***”
- **3:31-34:** “FIG. 3 is a schematic diagram illustrating an exemplary incident and elements of ***a system for identifying and responding to such an incident*** according to further embodiments of the present invention.”

(b) Element [1.a.1]

67. Element [1.a] recites “a device among a plurality of acoustic devices; wherein the device is configured as a controller, wherein the controller is configured to perform operations comprising,” which I have analyzed as element [1.a.1] in this section and [1.a.2] in the next section.

68. **Element [1.a.1] recites “a device among a plurality of acoustic devices.”** This element is met by Denny alone.

69. Denny discloses a device (*e.g.*, “remote sensing unit 316”) among a plurality of acoustic devices (*e.g.*, “remote sensing units” each having “an audio recorder”). *See, e.g.*, Denny:

- **Figure 3 (annotated):**

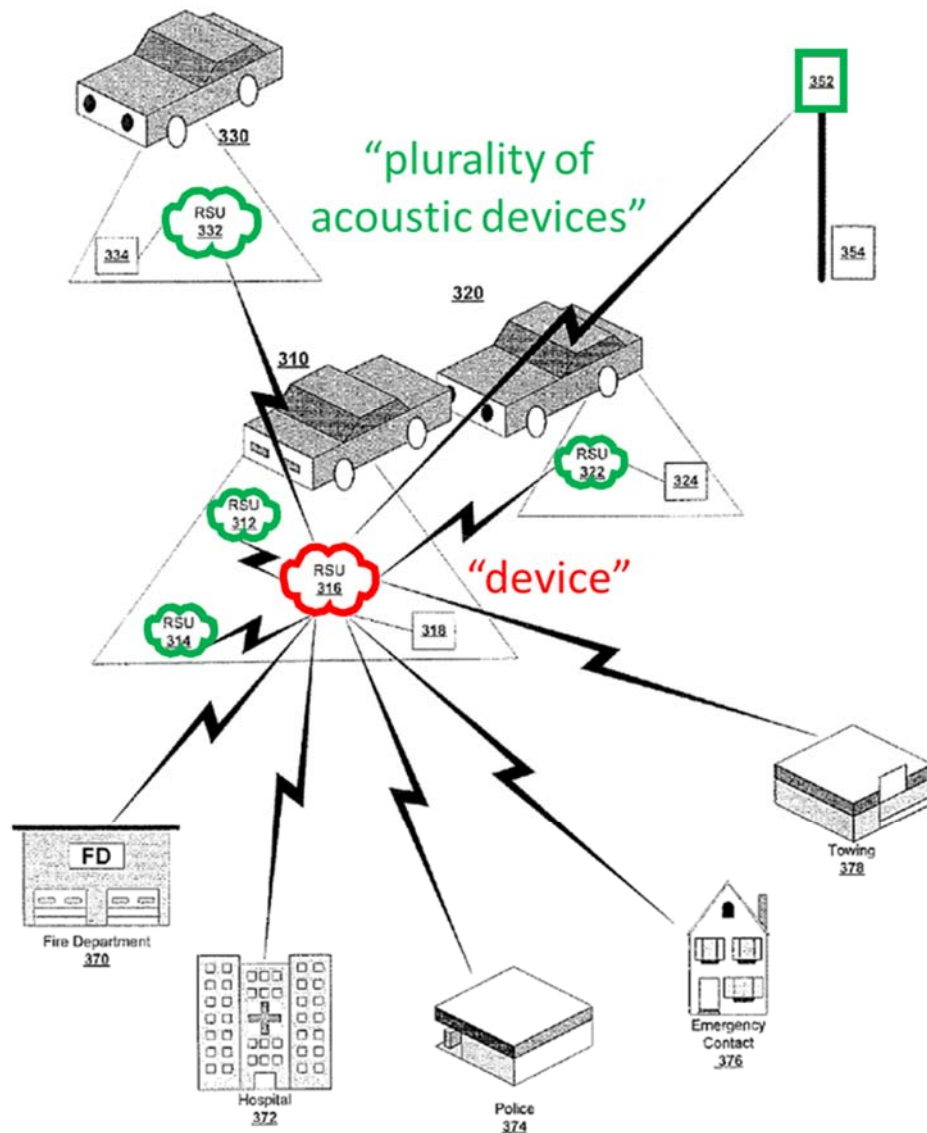


Figure 3

- Figure 6 (annotated):

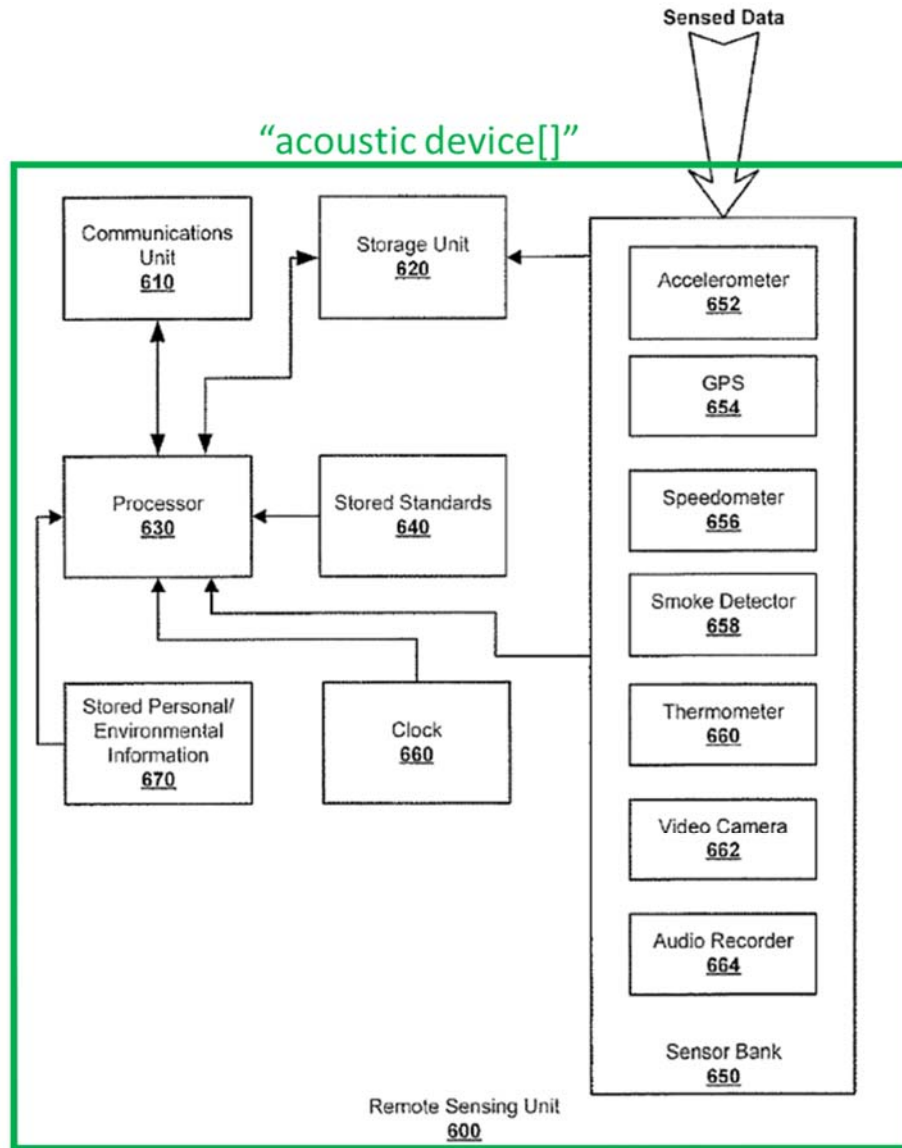


Figure 6

- 5:53-67: *“Each remote sensing unit includes one or more sensors that intermittently or continuously collect data regarding what is occurring in the vicinity of the remote sensing unit. A few examples of the types of sensors that may be included on a remote sensing unit include a noise meter, an audio recorder, an accelerometer, a speedometer, a clock, a video camera, a global positioning satellite receiver, a thermometer, a breathalyzer, a wind gauge, a seat belt sensor, etc”*

- **6:16-34:** “The *remote sensing units also typically include capabilities for communicating with other remote sensing units*, with a system hub, and/or with other elements of the system such as, for example, a local aggregator. *Upon determining that out-of-range sensor readings indicate that an incident has occurred, a remote sensing unit* (or other element of the system that makes such a determination) *may identify and communicate with additional remote sensing units that are in the general vicinity of the remote sensing unit that collected the data relating to the incident. These additional remote sensing units may then be contacted* (1) to ensure that they keep data that was collected around the time of the incident and/or (2) *to request that they transmit the relevant data to a system element that will perform further analysis of the incident based on an aggregation of sensed data collected by a plurality of remote sensing units*. An element of the system may also initiate a response to the incident such as dispatching police, fire and/or ambulance units to the location of the incident.”
- **7:18-27:** “It will be appreciated that the types of sensors carried by each remote sensing unit 12, 14, 16, 22, 32, 42, 52, and hence the collected sensor data contained in the data sets 18, 24, 34, 44, 54, may be quite varied. For example, *the first data set 18 and/or the second data set 24 may include* accelerometer data, speedometer data, *audio data*, braking data, global positioning satellite location data, temperature data, rain detector information, information regarding the number of passengers, seat belt status information, breathalyzer information, trajectory information, etc. Some of this collected data may be indicative of an automobile accident (i.e., a sudden deceleration, the stopping of the vehicle, the vehicle decelerating more quickly than anticipated based on the braking data, audio recordings of the sound of the vehicles colliding, etc.).”
- **9:36-64:** “FIG. 3 is a schematic diagram illustrating *several remote sensing units that are in the vicinity of an automobile accident* (i.e., an exemplary incident). . . . As shown in FIG. 3, an automobile accident occurs between a first vehicle 310 and a second vehicle 320. The first vehicle 310 involved in the automobile accident has two passengers (not shown), each of whom is carrying a *personal remote sensing unit 312, 314*, and the first vehicle 310 also has a *built-in remote sensing unit 316*.

The second vehicle 320 has a single passenger (not shown) who is carrying a **remote sensing unit 322**. A third vehicle 330 that contains an **embedded remote sensing unit 332** is also in the vicinity at the time of the accident, and a **fixed remote sensing unit 352** is also located nearby. When the first vehicle 310 collides with the second vehicle 320, **each of the remote sensing units 312, 314, 316, 322, 332, 352 may collect sensor data** that provides information about the collision The flow chart of FIG. 4 depicts an exemplary set of operations that show how the remote sensing unit 316 may identify that the automobile accident occurred....”

- **13:50-56:** “Any one of, or all of, the remote sensing units illustrated in **FIG. 1, 3 and/or 5 could be implemented using the remote sensing unit 600** of FIG. 6. As shown in FIG. 6, **the remote sensing unit 600 may include** a communications unit 610, a storage unit 620, a processor 630, stored standards 640, **a sensor bank 650**, a clock 660 and stored personal and/or environmental information 670.”
- **15:18-43:** “The remote sensing unit 600 also includes a sensor bank 650. The **sensor bank 650 includes one or more sensors that collect data regarding the surrounding environment**. The block diagram of FIG. 6 illustrates exemplary sensors that may be included in the sensor bank 650 such as . . . **audio recorder 664**”

70. As disclosed in connection with Figure 3, Denny discloses RSUs (including an RSU 316) “that are in the vicinity of an automobile accident (i.e., an exemplary incident).” Denny, 6:16-34, 9:36-64.

71. Denny further discloses that each RSU “includes one or more sensors that intermittently or continuously collect data regarding what is occurring in the vicinity of the remote sensing unit,” and one of those sensors is an “audio recorder.” Denny, 5:53-67. Any one of, or all of the RSUs in the vicinity include “a sensor

bank” that “collect data,” including from the “audio recorder.” Denny, 13:50-56, 15:18-43.

72. The RSUs, which each include “an audio recorder,” are considered an acoustic device, as that term would have been understood by a person of ordinary skill in the art. For example, these RSUs (including RSU 316) have acoustic-related capabilities, such as recording audio data. Indeed, Denny discloses that the data collected by the sensors includes, for example, “audio data.” Denny, 7:18-27.

(c) Element [1.a.2]

73. **Element [1.a.2] recites “wherein the device is configured as a controller, wherein the controller is configured to perform operations comprising.”** This element is met by Denny.

74. Denny discloses the device is configured as a controller (*e.g.*, “remote sensing unit 316” “identif[ies] additional...RSUs...that may have collected data about the incident” and “collect[s] data from each of the other identified remote sensing units”), wherein the controller is configured to perform operations (*e.g.*, RSU 316 performs a “set of operations”). *See, e.g.*, Denny:

- **Figure 4:**

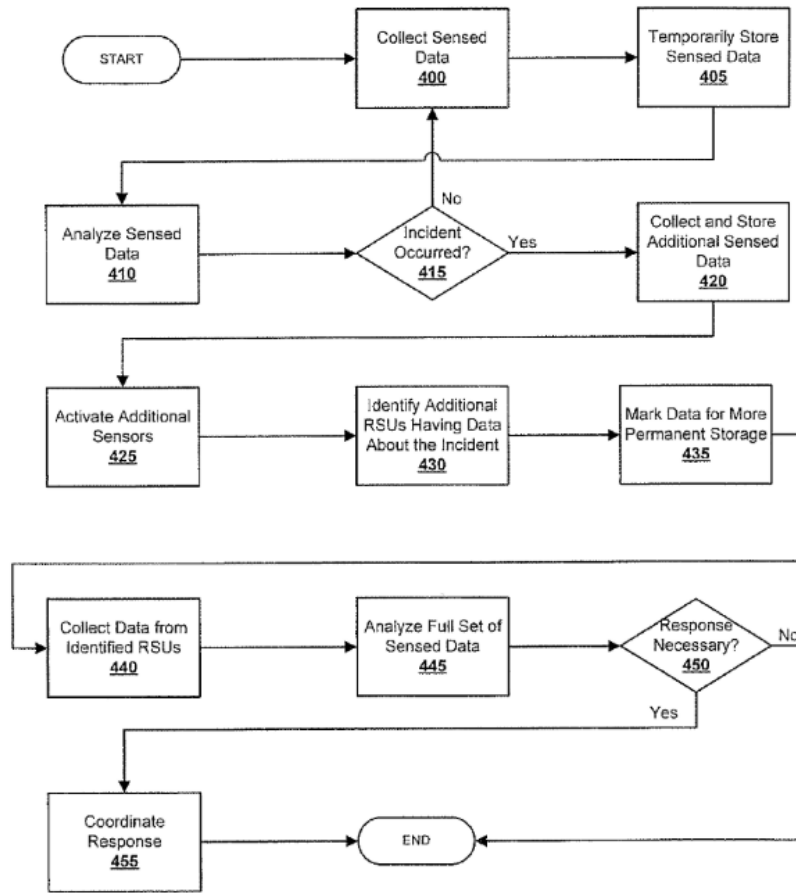


Figure 4

- 6:16-34: “The *remote sensing units also typically include capabilities for communicating with other remote sensing units*, with a system hub, and/or with other elements of the system such as, for example, a local aggregator. *Upon determining that out-of-range sensor readings indicate that an incident has occurred, a remote sensing unit* (or other element of the system that makes such a determination) *may identify and communicate with additional remote sensing units that are in the general vicinity of the remote sensing unit that collected the data relating to the incident. These additional remote sensing units may then be contacted* (1) to ensure that they keep data that was collected around the time of the incident and/or (2) *to request that they transmit the relevant data to a system element that will perform further analysis of*

- the incident based on an aggregation of sensed data collected by a plurality of remote sensing units.*** An element of the system may also initiate a response to the incident such as dispatching police, fire and/or ambulance units to the location of the incident.”
- **7:52-8:2:** “The systems and methods according to embodiments of the present invention may allow for collaboration between some or all of the remote sensing units 12, 14, 16, 22, 32, 42, 52 in order to collect and save data relating to the incident (here an automobile accident) and/or to coordinate a response to the incident. In particular, as shown in FIG. 1, ***a remote sensing unit such as remote sensing unit 16 may initiate communication with some or all of the other remote sensing units in the general vicinity (e.g., remote sensing units 12, 14, 22, 32, 42) using, for example, a direct communication link, a paging channel, etc. As part of these communications, remote sensing unit 16 may, for example, direct each of the other remote sensing units 12, 14, 22, 32, 42 to (1) provide identification information, (2) more permanently store any sensed data that each of these remote sensing units may have collected about the accident and/or (3) to forward sensed data collected about the incident to remote sensing unit 16 and/or to some other element in the system (such as system hub 60).***”
 - **9:43-64:** “. . . The first vehicle 310 involved in the automobile accident has two passengers (not shown), each of whom is carrying a personal remote sensing unit 312, 314, and the first vehicle 310 also has a built-in ***remote sensing unit 316 The flow chart of FIG. 4 depicts an exemplary set of operations that show how the remote sensing unit 316 may identify that the automobile accident occurred in one specific embodiment of the present invention, and respond to the accident*** by contacting for example, a fire department 370, a hospital 372, a police department 374, an emergency contact 376 and/or a towing service 378.”
 - **10:18-36:** “As shown at block 430 of FIG. 4, ***the remote sensing unit may also proceed to identify additional remote sensing units (RSUs) that may have collected data about the incident (and/or which could be activated to start collecting data about the incident) . . . A remote sensing unit that determines that an incident has occurred may use such a paging channel to page all other remote sensing units in the general vicinity.*** The remote sensing unit may then assume that any

remote sensing units that respond to the page may have data regarding the incident, or may collect data (e.g., global positioning satellite data) from the responding remote sensing units to make a determination as to whether the responding remote sensing units have data regarding the incident.”

- **11:9-26: “One of the remote sensing units (e.g., the remote sensing unit that identified that an incident occurred) may then proceed to collect data from each of the other identified remote sensing units”**

75. See my discussion for element [1.a.1] above (Section IX.A.2.b).

76. Denny discloses one of the RSUs in the vicinity of the incident, such as RSU 316, assumes control of the other RSUs. Denny, 6:16-34, 9:43-64, 10:18-36. See also Denny, 7:52-8:2.

77. For example, upon detection of an incident, RSU 316 “identif[ies] . . . additional remote sensing units that are in the general vicinity of the remote sensing unit” and “contact[s]” them “to request that they transmit the relevant data to a system element that will perform further analysis of the incident,” such as to RSU 316. Denny, 6:16-34, 9:43-64, 10:18-36, 11:9-26.

78. Figure 4 of Denny “is a flow chart illustrating operations that may be performed at, for example, the remote sensing unit 316 of FIG. 3 to identify that the automobile accident has occurred and to coordinate an appropriate response thereto.” Denny, 9:38-42. I discuss these operations in detail in connection with elements [1.b] to [1.f] and Claims 5 and 7-9 below.

(d) Element [1.b]

79. **Element [1.b]** recites “selecting a subset of acoustic devices from among the plurality of acoustic devices for acquiring sensor acoustic data.” This element is met by Denny.

80. Denny discloses that the controller is configured to select a subset of acoustic devices (*e.g.*, RSU 316 “identif[ies]” “remote sensing units” 312, 314, 322, 332 and 352 “in the general vicinity of the incident” and “collect[s] data about the incident”) from among the plurality of acoustic devices for acquiring sensor acoustic data (*see* [1.a.1]-[1.a.2]). *See, e.g.*, Denny:

- **Figure 3 (annotated):**

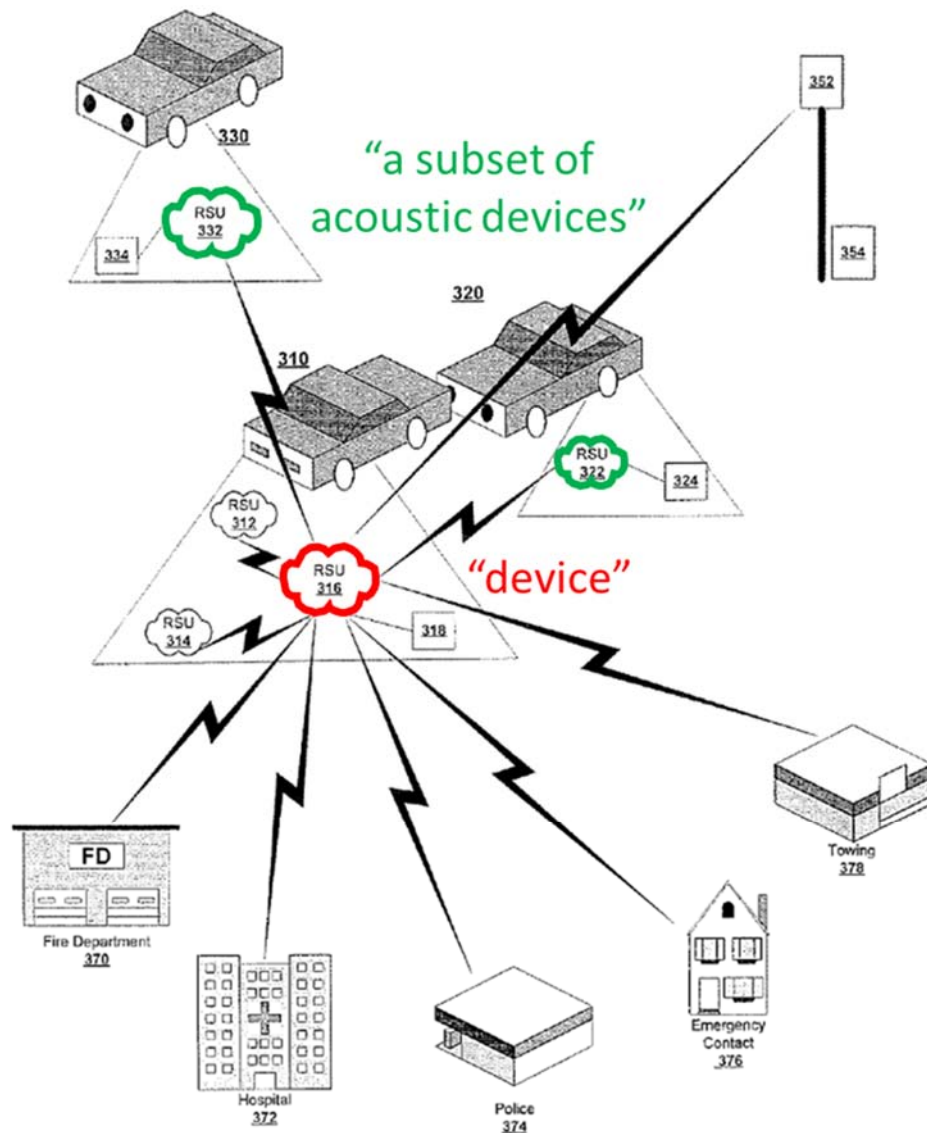


Figure 3

- Figure 4 (annotated):

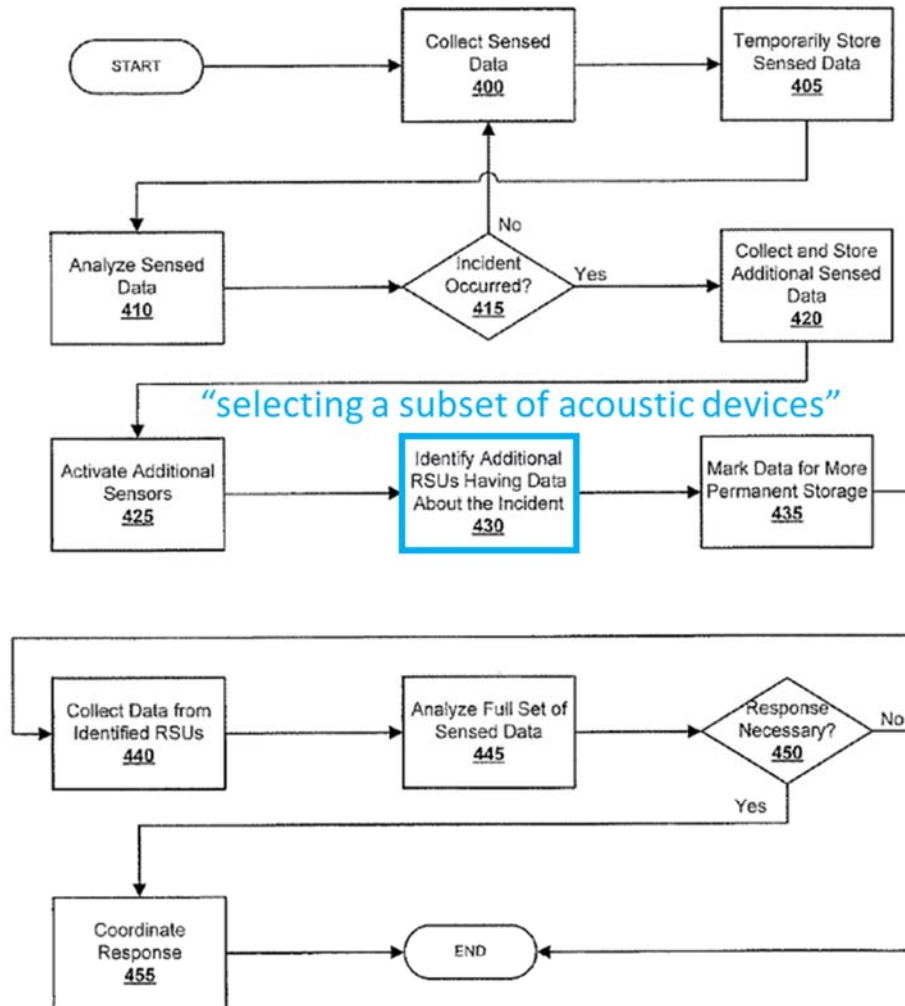


Figure 4

- **6:16-34:** “The *remote sensing units also typically include capabilities for communicating with other remote sensing units*, with a system hub, and/or with other elements of the system such as, for example, a local aggregator. *Upon determining that out-of-range sensor readings indicate that an incident has occurred, a remote sensing unit* (or other element of the system that makes such a determination) *may identify and communicate with additional remote sensing units that are in the general vicinity of the remote sensing unit that collected the data relating to the incident. These additional remote sensing units may then*

- be contacted* (1) to ensure that they keep data that was collected around the time of the incident and/or (2) *to request that they transmit the relevant data to a system element that will perform further analysis of the incident based on an aggregation of sensed data collected by a plurality of remote sensing units*. An element of the system may also initiate a response to the incident such as dispatching police, fire and/or ambulance units to the location of the incident.”
- **9:43-64:** “As shown in FIG. 3, an automobile accident occurs between a first vehicle 310 and a second vehicle 320. The first vehicle 310 involved in the automobile accident has two passengers (not shown), each of whom is carrying a *personal remote sensing unit 312, 314*, and the first vehicle 310 also has a *built-in remote sensing unit 316*. The second vehicle 320 has a single passenger (not shown) who is carrying a *remote sensing unit 322*. A third vehicle 330 that contains an *embedded remote sensing unit 332* is also in the vicinity at the time of the accident, and a *fixed remote sensing unit 352* is also located nearby. When the first vehicle 310 collides with the second vehicle 320, *each of the remote sensing units 312, 314, 316, 322, 332, 352 may collect sensor data* that provides information about the collision. This collected sensor data is depicted in FIG. 3 as data sets 318, 324, 334, 354.”
 - **10:18-36:** “As shown at block 430 of FIG. 4, *the remote sensing unit may also proceed to identify additional remote sensing units (RSUs) that may have collected data about the incident* (and/or which could be activated to start collecting data about the incident). This may be accomplished in a variety of ways. For example, . . . A remote sensing unit that determines that an incident has occurred may use such a paging channel to page all other remote sensing units in the general vicinity. The remote sensing unit may then assume that any remote sensing units that respond to the page may have data regarding the incident, or may collect data (e.g., global positioning satellite data) from the responding remote sensing units to make a determination as to whether the responding remote sensing units have data regarding the incident.”
 - **10:37-11:2:** “In other embodiments, *a remote sensing unit may use mesh networking techniques at block 430 of FIG. 4 to identify additional remote sensing units (RSUs) that may have collected data about the incident*. Pursuant to these mesh networking techniques, the

remote sensing unit might, for example, contact other nearby remote sensing units who, in turn, would contact other nearby remote sensing units on an ad hoc basis in order to identify all of the remote sensing units that were in the general vicinity of the incident. GPS data could be included in the messages forwarded between remote sensing units to ensure that only remote sensing units in the general vicinity of the incident are contacted. In still other embodiments, a page could be sent to every remote sensing unit and responsive information provided by the remote sensing units (e.g., location data) could be used to identify which other remote sensing units are likely to have collected data regarding the incident. ***In still other embodiments, every remote sensing unit could continuously or periodically broadcast its identification (e.g., via an ultrawideband system) and perhaps other information, such as its location, which could then be used by a remote sensing unit to identify the other remote sensing units in the vicinity of the incident.*** In still further embodiments, at block 430 of FIG. 4 the remote sensing unit might sense communications networks that are operating in the area and send out a page or messages on each different type of network as means of contacting and identifying other remote sensing units in the general vicinity”

- ***11:9-26: “One of the remote sensing units (e.g., the remote sensing unit that identified that an incident occurred) may then proceed to collect data from each of the other identified remote sensing units”***

81. See my discussion for elements [1.a.1]-[1.a.2] above (Section IX.A.2.b-c).

82. Denny discloses a controller RSU, such as RSU 316, “identif[ies] additional [RSUs] that may have collected data,” such as RSUs 312, 314, 322, 332, 352, that are “in the vicinity of the incident.” Denny, 10:18-10:22, 10:53-58. See also Denny, 9:43-64.

83. The controller RSU uses the “identification” and “location” data of the additional RSUs to identify them as potentially having collected data related to the incident. Denny, 10:53-58. The controller RSU then “contact[s]” the additional RSUs “to request that they transmit the relevant data to a system element that will perform further analysis of the incident,” such as to RSU 316. Denny, 6:16-34. *See also* Denny, 11:9-26. As discussed in connection with element [1.a.1] above (Section IX.A.2.b), such data includes audio data captured by the audio recorder, and such data is sensor acoustic data.

84. By identifying additional RSUs and requesting them to send collected data to the controller RSU, RSU 316 selects a subset of the RSUs. For example, the recited “plurality of acoustic devices” includes RSUs 312, 314, 316, 322, 332, and 352, and controller RSU 316 selects a subset of the acoustic devices by identifying RSUs 312, 314, 322, 332, 352 and requesting them to transmit their collected data to RSU 316.

85. Further, a person of ordinary skill in the art would have understood that Figure 3 of Denny is “exemplary” such that other RSUs besides RSUs 312, 314, 322, 332, 352 are dispersed in the geographic area and not identified as having collected data related to the incident because they are not considered to be “in the vicinity” of RSU 316. For example, as I show below in connection with Figure 3,

suppose there is a “Remote RSU” (annotated in pink) that is within the geographic area of RSU 316 but located further from RSU 316 than RSUs 312, 314, 322, 332, 352. Upon receiving the location of the “Remote RSU,” RSU 316 would not identify the “Remote RSU” as having collected information related to the incident based on its location not being “in the vicinity of the incident.” Denny, 10:18-10:22, 10:53-58. Such a decision by RSU 316 indicates that RSU 316 identifies RSUs, such as RSUs 312, 314, 322, 332, 352, that may have collected data based on whether their location is in the “vicinity” of RSU 316, thereby selecting a subset of acoustic devices based on their proximity to RSU 316.

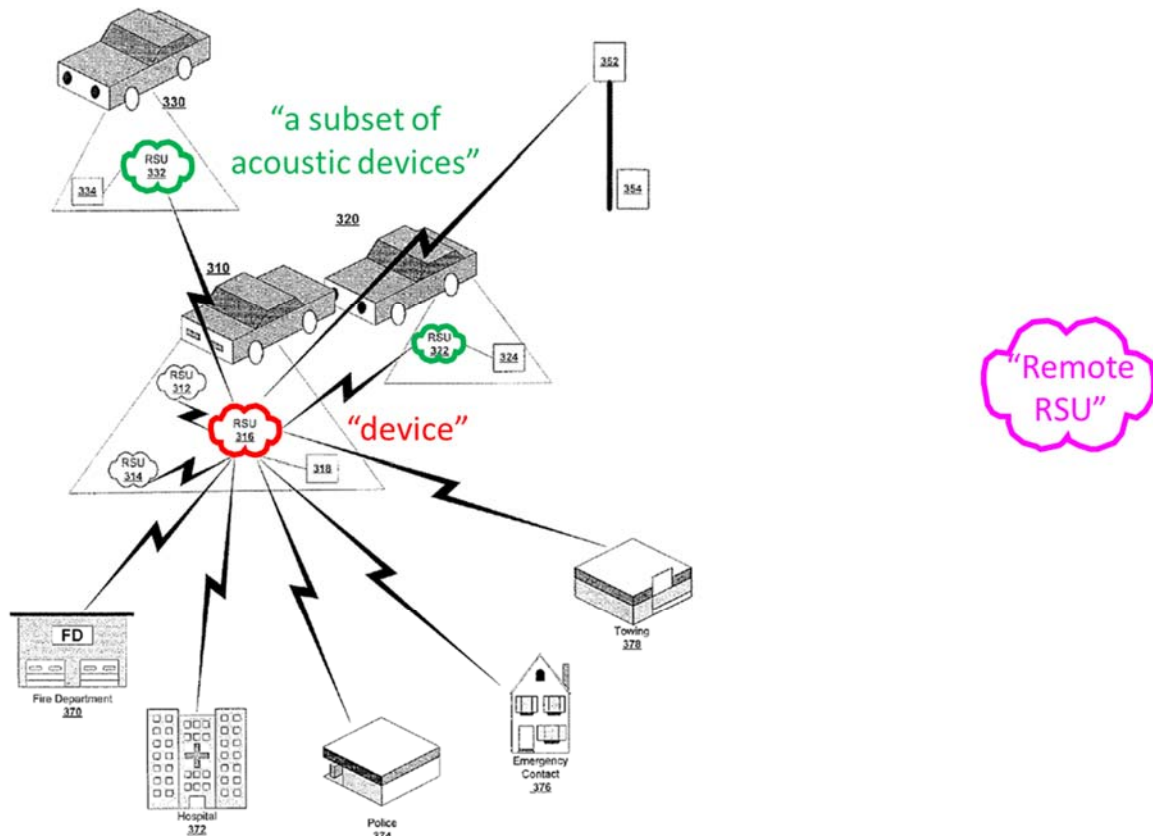


Figure 3

Denny, Figure 3 (annotated).

(e) Element [1.c]

86. Element [1.c] recites “wherein the subset of acoustic devices are configured to interchange device information and data over a communication link.” This element is met by Denny.

87. Denny discloses that the subset of acoustic devices are configured to interchange device information (*e.g.*, “every [RSU]...continuously or periodically broadcast its identification” for use by other RSUs) and data (*e.g.*, “information, such

as [RSU's] location") over a communication link (e.g., communication link over which information is "broadcast" / "Bluetooth" / "internet"). See, e.g., Denny:

- **Figure 3 (annotated):**

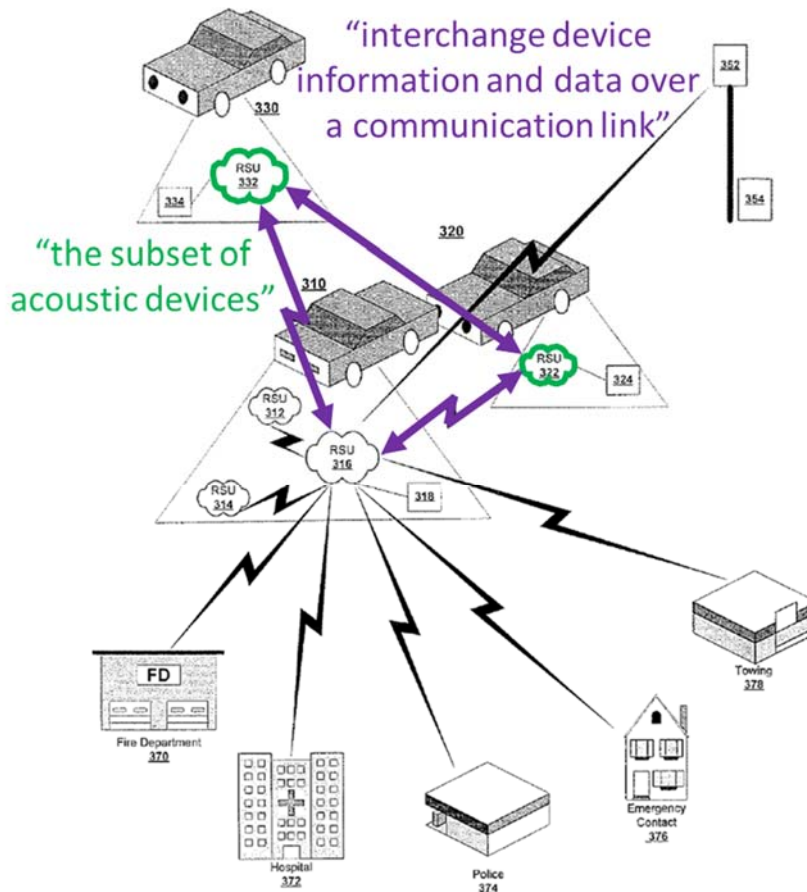


Figure 3

- **10:37-11:2:** "In other embodiments, a remote sensing unit may use mesh networking techniques at block 430 of FIG. 4 to identify additional remote sensing units (RSUs) that may have collected data about the incident. Pursuant to these mesh networking techniques, the remote sensing unit might, for example, contact other nearby remote sensing units who, in turn, would contact other nearby remote sensing units on an ad hoc basis in order to identify all of the remote sensing units that were in the general vicinity of the incident. GPS data could be included in the messages forwarded between remote sensing units to ensure that only

remote sensing units in the general vicinity of the incident are contacted. In still other embodiments, a page could be sent to every remote sensing unit and responsive information provided by the remote sensing units (e.g., location data) could be used to identify which other remote sensing units are likely to have collected data regarding the incident. ***In still other embodiments, every remote sensing unit could continuously or periodically broadcast its identification (e.g., via an ultrawideband system) and perhaps other information, such as its location, which could then be used by a remote sensing unit to identify the other remote sensing units in the vicinity of the incident.*** In still further embodiments, at block 430 of FIG. 4 the remote sensing unit might sense communications networks that are operating in the area and send out a page or messages on each different type of network as means of contacting and identifying other remote sensing units in the general vicinity. In other embodiments, a system hub (or other system element) could track the location of some or all of the remote sensing units, and the identification step at block 430 could simply comprise requesting the identification from such a system hub. Various other methods of identifying remote sensing units having data regarding the incident may be implemented.”

- **13:57-14:13:** “The ***communications unit 610 may be used to transmit and receive information between the remote sensing unit 600 and other remote sensing units as in the embodiments of FIGS. 1 and 3,*** and/or to transmit and receive information between the remote sensing unit 600 and a local aggregator and/or one or more system hubs (such as the local aggregator 550 or system hub 515 in FIG. 5). The communications unit 610 may comprise, for example, ***a cellular telephone, an internet protocol or other packet switched wireless communications device, a Bluetooth or WiMax connection, a landline telephone, a wired internet connection, a combination thereof, or any of a wide variety of other communications systems.*** In some embodiments, each remote sensing unit can directly communicate with all of the other elements of the system (e.g., other remote sensing units, local aggregators and system hubs). In other embodiments, some remote sensing units may only have indirect communications ability. By way of example, a ***remote sensing unit mounted in an automobile might include a communication unit 610 that is implemented as a Bluetooth transceiver. This Bluetooth***

transceiver could then interface with other remote sensing units and/or a system hub via a Bluetooth connection to a cellular telephone of one of the occupants of the automobile, and a cellular connection from that cellular telephone to the system hub.”

88. See my discussion for element [1.b] above (Section IX.A.2.d).

89. Denny discloses that “every remote sensing unit could continuously or periodically broadcast its identification (e.g., via an ultrawideband system) and perhaps other information, such as its location, which could then be used by a remote sensing unit to identify the other remote sensing units in the vicinity of the incident.” Denny, 10:53-58. For example, RSU 312 broadcasts its identification and location to the other RSUs, such as RSUs 314, 316, 322, 332, 352; RSU 314 broadcasts its identification and location to the other RSUs, such as RSUs 312, 316, 322, 332, 352; RSU 316 broadcasts its identification and location to the other RSUs, such as RSUs 312, 314, 322, 332, 352; and so on. The remote sensing unit that identifies the other remote sensing units becomes a controller, for example, RSU 316, and uses the broadcasted location information to identify which RSUs in the geographic area may have collected data related to the incident.

90. Denny therefore teaches that the RSUs “interchange” device information and location by, for example, a first RSU (e.g., RSU 322) sending its identification and location to a second RSU (e.g., RSU 332) and the second RSU sending its identification and location to the first RSU, such that the two RSUs

interchange their device information and location over a communication link between the two devices. I annotated Figure 3 above with a purple arrow to show these two RSUs are configured to interchange their identification information.

91. Denny further discloses that “[a]ny one of, or all of, the remote sensing units illustrated in FIG. 1, 3 and/or 5 could be implemented using the remote sensing unit 600 of FIG. 6.” Denny, 13:48-52. RSU 600 includes “a communications unit 610,” among other components. Denny, 13:53-56. The “communications unit 610” is “used to transmit and receive information between the remote sensing unit 600 and other remote sensing units as in the embodiments of FIGS. 1 and 3” and comprises, for example, “a cellular telephone, an internet protocol or other packet switched wireless communications device, a Bluetooth or WiMax connection, a landline telephone, a wired internet connection, a combination thereof, or any of a wide variety of other communications systems.” Denny, 13:57-14:1. Denny therefore teaches the RSUs of Figure 3 use these communication technologies to interchange identification and data via a communication link, such as a cellular link, a link to the Internet, a Bluetooth link, etc.

92. In addition to the examples discussed above, Denny’s disclosure of using the RSUs communicating with each other via the Internet teaches that the RSUs interchange device information and data. Denny, 13:57-14:1.

93. For example, by using the Internet, the RSUs exchange IP addresses and other data via a communication link. A person of ordinary skill in the art would have been familiar with wired internet connections and Internet Protocol (“IP”) communication devices that, for example, communicate using the Internet. As of the earliest claimed priority date of the ’329 patent, IP was a well-established protocol that specifies an “IP datagram consist[ing] of a header part and a text part.” Ex. 1012 (Introduction to Computer Networks, Tanenbaum, 1997 (“Tanenbaum”)), Page 86. The header includes “a 20 byte fixed part and a variable length optional part,” including a “Source address” and a “Destination address” that “indicate the network number and host number.” Tanenbaum, Pages 86-87. An example of such addresses includes an “IP address” that “[e]very host and router on the Internet has . . . which encodes its network number (prefix part of the address) and host number (suffix part of the address).” Tanenbaum, Page 88.

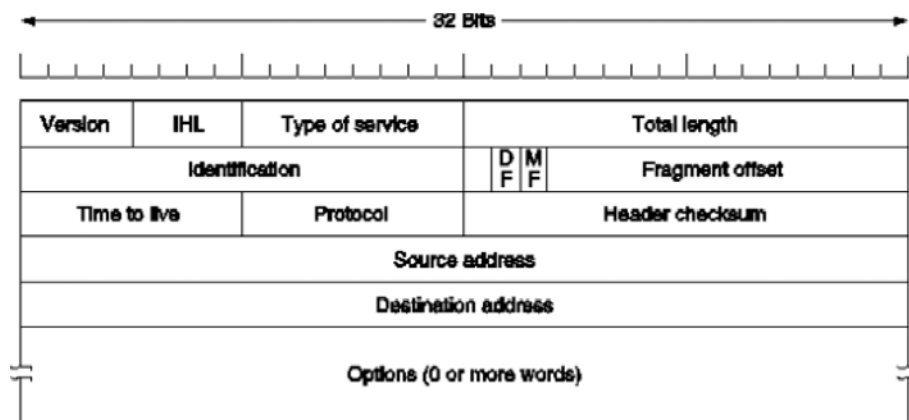


Fig. 5-45. The IP (Internet Protocol) header.

94. In the context of Denny, a person of ordinary skill in the art would have understood that a first RSU (e.g., RSU 322) would have a first address and a second RSU (e.g., RSU 332) would have a second address. When those RSUs would communicate, such as to communicate collected data to one another as I discussed in connection with elements [1.a.1]-[1.b] above (Section IX.A.2.b-d), they would have been configured to interchange their device information (e.g., their IP addresses) and data with each other using the Internet.

95. A person of ordinary skill in the art would have understood (or at minimum found obvious) that an IP address is device information because it is used as an identifier for the device such that other devices can communicate with the device using this device information (i.e., using its IP address).

96. Similarly, Denny's disclosure of using the RSUs communicating with each other via the Bluetooth teaches that the RSUs interchange device information and data. Denny, 13:57-14:1. For example, by using Bluetooth, the RSUs would exchange device information and other data via a communication link. A person of ordinary skill in the art would have been familiar with the Bluetooth standard and that a "Bluetooth Device Address" (or "BD_ADDR") is a "48 bit address used to identify each Bluetooth device." Ex. 1013 (Specification of the Bluetooth System, Vol. 1, Version 1.2, Nov. 5, 2003 ("Bluetooth")), Page 15. Bluetooth-enabled

devices would have the capability to operate in a “Device discovery” mode, which is “[a] procedure for retrieving the Bluetooth device address, clock, class-of-device field and used page scan mode from discoverable devices” (i.e., “Bluetooth device[s] in range that periodically listen[] on an inquiry scan physical channel and will respond to an inquiry on that channel. Discoverable device[s] are normally also connectable.”). Bluetooth, Page 16. Further, packets sent using Bluetooth include a “payload . . . used to transport the user data.” Bluetooth, Page 31.

Bluetooth Device	A Bluetooth Device is a device that is capable of short-range wireless communications using the Bluetooth system.
Bluetooth Device Address	A 48 bit address used to identify each Bluetooth device.
BD_ADDR	The Bluetooth Device Address, BD_ADDR, is used to identify a Bluetooth device.

Device discovery	A procedure for retrieving the Bluetooth device address, clock, class-of-device field and used page scan mode from discoverable devices.
Discoverable device	A Bluetooth device in range that periodically listens on an inquiry scan physical channel and will respond to an inquiry on that channel. Discoverable device are normally also connectable.

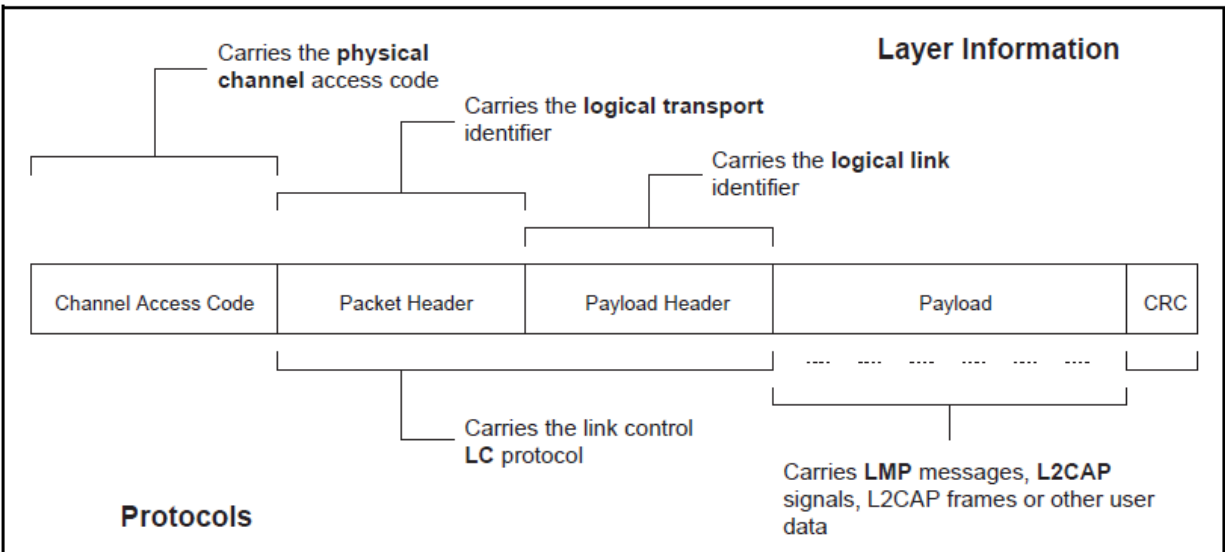


Figure 3.4: Bluetooth packet structure

97. In the context of Denny, a person of ordinary skill in the art would have understood that a first RSU (e.g., RSU 322) would have a first BD_ADDR and a second RSU (e.g., RSU 332) would have a second BD_ADDR. When those RSUs would communicate, such as to communicate collected data to one another as I discussed in connection with elements [1.a.1]-[1.b] above (Section IX.A.2.b-d), they would have been configured to interchange their device information (e.g., their BD_ADDR) and data with each other. For example, when the first RSU discovers the second RSU, the first RSU would receive the second RSU's BD_ADDR, and vice versa, such that the RSUs are configured to interchange device information. Further, Denny teaches that the RSUs would be configured to interchange data, such

as their location data or collected data related to an incident, in the payload of packets sent to the other RSUs using Bluetooth communications.

98. A person of ordinary skill in the art would have understood (or at minimum found obvious) that a BD_ADDR is device information because it is used as an identifier for the device such that other devices can communicate with the device using this device information (i.e., using its BD_ADDR).

(f) Element [1.d]

99. **Element [1.d] recites “receiving a first set of sensor acoustic data from a first acoustic device of the selected subset of acoustic devices.”** This element is met by Denny.

100. Denny discloses that the controller is configured to receive (e.g., “collect[.]”) a first set of sensor acoustic data (e.g., “data set[.]” 324 including “audio data”) from a first acoustic device of the selected subset of acoustic devices (e.g., “remote sensing unit 322”). See, e.g., Denny:

- **Figure 3 (annotated):**

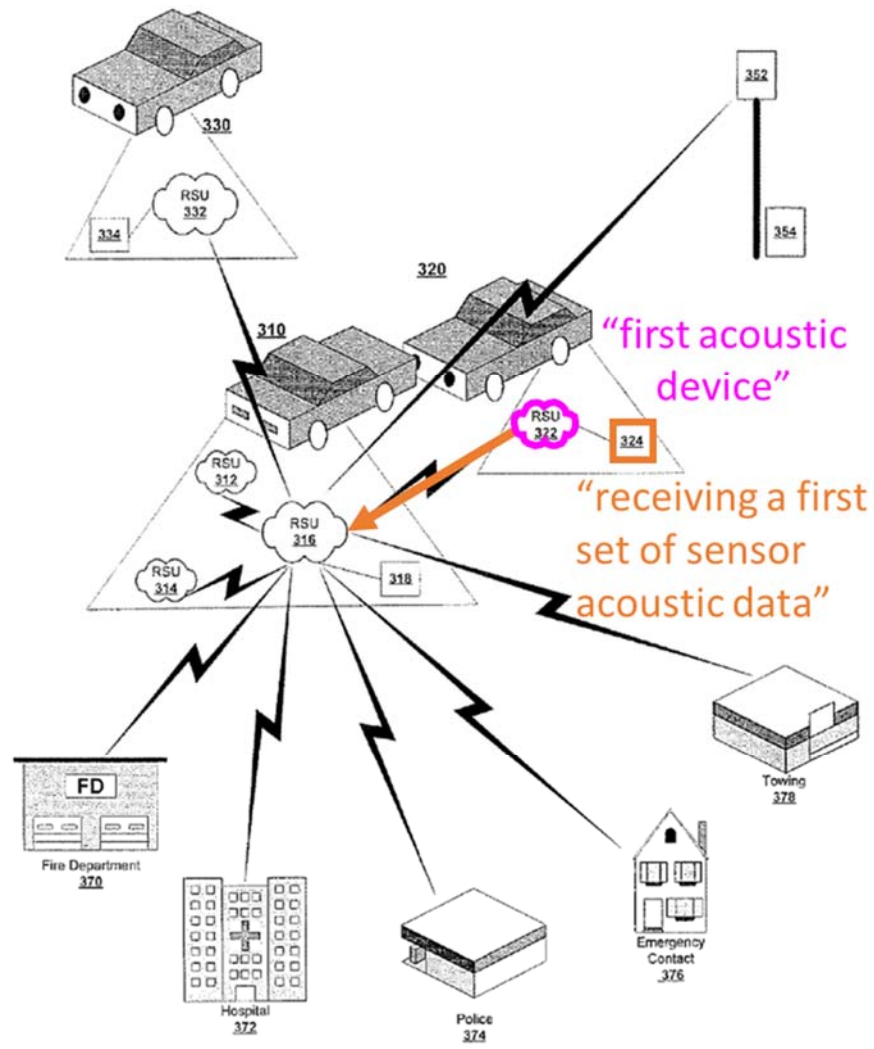


Figure 3

- Figure 4 (annotated):

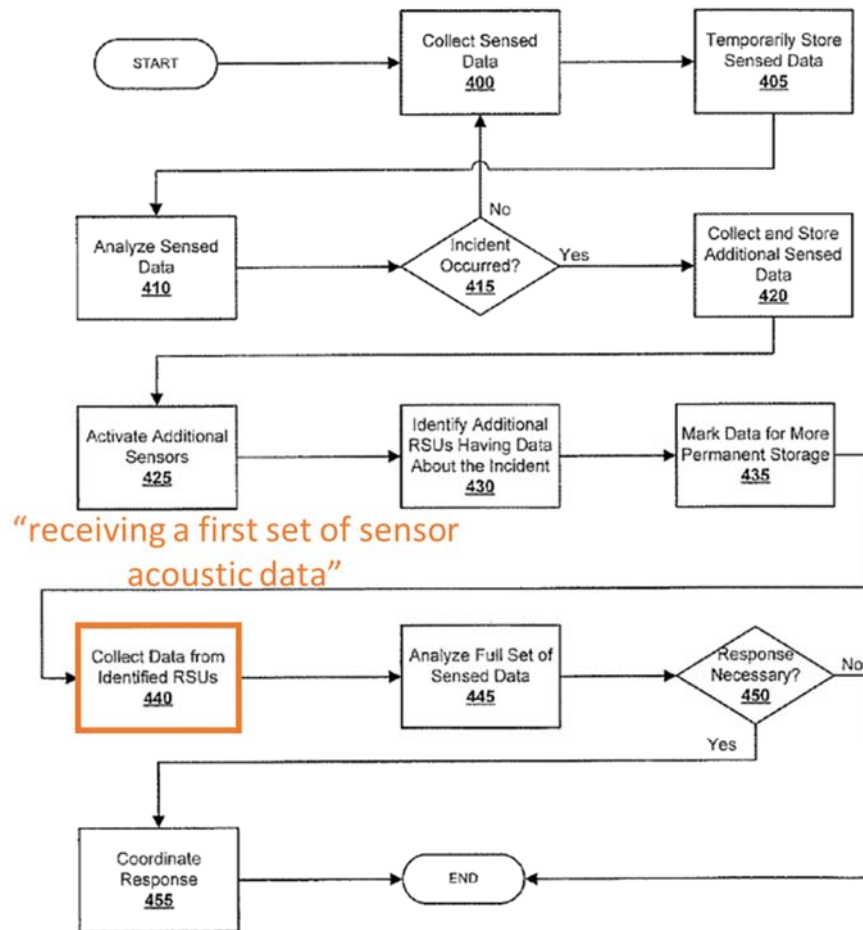


Figure 4

- 7:18-31: “It will be appreciated that the types of sensors carried by each remote sensing unit 12, 14, 16, 22, 32, 42, 52, and hence ***the collected sensor data contained in the data sets 18, 24, 34, 44, 54, may be quite varied.*** For example, ***the first data set 18 and/or the second data set 24 may include*** accelerometer data, speedometer data, ***audio data***, braking data, global positioning satellite location data, temperature data, rain detector information, information regarding the number of passengers, seat belt status information, breathalyzer information, trajectory information, etc. Some of this collected data may be indicative of an automobile accident (i.e., a sudden deceleration, the stopping of the vehicle, the vehicle decelerating more quickly than anticipated based on

- the braking data, audio recordings of the sound of the vehicles colliding, etc.).”
- **9:43-64:** “As shown in FIG. 3, an automobile accident occurs between a first vehicle 310 and a second vehicle 320. The first vehicle 310 involved in the automobile accident has two passengers (not shown), each of whom is carrying a *personal remote sensing unit 312, 314*, and the first vehicle 310 also has a *built-in remote sensing unit 316*. The second vehicle 320 has a single passenger (not shown) who is carrying a *remote sensing unit 322*. A third vehicle 330 that contains an *embedded remote sensing unit 332* is also in the vicinity at the time of the accident, and a *fixed remote sensing unit 352* is also located nearby. When the first vehicle 310 collides with the second vehicle 320, *each of the remote sensing units 312, 314, 316, 322, 332, 352 may collect sensor data* that provides information about the collision. This collected sensor data is depicted in FIG. 3 as *data sets 318, 324, 334, 354*.”
 - **9:65-10:17:** “As shown in FIG. 4, operations begin at block 400 with the remote sensing unit 316 collecting sensed data using its sensors. The data collected from the sensors is stored in some fashion at block 405. As noted above, due to memory constraints, the collected sensed data may be periodically overwritten to reduce the memory or other storage requirements of the remote sensing unit. As shown at blocks 410 and 415, the remote sensing unit may also either periodically or continuously analyze the collected sensed data to determine if an incident has occurred. Exemplary ways of making such a determination are discussed in more detail herein. *If no incident is deemed to have occurred, operations return from block 415 to block 400. If an incident is deemed to have occurred, then the remote sensing unit continues to collect and store additional sensed data (block 420).* In addition, the remote sensing unit may optionally activate additional sensors, such as sensors that are normally in standby mode due to power consumption constraints, cost concerns, memory storage limitations, wear concerns, etc. (block 425).”
 - **10:18-36:** “As shown at block 430 of FIG. 4, *the remote sensing unit may also proceed to identify additional remote sensing units (RSUs) that may have collected data about the incident* (and/or which could be activated to start collecting data about the incident). This may be accomplished in a variety of ways. For example, . . . A remote sensing

unit that determines that an incident has occurred may use such a paging channel to page all other remote sensing units in the general vicinity. The remote sensing unit may then assume that any remote sensing units that respond to the page may have data regarding the incident, or may collect data (e.g., global positioning satellite data) from the responding remote sensing units to make a determination as to whether the responding remote sensing units have data regarding the incident.”

- **10:37-11:2:** “In other embodiments, a remote sensing unit may use mesh networking techniques at block 430 of FIG. 4 to identify additional remote sensing units (RSUs) that may have collected data about the incident. Pursuant to these mesh networking techniques, the remote sensing unit might, for example, contact other nearby remote sensing units who, in turn, would contact other nearby remote sensing units on an ad hoc basis in order to identify all of the remote sensing units that were in the general vicinity of the incident. GPS data could be included in the messages forwarded between remote sensing units to ensure that only remote sensing units in the general vicinity of the incident are contacted. In still other embodiments, a page could be sent to every remote sensing unit and responsive information provided by the remote sensing units (e.g., location data) could be used to identify which other remote sensing units are likely to have collected data regarding the incident. ***In still other embodiments, every remote sensing unit could continuously or periodically broadcast its identification (e.g., via an ultrawideband system) and perhaps other information, such as its location, which could then be used by a remote sensing unit to identify the other remote sensing units in the vicinity of the incident.*** In still further embodiments, at block 430 of FIG. 4 the remote sensing unit might sense communications networks that are operating in the area and send out a page or messages on each different type of network as means of contacting and identifying other remote sensing units in the general vicinity. In other embodiments, a system hub (or other system element) could track the location of some or all of the remote sensing units, and the identification step at block 430 could simply comprise requesting the identification from such a system hub. Various other methods of identifying remote sensing units having data regarding the incident may be implemented.”

- **11:9-26: “One of the remote sensing units (e.g., the remote sensing unit that identified that an incident occurred) may then proceed to collect data from each of the other identified remote sensing units.** Once this additional data is collected, as shown at block 440 of FIG. 4, the remote sensing unit may perform a second analysis (block 445), this time on the more complete data set that includes data from additional remote sensing units and perhaps additional data collected subsequent to the identification of the incident at block 415. Based on this analysis, the remote sensing unit may determine whether a response is necessary to the identified incident (block 450). While this determination may be made earlier in other embodiments of the present invention, by waiting until a more complete data set has been collected and analyzed, it may be possible to more accurately identify the type of incident that has occurred and therefore enact a response that is appropriate for the specifically identified incident. At block 455, the remote sensing unit coordinates such a response, if necessary.”

101. See my discussion for elements [1.a.1]-[1.c] above (Section IX.A.2.b-e).

102. As I discussed in connection with elements [1.a.1] and [1.b] above (Section IX.A.2.b, d), Denny discloses that the controller RSU, such as RSU 316, identifies and requests the acoustic sensor data from the other RSUs.

103. Denny further discloses that, upon detection of an incident, the controller RSU “may then proceed to collect data from each of the other identified remote sensing units.” Denny, 11:9-26.

104. For example, in connection with Figure 3, after detecting an incident, controller RSU 316 identifies additional RSUs, such as RSUs 322 and 332, that likely have data related to the incident, such as data sets 324 and 334, based on their

proximity to the incident. Denny, 9:65-10:17, 10:18-10:36, 10:37-11:2, Figure 3, Figure 4. After identification of RSUs 322 and 332 as likely having data related to the incident, controller RSU 316 collects data set 324 from RSU 322. Denny, 11:9-26, Figure 3, Figure 4. *See also* Denny, 7:18-31.

(g) Element [1.e]

105. **Element [1.e]** recites “receiving a second set of sensor acoustic data from a second acoustic device of the selected subset of acoustic devices.” This element is met by Denny.

106. Denny discloses that the controller is configured to receive (*e.g.*, “collect[.]”) a second set of sensor acoustic data (*e.g.*, “data set[.]” 334 including “audio data”) from a second acoustic device of the selected subset of acoustic devices (*e.g.*, “remote sensing unit 332”). *See, e.g.*, Denny:

- **Figure 3 (annotated):**

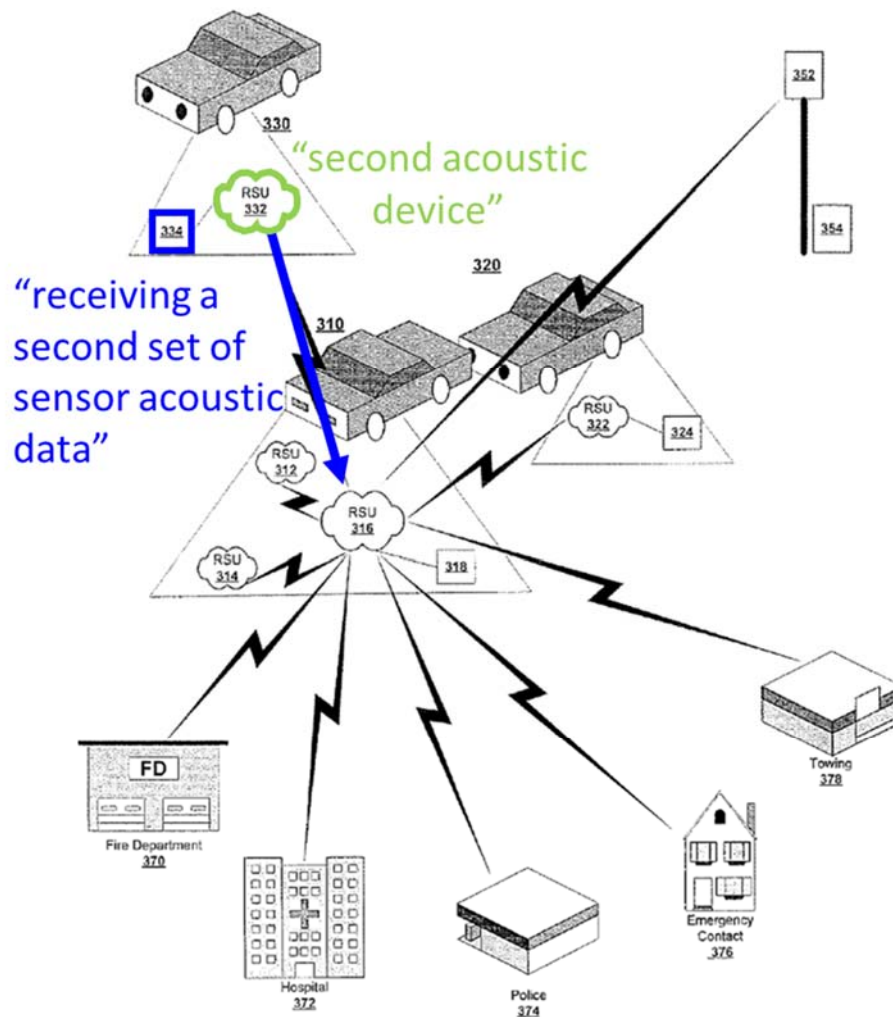


Figure 3

- Figure 4 (annotated):

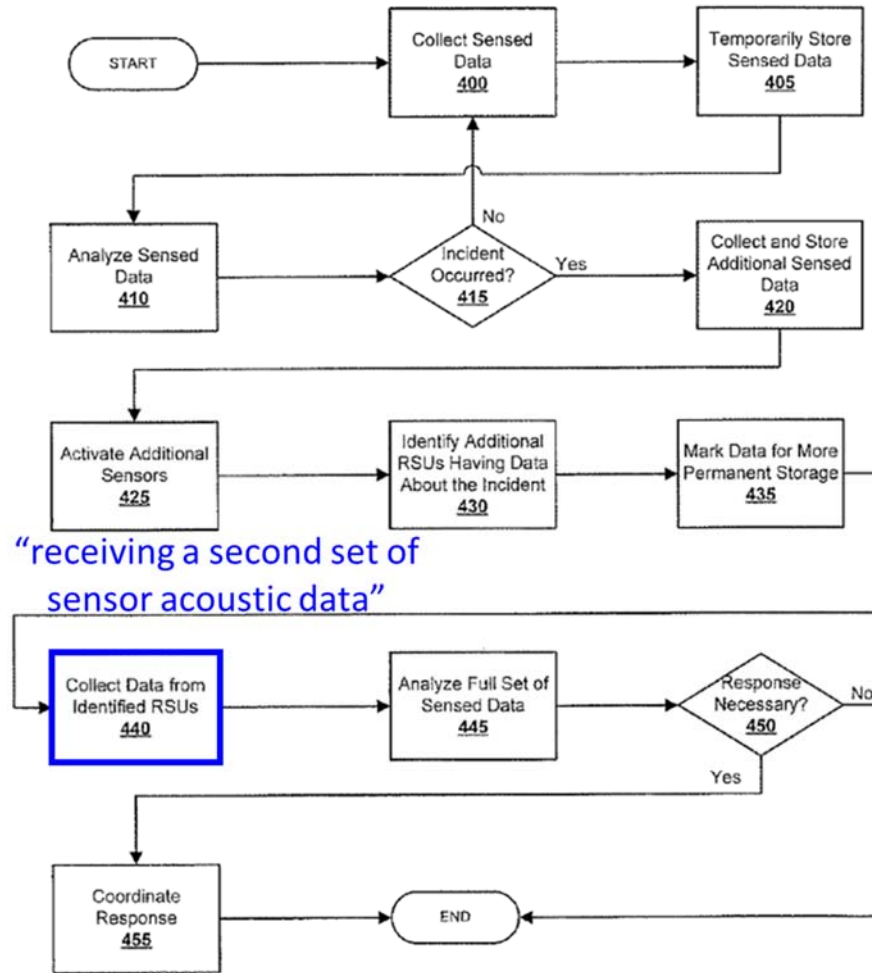


Figure 4

- 7:18-31: “It will be appreciated that the types of sensors carried by each remote sensing unit 12, 14, 16, 22, 32, 42, 52, and hence ***the collected sensor data contained in the data sets 18, 24, 34, 44, 54, may be quite varied.*** For example, ***the first data set 18 and/or the second data set 24 may include*** accelerometer data, speedometer data, ***audio data***, braking data, global positioning satellite location data, temperature data, rain detector information, information regarding the number of passengers, seat belt status information, breathalyzer information, trajectory information, etc. Some of this collected data may be indicative of an automobile accident (i.e., a sudden deceleration, the stopping of the

- vehicle, the vehicle decelerating more quickly than anticipated based on the braking data, audio recordings of the sound of the vehicles colliding, etc.).”
- **9:43-64:** “As shown in FIG. 3, an automobile accident occurs between a first vehicle 310 and a second vehicle 320. The first vehicle 310 involved in the automobile accident has two passengers (not shown), each of whom is carrying a **personal remote sensing unit 312, 314**, and the first vehicle 310 also has a **built-in remote sensing unit 316**. The second vehicle 320 has a single passenger (not shown) who is carrying a **remote sensing unit 322**. A third vehicle 330 that contains an **embedded remote sensing unit 332** is also in the vicinity at the time of the accident, and a **fixed remote sensing unit 352** is also located nearby. When the first vehicle 310 collides with the second vehicle 320, **each of the remote sensing units 312, 314, 316, 322, 332, 352 may collect sensor data** that provides information about the collision. This collected sensor data is depicted in FIG. 3 as **data sets 318, 324, 334, 354**.”
 - **10:18-36:** “As shown at block 430 of FIG. 4, **the remote sensing unit may also proceed to identify additional remote sensing units (RSUs) that may have collected data about the incident** (and/or which could be activated to start collecting data about the incident). This may be accomplished in a variety of ways. For example, . . . A remote sensing unit that determines that an incident has occurred may use such a paging channel to page all other remote sensing units in the general vicinity. The remote sensing unit may then assume that any remote sensing units that respond to the page may have data regarding the incident, or may collect data (e.g., global positioning satellite data) from the responding remote sensing units to make a determination as to whether the responding remote sensing units have data regarding the incident.”
 - **11:9-26:** “**One of the remote sensing units (e.g., the remote sensing unit that identified that an incident occurred) may then proceed to collect data from each of the other identified remote sensing units**. Once this additional data is collected, as shown at block 440 of FIG. 4, the remote sensing unit may perform a second analysis (block 445), this time on the more complete data set that includes data from additional remote sensing units and perhaps additional data collected subsequent to the identification of the incident at block 415. Based on this analysis, the

remote sensing unit may determine whether a response is necessary to the identified incident (block 450). While this determination may be made earlier in other embodiments of the present invention, by waiting until a more complete data set has been collected and analyzed, it may be possible to more accurately identify the type of incident that has occurred and therefore enact a response that is appropriate for the specifically identified incident. At block 455, the remote sensing unit coordinates such a response, if necessary.”

107. See my discussion for elements [1.a.1]-[1.d] above (Section IX.A.2.b-f).

108. As I discussed in connection with elements [1.a.1] and [1.b] above (Section IX.A.2.b, d), Denny discloses that the controller RSU, such as RSU 316, identifies and requests the acoustic sensor data from the other RSUs. Denny further discloses that, upon detection of incident, the controller RSU “may then proceed to collect data from each of the other identified remote sensing units.” Denny, 11:9-26.

109. For example, in connection with Figure 3, after detecting an incident, controller RSU 316 identifies additional RSUs, such as RSUs 322 and 332, that likely have data related to the incident, such as data sets 324 and 334, based on their proximity to the incident. Denny, 9:65-10:17, 10:18-10:36, 10:37-11:2, Figure 3, Figure 4. After identification of RSUs 322 and 332 as likely having data related to the incident, controller RSU 316 collects data set 334 from RSU 332. Denny, 11:9-26, Figure 3, Figure 4. *See also* Denny, 7:18-31.

(h) Element [1.f]

110. **Element [1.f] recites “analyzing at least one of the first set of sensor acoustic data or the second set of sensor acoustic data or a combination of both to identify if speech is present.”** This element is met by Denny.

111. Denny discloses that the controller is configured to analyze (e.g., “perform a second analysis”) at least one of the first set of sensor acoustic data (e.g., “data set[]” 324) or the second set of sensor acoustic data (e.g., “data set[]” 334) or a combination of both to identify if speech is present (e.g., “exemplary incidents include...fearful screaming”). *See, e.g.,* Denny:

- **Figure 4 (annotated):**

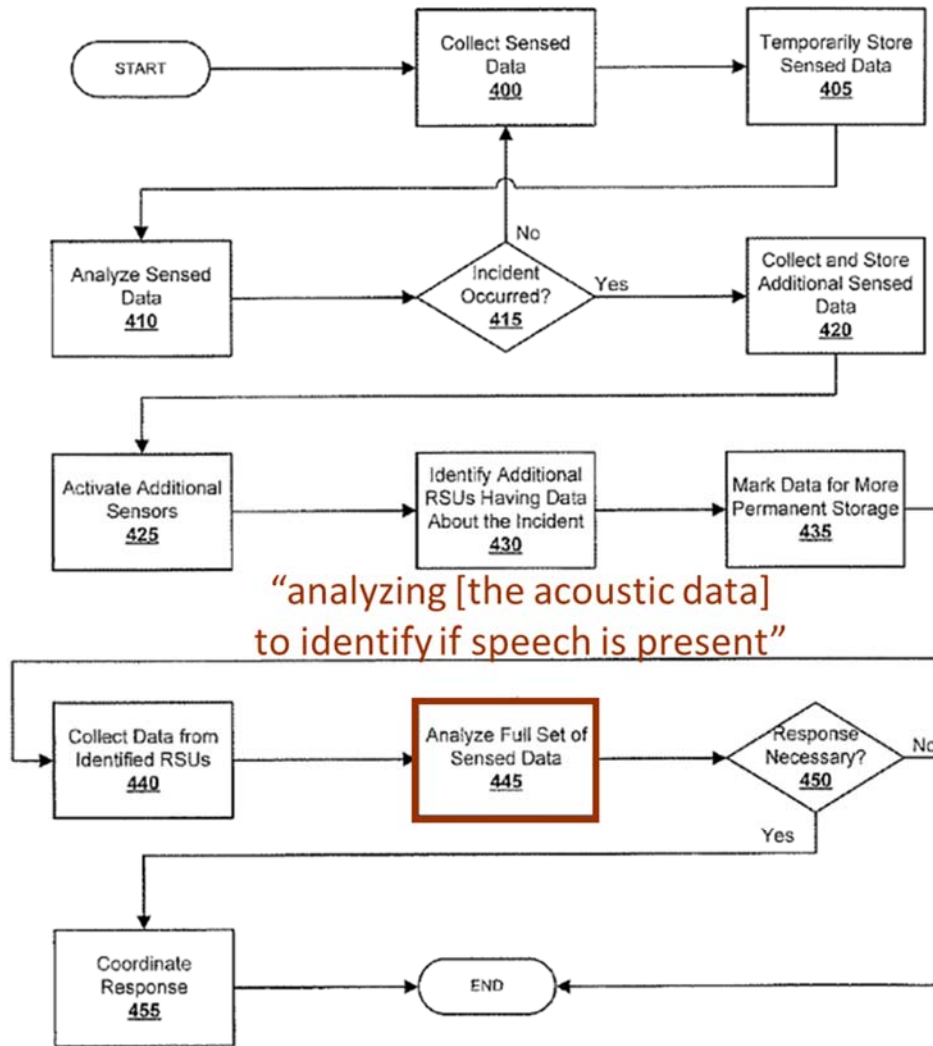


Figure 4

- **11:9-26:** “One of the remote sensing units (e.g., the remote sensing unit that identified that an incident occurred) may then proceed to collect data from each of the other identified remote sensing units. *Once this additional data is collected, as shown at block 440 of FIG. 4, the remote sensing unit may perform a second analysis (block 445), this time on the more complete data set that includes data from additional remote sensing units and perhaps additional data collected subsequent to the identification of the incident at*

block 415. ***Based on this analysis, the remote sensing unit may determine whether a response is necessary to the identified incident (block 450).***

While this determination may be made earlier in other embodiments of the present invention, by waiting until a more complete data set has been collected and analyzed, it may be possible to more accurately identify the type of incident that has occurred and therefore ***enact a response that is appropriate for the specifically identified incident.*** At block 455, the remote sensing unit ***coordinates such a response***, if necessary.”

- **16:61-17:10:** “While the above automobile accident provides one example of a type of incident that can automatically be identified by the systems and methods according to embodiments of the present invention . . . ***Other exemplary incidents include*** fires in homes, offices or automobiles, gunshot detection, plane or boat crashes, ***fearful screaming***, suspicious behavior, muggings, bombings, war, running out of gas, etc”

112. See my discussion for elements [1.a.2], [1.d]-[1.e] above (Section IX.A.2.c, f-g).

113. Denny discloses that, upon receiving the data sets from the additional RSUs, the controller RSU “perform[s] a second analysis (block 445), this time on the more complete data set that includes data from additional remote sensing units and perhaps additional data collected subsequent to the identification of the incident at block 415.” Denny, 11:12-17.

114. In the context of the examples I discussed above in connection with elements [1.d]-[1.e] (Sections IX.A.2.f-g), controller RSU 316 receives data sets 324 and 334 from RSUs 322 and 332, respectively, and performs a second analysis on the fuller set of data to confirm whether an incident occurred. Denny discloses “by

waiting until a more complete data set has been collected and analyzed, it may be possible to more accurately identify the type of incident that has occurred and therefore enact a response that is appropriate for the specifically identified incident.” Denny, 11:20-25. Based on this analysis, the controller RSU 316 “determine[s] whether a response is necessary to the identified incident (block 450)” and “coordinates such a response, if necessary.” Denny, 11:17-26.

115. While discussed in connection with “automobile accidents,” Denny discloses that the controller RSU 316 is capable of detecting other incidents, such as “fearful screaming.” Denny, 16:61-17:10.

116. If “fearful screaming” is detected in the data sets received from the additional RSUs, then the controller RSU “coordinates . . . a response” “appropriate for the specifically identified incident.” Denny, 11:9-26, 16:61-17:10, Figure 4. If “fearful screaming” is not detected, then the controller RSU does not coordinate a response and the incident response method ends. Denny, 11:9-26, 16:61-17:10, Figure 4.

117. A person of ordinary skill in the art would have understood (or at least found it obvious) that “fearful screaming” includes speech, such as a person fearfully screaming “help me,” resulting from an automobile accident. Denny contemplates that passengers involved in accidents may become “injured in the accident,”

suggesting that the passenger may need assistance and/or call for help. Denny, 1:26-27. Confirming the accident occurred based on the passenger's call for help, as opposed to just a generic scream, would have furthered Denny's goal of "accurately identify[ing] the type of incident that has occurred and therefore enact a response that is appropriate for the specifically identified incident." Denny, 11:9-26. Identifying speech would have advantageously given Denny's incident reporting system another reference point to consider when identifying the type of incident and enacting an appropriate response.

118. Further, implementing Denny's incident reporting system to identify if speech is present would have advantageously increased the reliability of the system. For example, a passenger of a vehicle may scream when he or she nearly gets into an accident with another vehicle, even though no actual accident occurs between the vehicles. In such a circumstance, the passenger of a vehicle may let out a fearful scream, such as "augh!," even though no accident occurred. If the substance of the scream were ignored, the controller RSU would coordinate a response based on that fearful scream even though an automobile accident did not occur. Therefore, in implementing Denny's system to detect speech, it would have been beneficial to initiate a response based on analyzed speech, such as the passenger calling for (e.g., "help me!"), not just a scream.

119. Notably, Denny’s list of identified incidents for detection is non-exhaustive, indicating “[o]ther exemplary incidents include fires in homes, offices or automobiles, gunshot detection, plane or boat crashes, fearful screaming, suspicious behavior, muggings, bombings, war, running out of gas, *etc.*” Denny, 16:61-17:10. Thus, to the extent Denny does not disclose detecting speech, Denny contemplates the detection of well known sound, such as speech.

120. Indeed, responding to incidents based on speech was known in the art. For example, Hirata discloses a portable radio device that initiates an “emergency notification process” when the device recognizes, using speech recognition, a user’s speech, such as when the user utters “help me.” Hirata, [0044], [0208].

(i) Claim 5

121. **Claim 5 recites “The system of claim 1, wherein the operations further comprise: selecting the subset of devices based on geographic proximity to a user.”** This claim is met by Denny. See my discussion of the elements of claim 1 above (Section IX.A.2.a-h).

122. Denny discloses that the controller selects the subset of devices based on geographic proximity to a user (*e.g.*, “built-in” RSU 316 of a “first vehicle 310 involved in [an] automobile accident ha[ving] two passengers” detects an incident

and “identifies additional [RSUs],” such as RSUs 312, 314, 332, 334, 352 based on their proximity to RSU 316 and the user). *See, e.g., Denny:*

- **5:53-67:** “Each remote sensing unit includes one or more sensors that intermittently or continuously collect data regarding what is occurring in the vicinity of the remote sensing unit. A few examples of the types of sensors that may be included on a remote sensing unit include a noise meter, an audio recorder, an accelerometer, a speedometer, a clock, a video camera, a global positioning satellite receiver, a thermometer, a breathalyzer, a wind gauge, a seat belt sensor, etc. Typically, most or all of the sensors on each remote sensing unit will sense and record data continuously to ensure that the sensors collect data in advance of and during incidents that occur in the vicinity of the sensor. ***A user associated with the remote sensing unit may also be provided a capability to selectively activate and/or deactivate the sensors included in the remote sensing unit.***”
- **9:43-64:** “As shown in FIG. 3, ***an automobile accident*** occurs between a first vehicle 310 and a second vehicle 320. The ***first vehicle 310 involved in the automobile accident has two passengers*** (not shown), each of whom is ***carrying a personal remote sensing unit 312, 314, and the first vehicle 310 also has a built-in remote sensing unit 316.*** The second vehicle 320 has a single passenger (not shown) who is carrying a ***remote sensing unit 322.*** A third vehicle 330 that contains an embedded ***remote sensing unit 332 is also in the vicinity at the time of the accident,*** and a ***fixed remote sensing unit 352 is also located nearby***”
- **10:18-36:** “As shown at block 430 of FIG. 4, ***the remote sensing unit may also proceed to identify additional remote sensing units (RSUs) that may have collected data about the incident*** (and/or which could be activated to start collecting data about the incident). This may be accomplished in a variety of ways. For example, in some embodiments of the present invention, the remote sensing units may have a low power communication system which they can use to communicate via, for example, a paging channel, with other remote sensing units in the general vicinity (e.g., within a mile)”

123. See my discussion for elements [1.a.2] and [1.b] above (Section IX.A.2c-d).

124. Denny discloses that there is “[a] user associated with the remote sensing unit.” Denny, 5:64-67.

125. Denny further discloses a “first vehicle” 310 having a “built-in” RSU 316 and “two passengers” that are associated with RSU 316. Denny, 9:43-64.

126. As I discussed above in connection with element [1.b] (Section IX.A.2.d), [w]hen an “automobile accident” occurs between the first vehicle and a second vehicle, such as vehicle 320, controller RSU 316 detects an incident occurred and “identifies additional [RSUs],” such as RSUs 312, 314, 332, 334, and 352, that “have collected data about the incident” because they are “in the vicinity of the incident,” which involves the user of controller RSU 316 (e.g., one of the passengers of the first vehicle 310 having built-in RSU 316). Denny, 9:43-64, 10:18-36.

(j) Claim 7

127. **Claim 7 recites “The system of claim 1, wherein the operations further comprise: generating an alert signal based upon an analysis of at least one of the first set of acoustic sensor data or the second set of acoustic data or a combination of both.”** This claim is met by Denny. See my discussion of the elements of claim 1 above (Section IX.A.2.a-h).

128. Denny discloses that the controller generates an alert signal (*e.g.*, “automatically notify the local fire department 370, the nearest hospital 372 (or emergency response unit) to the site of the collision, and/or the closest police substation 374”) based upon an analysis of at least one of the first set of acoustic sensor data or the second set of acoustic data or a combination of both (*e.g.*, “based on . . . the analysis of the sensed data,” “data sets” 324 and 334; *see* [1.d]-[1.f]). *See, e.g.*, Denny:

- **Figure 4 (annotated):**

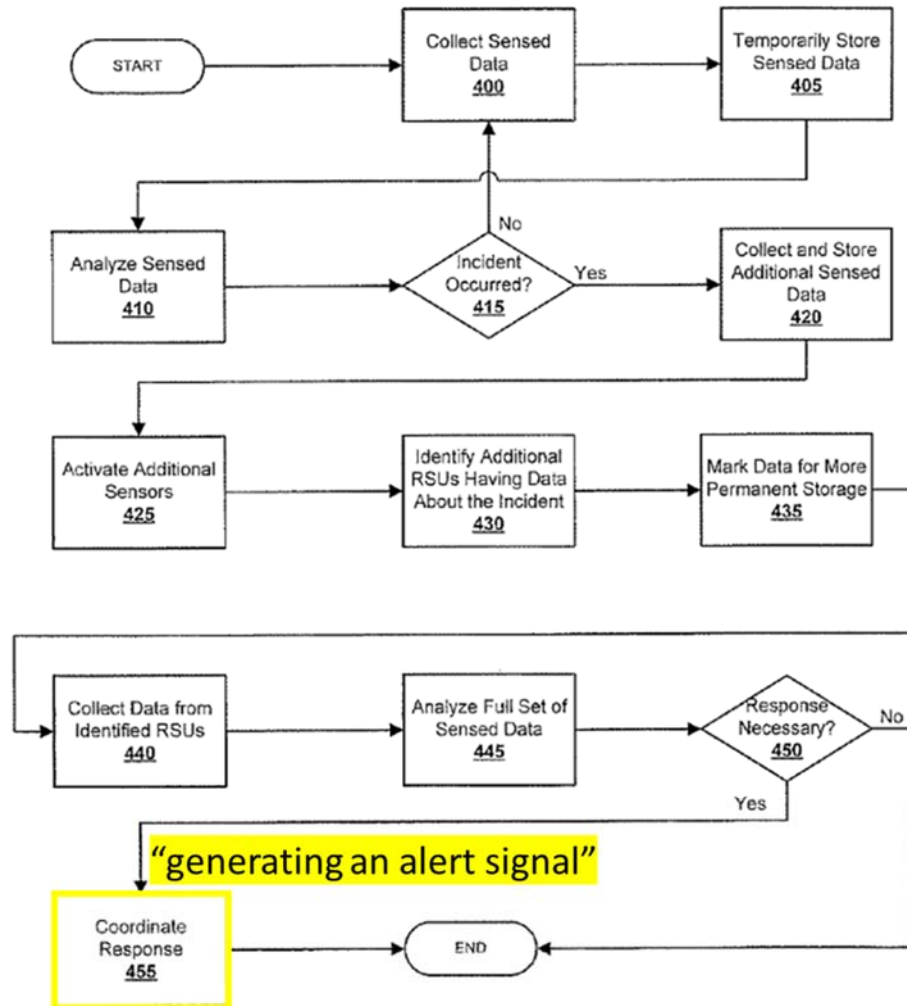


Figure 4

- **11:9-26:** “One of the remote sensing units (e.g., the remote sensing unit that identified that an incident occurred) may then proceed to collect data from each of the other identified remote sensing units. ***Once this additional data is collected, as shown at block 440 of FIG. 4, the remote sensing unit may perform a second analysis (block 445), this time on the more complete data set that includes data from additional remote sensing units and perhaps additional data collected subsequent to the identification of the incident at block 415. Based on this analysis, the remote sensing unit may determine whether a response is necessary to***

the identified incident (block 450). While this determination may be made earlier in other embodiments of the present invention, by waiting until a more complete data set has been collected and analyzed, it may be possible to more accurately identify the type of incident that has occurred and therefore ***enact a response that is appropriate for the specifically identified incident.*** At block 455, the remote sensing unit ***coordinates such a response,*** if necessary.”

- **11:27-55:** “The ***responsive measures*** that are enacted at block 455 in response to ***determining that an incident has occurred*** may be preprogrammed responses. The particular response selected may be ***based on, for example, the analysis of the sensed data performed at block 445*** (or alternatively based on the analysis performed at block 410) of FIG. 4. Referring again to our automobile accident example of FIG. 3, the analysis of the sensed data by remote sensing unit 316 may indicate with a high degree of probability that the first vehicle 310 was involved in some sort of collision. ***Upon making this determination, the remote sensing unit 310 could be programmed to automatically notify the local fire department 370, the nearest hospital 372 (or emergency response unit) to the site of the collision, and/or the closest police substation 374***”

129. See my discussion for elements [1.a.2], [1.d]-[1.f] above (Section IX.A.2.c, f-h).

130. As I discussed in connection with element [1.f] (Section IX.A.2.h), Denny discloses that, after receiving data from the additional RSUs, controller RSU 316 “determine[s] whether a response is necessary to the identified incident (block 450)” and “coordinates such a response, if necessary.” Denny, 11:17-26.

131. Denny further discloses that such “responsive measures” include “automatically notify[ing] the local fire department 370, the nearest hospital 372 (or

emergency response unit) to the site of the collision, and/or the closest police substation 374.” Denny, 11:27-55. Such a notification constitutes an alert signal because it alerts an entity that an incident occurred.

(k) Claim 8

132. **Claim 8 recites “The system of claim 1, wherein the operations further comprise: analyzing at least one of the first set of acoustic sensor data or the second set of acoustic sensor data or a combination of both for animal sounds.”** This claim is met by Denny. See my discussion of the elements of claim 1 above (Section IX.A.2.a-h).

133. Denny discloses that the controller analyzes at least one of the first set of acoustic sensor data (*see* [1.d]) or the second set of acoustic sensor data (*see* [1.e]) or a combination of both for animal sounds (*e.g.*, “fearful screaming”).

134. See my discussion for elements [1.a.2], [1.d]-[1.f] above (Section IX.A.2.c, f-h).

135. To the extent human sounds are considered “animal sounds,” Denny discloses that the system can be used to detect “fearful screaming.” See my discussion regarding element [1.f] above (Section IX.A.2.h).

136. Further, it would have been obvious to implement Denny's incident reporting system to analyze acoustic data containing animal sounds, such as an injured dog's whimper or bark, resulting from a car accident.

137. For example, Murata discloses a system that "convert[s] the features of the animal vocalization data 132 into a predetermined vocalization pattern . . . which is then compared and matched with reference vocalization patterns to determine the emotions contained in the animal vocalization data." Murata, [0084]. It would have been obvious to implement Denny's incident reporting system to analyze animal vocalization data. Denny discloses detecting various incidents, including automobile accidents, and automobile accidents were known to involve animals. Confirming an accident occurred based on the animal vocalizations would have furthered Denny's goal of "accurately identify[ing] the type of incident that has occurred and therefore enact a response that is appropriate for the specifically identified incident." Denny, 11:9-26. Analyzing animal vocalizations would have advantageously given Denny's incident reporting system another reference point to consider when identifying the type of incident and enacting an appropriate response, such as alerting a veterinarian or animal control in the event an accident involving an animal occurred.

(I) Claim 9

138. Claim 9 recites “The system of claim 1, wherein the operations further comprise: determining the locations of each of the selected subset of acoustic devices.” This claim is met by Denny. See my discussion of the elements of claim 1 above (Section IX.A.2.a-h).

139. Denny discloses that the controller determines the locations of each of the selected subset of acoustic devices (*e.g.*, RSU 316 uses “location” data of RSUs 312, 314, 322, 332 and 352 to “identify” them as “additional . . . RSUs” having “data about the incident”). See, *e.g.*, Denny:

- **10:18-36:** “As shown at block 430 of FIG. 4, *the remote sensing unit may also proceed to identify additional remote sensing units (RSUs) that may have collected data about the incident* (and/or which could be activated to start collecting data about the incident). This may be accomplished in a variety of ways. For example, . . . A remote sensing unit that determines that an incident has occurred may use such a paging channel to page all other remote sensing units in the general vicinity. The remote sensing unit may then assume that any remote sensing units that respond to the page may have data regarding the incident, or may collect data (*e.g.*, global positioning satellite data) from the responding remote sensing units to make a determination as to whether the responding remote sensing units have data regarding the incident.”
- **10:37-11:2:** “In other embodiments, a remote sensing unit may use mesh networking techniques at block 430 of FIG. 4 to identify additional remote sensing units (RSUs) that may have collected data about the incident. Pursuant to these mesh networking techniques, the remote sensing unit might, for example, contact other nearby remote sensing units who, in turn, would contact other nearby remote sensing units on an ad hoc basis in order to identify all of the remote sensing units that were in the general vicinity of the incident. GPS data could be included in the

messages forwarded between remote sensing units to ensure that only remote sensing units in the general vicinity of the incident are contacted. In still other embodiments, a page could be sent to every remote sensing unit and responsive information provided by the remote sensing units (e.g., location data) could be used to identify which other remote sensing units are likely to have collected data regarding the incident. ***In still other embodiments, every remote sensing unit could continuously or periodically broadcast its identification (e.g., via an ultrawideband system) and perhaps other information, such as its location, which could then be used by a remote sensing unit to identify the other remote sensing units in the vicinity of the incident.*** In still further embodiments, at block 430 of FIG. 4 the remote sensing unit might sense communications networks that are operating in the area and send out a page or messages on each different type of network as means of contacting and identifying other remote sensing units in the general vicinity. In other embodiments, a system hub (or other system element) could track the location of some or all of the remote sensing units, and the identification step at block 430 could simply comprise requesting the identification from such a system hub. Various other methods of identifying remote sensing units having data regarding the incident may be implemented.”

140. See my discussion for elements [1.a.2], [1.b]-[1.c], [5] above (Section IX.A.2.c-e, i).

141. As I discussed in connection with elements [1.b] and [5] above (Section IX.A.2.d, i), Denny discloses a controller RSU, such as RSU 316, “identif[ies] additional [RSUs] that may have collected data,” such as RSUs 312, 314, 322, 332, 352, that are “in the vicinity of the incident.” Denny, 10:18-10:22, 10:53-58. The controller RSU uses the “identification” and “location” data of the additional RSUs

to identify them as potentially having collected data related to the incident. Denny, 10:53-58.

142. Using the “location” data to identify which RSUs may have collected data related to the incident involves the controller RSU determining the locations of those additional RSUs selected as the subset of RSUs. For example, for controller RSU 316 to identify additional RSUs, such as RSUs 312, 314, 322, 332, 352, that may have collected data related to the incident, the controller RSU 316 would have used the “location” data those additional RSUs broadcasted to controller RSU 316, as I discussed in connection with elements [1.b]-[1.c] (Section IX.A.2.d-e). Upon detection of an incident, controller RSU 316 would have analyzed the “location” data of each RSU in the vicinity that broadcasted its location data to RSU 316, and RSU 316 would have determined the location of each such RSU and decide whether it may have collected data related to the incident based on its determined location. Once controller RSU 316 identifies the RSUs that may have data related to the incident, controller RSU 316 would have determined the locations of each of the selected subset of acoustic devices, such as the locations of RSUs 312, 314, 322, 332, 352.

143. At minimum, it would have been obvious for the controller RSU to determine the location of each RSU selected for the subset. For example, it would

have been obvious for controller RSU 316 to not only receive the locations of proximate RSUs, but to also determine those locations and use the results to determine whether a given RSU is “within the vicinity” such that the RSU may have collected data related to the incident. Further, it would have been obvious for the controller RSU to receive updated location information from the other identified RSUs. For example, when Denny’s RSUs are implemented such that they periodically broadcast their locations, the controller RSU would determine whether an RSU is no longer in the vicinity of the incident based on updated information. It would have been obvious for the controller RSU to receive updated location information of the RSUs and then determine their updated locations because such RSUs might have been in the vicinity at a first time but since left a second time when the incident occurred. Such an implementation would have advantageously increased the efficiency and reliability of Denny’s system, as it would have avoided overburdening controller RSU 316 with data from an RSU that is no longer in the vicinity of the incident, and it would have limited the set of data performed during the controller RSU’s “second analysis” to sensed data captured in the vicinity of the incident (not sensed data captured at another location where an RSU has since moved).

B. Ground 2: Denny in view of Hirata (Claims 1-9)

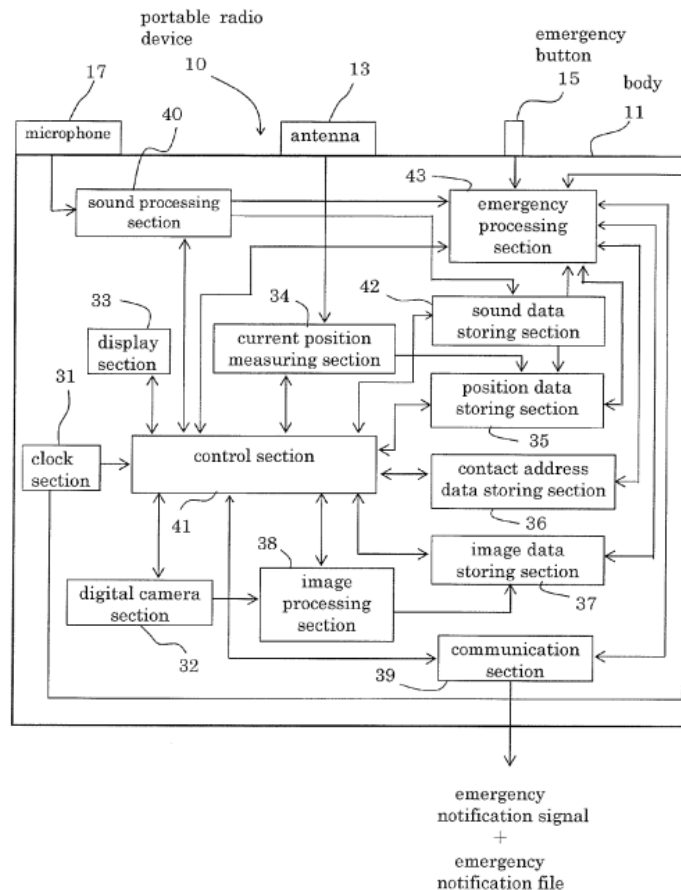
1. Overview of Hirata

144. Hirata is directed to a “a portable radio device having an emergency notifying function, an emergency notification apparatus, and an emergency notification system” that “make it possible to notify quickly and easily a state of emergency such as a crime, accident, and disaster to desired persons.” Hirata, [0001]; *see also* Hirata, [0019] (“The above-described difficulties and demands are applicable in not only the cases where people encounter crimes but also the cases where people encounters accidents (e.g., traffic accident) or disasters (e.g., fire).”). When “said person is in a dangerous state (a state of emergency),” others can be notified, including “his/her family and/or acquaintances, the police, a private security company, a firehouse and so on.” Hirata, [0020]. The “portable radio device” is “a portable device capable of speech communication and/or data transmission by radio,” such as “portable telephones” or “automobile telephones,” among others. Hirata, [0002].

145. Hirata discloses that “a sound processing means” processes “sound collected by [a] microphone to generate sound data,” and “the sound processing means performs voice or speech recognition using the sound data to judge whether the emergency notification process is necessary or not.” Hirata, [0044]. For

example, when an incident occurs and “the user of the device 10 judges that he/she is in a state of danger” and “seeks someone’s help by giving a scream ‘augh’ or uttering some words such as ‘help me,’” the “microphone” of device 10 picks up the utterance, which is then processed by sound processing section 40. Hirata, [0044], [0206], [0208]. Sound processing section 40 performs “speech recognition using the sound data” to “judge whether the emergency notification process is necessary or not.” Hirata, [0044], [0208].

(FIG.3)



Hirata, Figure 3.

146. The “emergency notification process” is “any process . . . [to] make a notification” to “predetermined contact addresses” that “the sender of the emergency notification data is in a state of emergency,” such as “to the police, [a] private security company, and his/her family and friends.” Hirata, [0056], [0206]. If sound processing section 40 judges that the emergency notification process is not necessary, then the emergency notification process is not performed. Hirata, [0044], [0208]. If the “sound processing section 40” “judges that the emergency notification process is necessary,” then the “emergency notification process” is performed. Hirata, [0044], [0208].

2. Motivation to Apply Hirata’s Teachings to Denny

147. Denny and Hirata are in the same field as the ’329 patent and pertinent to the problems addressed by the ’329 patent. For example, the ’329 patent’s field includes acoustic data analysis and the ’329 patent purports to address problem of detecting triggering events. ’329 patent, 1:25-29 (“The present invention relates to processing of information from a population of data acquisition devices, and in some examples, relates to processing of audio or multimedia data acquired from an adaptively selectable population of personal wireless devices.”), 1:44-67 (“In one aspect of the present invention, in general, the audio and multimedia acquisition capabilities of a set of devices may be exploited to aggregate acquired content and

fuse the information in that content, for instance, for audio scene analysis. . . The information filtered to users may be utilized to form virtual communities based on shared interests and common information, and to ensure that relevant information including alerts, marketing information, and news reaches these communities.”).

148. Denny’s field includes acoustic data analysis as well, and Denny is pertinent to the problem of detecting triggering events. Denny, Abstract (“Methods for responding to a potential incident are provided in which data about the potential incident is received from a first remote sensing unit. Additional remote sensing units are identified that may have additional data about the potential incident, and additional data about the potential incident is received from at least some of these additional remote sensing units. The totality of the received data is then analyzed, and at least one remote entity is automatically notified regarding the occurrence of the potential incident.”), 5:55-60 (“A few examples of the types of sensors that may be included on a remote sensing unit include a noise meter, an audio recorder, an accelerometer, a speedometer, a clock, a video camera, a global positioning satellite receiver, a thermometer, a breathalyzer, a wind gauge, a seat belt sensor, etc.”), 7:21-41 (“For example, the first data set 18 and/or the second data set 24 may include accelerometer data, speedometer data, audio data, braking data, global positioning satellite location data, temperature data, rain detector information, information

regarding the number of passengers, seat belt status information, breathalyzer information, trajectory information, etc.”), 16:61-17:10 (“fearful screaming”).

149. As discussed above in Section IX.B.1, Hirata’s field also includes acoustic data analysis and Hirata is pertinent to the problem of detecting triggering events. Hirata, Abstract (“A portable radio device, an emergency notification apparatus, and an emergency notification system are provided. . . . Then, the emergency notification data is transmitted by radio to the emergency notification apparatus 70 along with an emergency notification signal.”), [0044] (“In another preferred embodiment of the portable radio device according to the present invention, a sound collecting microphone, and a sound processing means for processing sound collected by the microphone to generate sound data are further provided, wherein the sound processing means performs voice or speech recognition using the sound data to judge whether the emergency notification process is necessary or not, and wherein if the sound processing means judges that the emergency notification process is necessary, the sound processing means causes the emergency processing means to perform the emergency notification process.”), [0208] (“When the emergency button 15 is unable to be pressed for some reason, it is sufficient that the said user seeks someone’s help by giving a scream ‘augh’ or uttering some words such as ‘help me’. In response, the voice or sound is taken into

the sound processing section 40 by way of the microphone 17 and voice recognition is performed therein. If it is judged that the voice is the registered one, the sound processing section 40 sends the activation signal to the emergency processing section 43 and as a result, the predetermined “emergency notification process” is executed at once.”).

150. Further, the '329 patent, Denny, and Hirata each contemplate acoustic incident reporting systems comprising a device that collects and analyzes data for certain information in various applications, including emergencies. '329 patent, 4:42-49 (“As introduced above, any particular device 120, 120' is able to sense some aspect of an overall audio “scene” in its environment. Such a scene may include, for example, the device owner's own speech even when not carrying out a telephone call, other sounds made by the owner (such as coughing), the speech of others in proximity to the user and environmental sounds in proximity to the user (such as sirens, gunshots, etc.).”), 16:47-65 (“Generally, use cases described above use various triggering events to begin local logging of audio and/or to initiate communication with the server 140, device 120' and/or other nearby devices 120. In addition to audio-based events (e.g., specific words, spoken topics, music, sounds, etc.), other events may trigger monitoring and/or communication. . . . For example, high acceleration may be associated with a vehicle accident or a fall, and this may

initiate audio monitoring or communication with the server 140 (or device 120'), which may be able to determine if an accident has occurred based on the audio scene 130, in which case emergency help may be summoned.”); *see also* '329 patent, 14:50-64, 20:1-21:2; Denny, 9:57-64 (“The flow chart of FIG. 4 depicts an exemplary set of operations that show how the remote sensing unit 316 may identify that the automobile accident occurred in one specific embodiment of the present invention, and respond to the accident by contacting for example, a fire department 370, a hospital 372, a police department 374, an emergency contact 376 and/or a towing service 378.”), 16:61-17:10 (“fearful screaming”); *see also* Denny, 11:27-55; Hirata, [0208] (“When the emergency button 15 is unable to be pressed for some reason, it is sufficient that the said user seeks someone's help by giving a scream ‘augh’ or uttering some words such as ‘help me’. In response, the voice or sound is taken into the sound processing section 40 by way of the microphone 17 and voice recognition is performed therein. If it is judged that the voice is the registered one, the sound processing section 40 sends the activation signal to the emergency processing section 43 and as a result, the predetermined “emergency notification process” is executed at once.”); *see also* Hirata, [0044].

151. Denny discloses detecting “fearful screaming” incidents, and Hirata provides an exemplary form of “fearful screaming” detection using speech and

keywords, such as “help me.” Denny, 16:61-17:10; Hirata, [0208]. A person of ordinary skill in the art would have been motivated to apply Hirata’s keyword detection teachings in implementing Denny’s incident reporting system. Such an implementation would have advantageously enhanced Denny’s system to detect incidents based on spoken words associated with an incident, such as a person saying “help me” when, for example, a car accident occurs. Denny contemplates that passengers involved in accidents may become “injured in the accident,” suggesting that the passenger may need assistance and/or call for help. Denny, 1:26-27. Confirming the accident occurred based on the passenger’s call for help, as opposed to just a scream, would have furthered Denny’s goal of “accurately identify[ing] the type of incident that has occurred and therefore enact a response that is appropriate for the specifically identified incident.” Denny, 11:9-26. For example, using key words such as “help me” would have ensured that only those incidents that actually require assistance would trigger a request for help from emergency services. On the other hand, screams of joy or fear that were not part of an incident that actually needed assistance would not trigger an event, ensuring the accuracy of incident reporting. Identifying speech and keywords would have advantageously given Denny’s incident reporting system another reference point to consider when identifying the type of incident and enacting an appropriate response.

152. A person of ordinary skill in the art would have found it obvious to apply Hirata's known keyword detection technique to improve Denny's incident identification system in the same way. For example, it would have been obvious to implement Denny's controller RSU, such as RSU 316, such that it would analyze received audio data comprising speech to determine if an incident occurred and make an appropriate response, as taught by Hirata.

153. Further, a person of ordinary skill in the art would have been motivated to apply Hirata's teachings of detecting an incident in response to a specific, predetermined keyword in implementing Denny's incident reporting system. Such an implementation would have advantageously increased the accuracy of Denny's system. For example, the system would accurately detect an incident or trigger an emergency response based on speech being present in the received signals. This would have ensured that the relevant authorities are "notified quickly and surely" of "a state of emergency." Hirata, [0066] *see also* Hirata, [0144] ("For example, the microphone 17 is used for voice recognition to judge whether the emergency notification is necessary or not..."). By using targeted keywords (such as "help me") rather than sound in general, applying Hirata's teaching in implementing Denny's incident reporting system would improve the system to more accurately discern between acoustic data that requires a responsive action (e.g., "help me")

from another acoustic data that does not require a responsive action (e.g., “I’m tired” or a relatively loud sound unrelated to an incident, such as a fearful scream when an accident does not occur).

154. As another example of increasing the accuracy of Denny’s system, applying Hirata’s teaching in implementing Denny’s incident reporting system would have also improved the system to discern between different types of incidents and the appropriate response thereto. For example, upon detection of the keyword “help me,” a person of ordinary skill in the art would have understood the benefits in sending a notification to only the police department 374, unless other information indicated the need for another service, such as towing service 378 (*see* Denny, Figure 3). Upon detection of the keyword “help me, I have a flat tire,” a person of ordinary skill in the art would have understood the benefits in sending a notification (in lieu of or in addition to the police department 374) to towing service 378 so that the service is deployed to the location of the incident to assist with the flat tire.

155. A person of ordinary skill in the art would have had a reasonable expectation of success in applying Hirata’s speech detection teachings in implementing Denny’s incident reporting system. As I discussed above in this Section, both references teach incident reporting systems that use audio data to perform an appropriate response. Further, both Denny and Hirata disclose using

software (e.g., stored in memory to instruct a processor) to carry out their respective functionalities. Denny, 2:8-11 (“The remote sensing units also include a storage unit that stores the collected data, and a processor that may be used to analyze the collected data to determine if an incident has occurred.”); *see also* Denny, 2:62-3:16, 4:27-5:9, 5:35-52, 13:48-56, 14:23-31, 15:52-57, Figure 6; Hirata, [0041] (“Since the emergency notification process includes the above-described steps, it may be presumed that the emergency processing means is easily realized with software. However, the emergency processing means is not limited to this. The emergency processing means may be realized with hardware or the combination of hardware and software.”); *see also* Hirata, Abstract, [0002], [0157], [0208], Figure 3.

156. Implementing Hirata’s teaching in Denny would have required only an additional sound pattern to be recognized by Denny’s controller RSU. For example, Denny discloses that it detects incidents using an audio recorder, which a person of ordinary skill in the art would have understood teaches and suggests that Denny’s RSUs recognize sound patterns. Applying Hirata’s keyword detection teachings in implementing Denny’s incident reporting system would have required Denny’s RSUs to recognize only additional sound patterns, such as “help me.” Implementing Denny’s RSUs, which use processor and memories, to identify this keyword would have been straightforward, requiring Denny’s RSUs to be configured to recognize

“help me.” Such an implementation would have advantageously improved Denny’s incident reporting system to detect incidents.

3. Invalidity of Claims 1-9 Over Denny in view of Hirata

157. In addition to my discussion in Sections IX.B.1-IX.B.2, the following identifies example disclosures followed by bulleted excerpts that each disclose and/or render obvious the Challenged Claims.

(a) Claim 1

158. Regarding elements [1.a]-[1.f], see my discussion in Ground 1 regarding Denny and its disclosure of these elements. See Section IX.A.2.a-h.

159. Regarding element [1.f], to the extent additional disclosure of “identify[ing] if speech is present” is required, Hirata further discloses analyzing acoustic data (*e.g.*, “sound data,” such as “utter[ed] . . . words,” picked up by a “microphone”) to identify if speech is present (*e.g.*, performing “speech recognition” on “the sound data to judge whether the emergency notification process is necessary or not”).

160. As I discussed in Section IX.B.1, Hirata discloses a portable device comprising a “microphone” that picks up sound, such as a “user seek[ing] someone’s help” who “utter[s] some words such as ‘help me,’” that is processed using “speech recognition” to “judge whether the emergency notification process is necessary or

not,” such as “notif[ying] . . . the police, [a] private security company, and his/her family and friends.” Hirata, [0044], [0206], [0208], Figure 3.

161. As I discussed in Section IX.B.2, a person of ordinary skill in the art would have been motivated to apply these teachings from Hirata in implementing Denny’s incident reporting system.

(b) Claim 2

162. **Claim 2 recites “The system according to claim 1, wherein the operations further comprise: analyzing the speech for a keyword.”** This claim is met by Denny in view of Hirata.

163. Hirata discloses analyzing the speech for a keyword (*e.g.*, performing “speech recognition” on “utter[ed] . . . words,” such as “help me”).

164. As I discussed in Section IX.B.1, Hirata discloses a portable device comprising a “microphone” that picks up sound, such as a “user seek[ing] someone’s help” who “utter[s] some words such as ‘help me,’” that is processed using “speech recognition” to “judge whether the emergency notification process is necessary or not,” such as “notif[ying] . . . the police, [a] private security company, and his/her family and friends.” Hirata, [0044], [0206], [0208], Figure 3.

165. As I discussed in Section IX.B.2, a person of ordinary skill in the art would have been motivated to apply these teachings from Hirata in implementing Denny's incident reporting system.

(c) Claim 3

166. **Claim 3 recites “The system of claim 2, wherein the first set of sensor acoustic data and the second set of sensor acoustic data are received based on a triggering event.”** This claim is met by Denny in view of Hirata.

167. See my discussion of elements [1.d]-[1.e] and claim 2 above in Sections IX.A.2.f-g and IX.B.3.b.

168. Denny discloses that the first set of sensor acoustic data (*see* element [1.d], Section IX.A.2.f) and the second set of sensor acoustic data (*see* element [1.e], Section IX.A.2.g) are received based on a triggering event (*e.g.*, “remote sensing unit [316] . . . determine[s] if an incident has occurred” and then “identif[ies]” and “collect[s]” “data sets” 324 and 334 from RSUs 322 and 332).

169. As discussed in connection with elements [1.a.1]-[1.e] (Section IX.A.b-g), Denny discloses that the controller RSU, such as RSU 316, first determines if an incident has occurred. If the controller RSU determines that an incident has occurred, the controller RSU identifies additional RSUs to collect sensor data from in the vicinity of the detected incident. Upon receipt, the controller RSU analyzes

the fuller set of collected data to again determine if an incident occurred, performing a second analysis on the more complete set of data to accurately identify whether an incident occurred and enact an appropriate response. Denny, 9:65-10:17, 10:18-10:36, 11:12-17, Figure 4. Therefore, the controller RSU 316 receives the data from the additional RSUs based on a triggering event, such as the controller RSU 316 originally determining that an incident occurred.

(d) Claim 4

170. **Claim 4 recites “The system of claim 3, wherein the operations further comprise: determining a direction of measurement of at least one device of the subset of devices.”** This claim is met by Denny in view of Hirata.

171. Denny discloses determining a direction of measurement of at least one device of the subset of devices (*e.g.*, determining “the direction where an incident is believed to have happened”).

172. See my discussion of claim 3 above in Section IX.B.3.c.

173. Denny discloses that the controller RSU confirms an incident occurred after a “second analysis” and its “response” includes “activating additional sensors on one or more remote sensing units, and/or modifying the current settings on various sensors (*e.g.*, redirecting a video camera to point in the direction where an incident is believed to have happened).” Denny, 9:13-27, 11:12-17.

174. For example, the controller RSU “modif[ies] the current settings on various sensors,” including its own sensors or those of other RSUs, such as redirecting their video camera to point in the direction where an incident is believed to have happened (i.e., the location of the incident). Denny, 9:13-27. By “redirecting a video camera to point in the direction where an incident is believed to have happened,” the controller RSU uses a reference point to determine where to redirect the video camera(s). For example, if RSU 352 becomes the controller RSU and identifies RSU 332 as having collected data related to an incident (e.g., an automobile accident between the first and second vehicles 310 and 320), RSU 352 knows where to redirect its video camera (or video camera of, e.g., RSU 332) based on a direction of measurement of RSU 332. The sound waves from the automobile accident travel to RSU 332’s microphone from a specific direction (e.g., southeast), and this direction data is sent from RSU 332 to controller RSU 352 so that controller RSU 352 knows where to redirect its video camera or the video camera of other RSUs, such as RSU 332.

175. At minimum, it would have been obvious for the controller RSU to determine the direction of measurement of an additional RSU to redirect a video camera to the location of an incident and receive video data from that location. Indeed, it was known in the art for controller devices to receive direction of

measurement data to determine the location of an incident, and it would have been obvious to implement Denny's incident reporting system such that the controller RSU receives direction data to determine where to redirect video cameras so that they point in the direction of an incident. *See, e.g.*, Green, [0024] ("Using an array of sensors information regarding the direction of origin of an acoustic wavefront can be gathered as the acoustic wave will pass the different sensors at different times. The processor can use this information to determine the location of an event."), [0046] ("The signal processing may be performed by the module that detects the event to determine the type of event and its direction. In such case all that needs to be communicated to the module acting in control mode is the type of event and the location information. However in some cases it may be better for the module acting in control mode to perform the analysis, in which case the detecting module will transmit the raw data signal to the control mode.").

176. Moreover, while Denny's discussion of determining direction is disclosed in connection with Figures 1 and 2, to the extent those figures are considered to be part of a different embodiment than the embodiment shown in Figures 3 and 4, it would have been obvious to implement the functionality of identifying the direction of a source of sound in the RSUs disclosed in connection with Figures 3 and 4, as the RSUs disclosed in connection with Figures operate in

the same manner. For example, in connection with all of these figures, Denny discloses that a response is carried out after performing a “second analysis” on the received data. Denny further discloses that each RSU has a “sensor bank” that includes “a video camera.” Denny, 13:50-57 (“Any one of, or all of, the remote sensing units illustrated in FIG. 1, 3 and/or 5 could be implemented using the remote sensing unit 600 of FIG. 6. As shown in FIG. 6, the remote sensing unit 600 may include . . . a sensor bank 650 . . .”), 15:20-25 (“The block diagram of FIG. 6 illustrates exemplary sensors that may be included in the sensor bank 650 such as . . . a video camera 662 . . .”). Applying the teachings disclosed in connection with Figures 1 and 2 to Figures 3 and 4 would have been straightforward and the use of a known technique to improve similar devices in the same way, such that the RSUs in Figures 3 and 4 would have been capable of determining the direction of sound for purposes, e.g., of redirecting a video camera to point in the direction of an incident.

177. My discussion of this claim is consistent with the ’329 patent’s disclosure. For example, the specification discloses that “audio is buffered at devices 120 carried by multiple soldiers, and the combined information may be used to estimate the direction of a sniper location.” ’329 patent, 14:60-64. The ’329 patent’s specification also discloses that “devices 120 may locally exchange information to perform aggregated analysis,” including “local assessments of

shooter direction based on the information they obtain.” ’329 patent, 14:66-15:7. My discussion above is consistent with these “local assessments” performed by devices 120.

178. To the extent the ’329 patent discloses using the locations of the subset of devices to determine the direction of measurement of a subset device, Denny discloses this concept. For example, as I discussed in connection with claim 9 above in Section IX.A.2.1, Denny discloses that the controller RSU determines the locations of each of the subset RSUs identified as having collected data related to the incident. It would have been obvious for Denny’s controller RSU to use this location data to determine the direction of measurement of a subset RSU when redirecting its video camera (or other RSUs’ video cameras) to point in the direction of an incident.

179. A person of ordinary skill in the art would have understood that applying Hirata’s teachings that I discuss above in connection with claims 1-3 (Section IX.B.1.a-c) in implementing Denny’s system would not affect Denny’s controller RSU determination of the direction of measurement of the additional RSUs.

(e) Claim 5

180. **Claim 5 recites “The system of claim 1, wherein the operations further comprise: selecting the subset of devices based on geographic proximity to a user.”** Denny discloses claim 5. See my discussion in Section IX.A.2.i. Applying Hirata’s teachings of speech recognition to Denny’s incident reporting system would not impact the analysis of Claim 5. Therefore, the same analysis regarding Denny (Section IX.A.2.i) applies such that Denny in view of Hirata render Claim 5 obvious.

(f) Claim 6

181. **Claim 6 recites “The system of claim 2, wherein the operations further comprise: activating a sensor based upon the keyword.”** This claim is met by Denny in view of Hirata.

182. Denny discloses that the controller (*e.g.*, RSU 316) activates a sensor based upon detected speech (*e.g.*, “activating additional sensors on one or more remote sensing units” based on “fearful screaming”).

183. See my discussion of elements [1.b], [1.f], and claim 2 above in Sections IX.A.2.d, h and IX.B.3.b.

184. Denny discloses that the controller RSU confirms an incident occurred after a “second analysis” and its “response” includes “activating additional sensors

on one or more remote sensing units.” Denny, 9:13-27, 11:12-19. One such sensor includes a “video camera.” Denny, 15:20-25.

185. Denny discloses that the controller RSU’s “response” after confirming an incident occurred includes “activating additional sensors on one or more remote sensing units,” such as turning on its video camera or the video camera of one or more other RSUs. Denny, 9:13-27, 11:12-19. For example, the controller RSU, such as RSU 316, collects data from the additional RSUs, such as RSUs 322 and 332. After performing a “second analysis” to confirm an incident, such as “fearful screaming,” the controller RSU activates its own video camera or the video camera of another RSU, such as the video camera(s) of RSUs 322 and/or 332. Denny, 9:13-27, 11:12-19, 17:3-6.

186. While Denny’s discussion of activating sensors after a “second analysis” is disclosed in connection with Figures 1 and 2, to the extent those figures are considered to be part of a different embodiment than the embodiment shown in Figures 3 and 4, it would have been obvious to implement the functionality of activating sensors after a “second analysis” in the RSUs disclosed in connection with Figures 3 and 4, as the RSUs disclosed in connection with Figures operate in the same manner. For example, in connection with all of these figures, Denny discloses that a response is carried out after performing a “second analysis” on the received

data. Denny further discloses that each RSU has a “sensor bank.” Denny, 13:50-57 (“Any one of, or all of, the remote sensing units illustrated in FIG. 1, 3 and/or 5 could be implemented using the remote sensing unit 600 of FIG. 6. As shown in FIG. 6, the remote sensing unit 600 may include . . . a sensor bank 650 . . .”), 15:20-25 (“The block diagram of FIG. 6 illustrates exemplary sensors that may be included in the sensor bank 650 such as . . . a video camera 662 . . .”). Applying the teachings disclosed in connection with Figures 1 and 2 to Figures 3 and 4 would have been straightforward and the use of a known technique to improve similar devices in the same way, such that the RSUs in Figures 3 and 4 would have been capable of activating sensors in response to performing a second analysis and determining an incident occurred.

187. Such an implementation would have advantageously enhanced the reliability of Denny’s system. For example, after confirming an incident occurred, the controller RSU would have activated other sensors, such as its own video camera or the video camera of another RSU, and a person of ordinary skill in the art would have recognized the benefits in using that video data to appropriately identify the incident, such as whether there was a fire requiring the fire department to be dispatched in response to, for example, a car accident. Denny, 9:57-64, 11:36-40.

188. Hirata discloses the keyword. See my discussion in connection with claim 2 in Section IX.B.3.b.

189. A person of ordinary skill in the art would have understood and found obvious that, in applying Hirata's teachings of speech recognition to Denny's incident reporting system, the additional sensor or sensors would be activated based on the detected keyword, such as "help me," triggering the response in order to advantageously "determine whether a response is necessary to the identified incident." Denny, 11:12-19. For example, upon the controller RSU receiving audio data from an additional RSU such as a person saying "help me," the controller RSU would activate an additional sensor, such as a video camera, in the additional RSU and/or in the controller RSU to capture footage of the incident.

(g) Claims 7-9

190. Denny discloses claims 7-9. See my discussion in Section IX.A.2.j-1. Applying Hirata's teachings of speech recognition to Denny's incident reporting system would not impact the analysis of claims 7-9. Therefore, the same analysis regarding Denny (Section IX.A.2.j-1) applies such that Denny in view of Hirata render claims 7-9 obvious.

C. Ground 3: Denny in view of Byers (Claims 1-11)

1. Claim 1

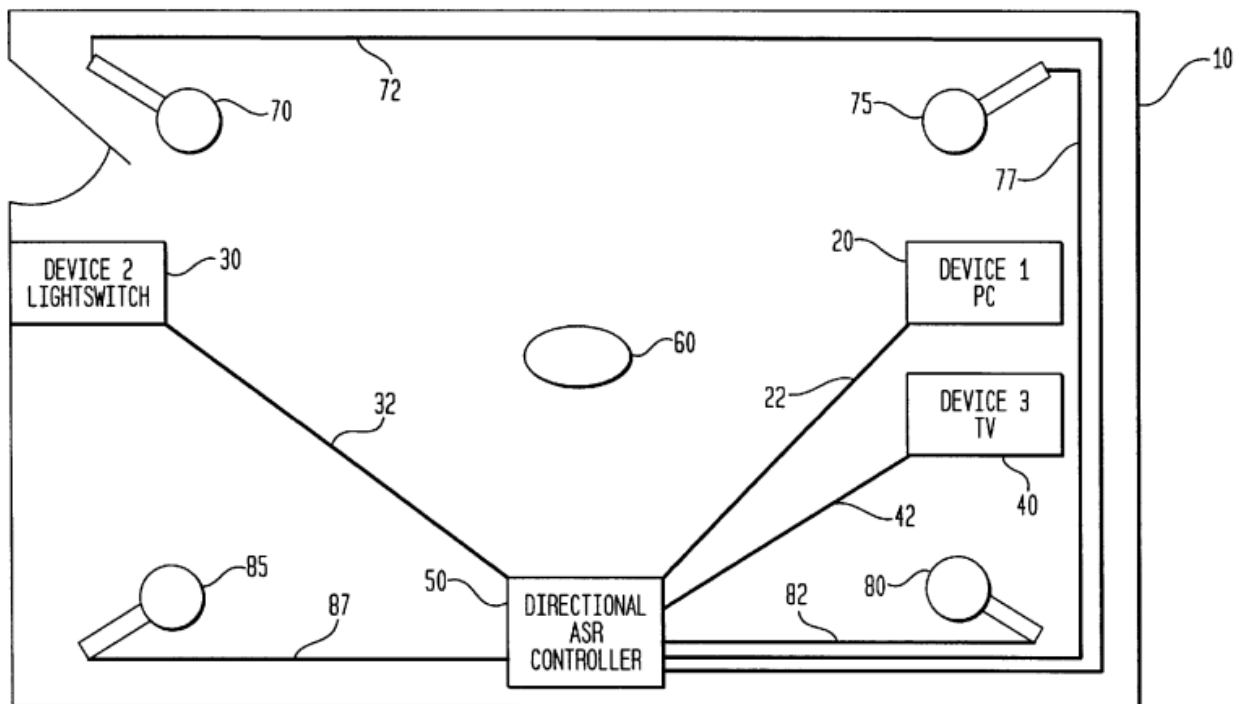
191. Regarding elements [1.a]-[1.f], see my discussion in Ground 1 regarding Denny and its disclosure of these elements. See Section IX.A.2.a-h.

192. Regarding element [1.f], to the extent additional disclosure of “identify[ing] if speech is present” is required, Byers further discloses analyzing acoustic data (*e.g.*, “voice command[s]” “pick[ed] up or transduce[d]” by “microphones” into “microphone signal[s]”) to identify if speech is present (*e.g.*, “perform[ing] speech recognition” on “the plurality of microphone signals” for a “valid match”).

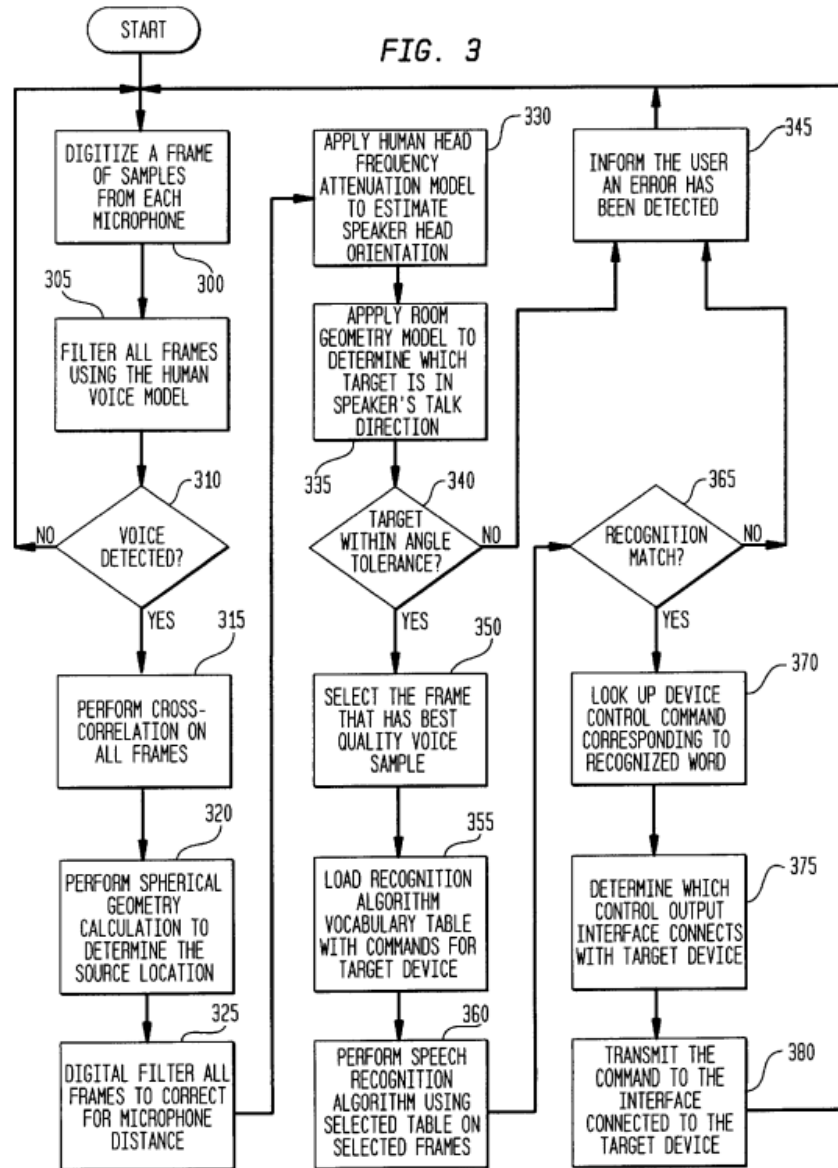
193. Byers is directed to “voice control of electronic devices, control of a number of distributed processing systems, multi-pickup sensing apparatus, and to triangulation of a user’s position.” Byers, 1:14-17. Byers discloses “a plurality of microphones” that “each individually and respectively pick up or transduce the voice command into a microphone signal.” Byers, 4:33-49, 5:2-4. Each of these microphones “relays it’s microphone signal . . . to the directional ASR controller 50.” Byers, 4:66-5:7, 4:20-22 (disclosing a “directional automatic speech recognition (ASR) controller 50”). Controller 50 “interprets the plurality of microphone signals thus received and determines which direction the user was

facing when the voice command was spoken.” Byers, 5:6-12. The controller 50 then “performs speech recognition on the best quality digitized samples” using “a speech recognition vocabulary table” that “consist[s] of all the possible commands for the successfully detected device.” Byers, 8:22-35. If “no match was made,” the user is alerted that an error was detected. Byers, 8:33-35. However, if “a valid match was made,” the controller 50 “determin[es] the control command for the successfully detected device responsive to the valid match” and transmits “the control command for the successfully detected device.” Byers, 8:38-47.

FIG. 1



Byers, Figure 1.



Byers, Figure 3. *See also* Byers, 7:27-28 (“FIG. 3 is a program flow chart of the directional ASR controller 50 of the present invention.”).

194. Like the '329 patent and Denny, Byers' field includes acoustic data analysis, and Byers is pertinent to the problem to detecting triggering events

purportedly addressed by the '329 patent. *See* '329 patent, 1:25-29, 1:44-67; Byers, Abstract (“Multiple microphones feed a signal processing system which determines or estimates both a user’s location and a user’s orientation within a room as the user issues voice commands, and further determines the microphone providing the best signal.”), 1:14-17 (“This invention relates to voice control of electronic devices, control of a number of distributed processing systems, multi-pickup sensing apparatus, and to triangulation of a user’s position.”), 2:10-18, 4:20-5:7; Denny, Abstract, 1:7-9, 5:55-60, 7:21-41, 16:61-17:10.

195. Like the '329 patent, Denny and Byers each contemplate an acoustic analysis system comprising a device that collects and analyzes data for certain information in various applications. '329 patent, 4:42-49, 14:50-64, 16:47-65, 20:1-21:2; Denny, 9:57-64, 11:27-55, 16:61-17:10; Byers, Abstract, 1:14-17, 2:10-18, 4:20-5:7.

196. A person of ordinary skill in the art would have been motivated to apply Byers’ teachings of using keyword detection in implementing Denny’s incident reporting system. Such an implementation would have advantageously enhanced Denny’s system to detect incidents based on spoken words, including voice commands, associated with an incident, such as a person saying “help me” or “call 911” when, for example, a car accident occurs. Denny contemplates that passengers

involved in accidents may become “injured in the accident,” suggesting that the passenger may need assistance and/or call for help. Denny, 1:26-27. Confirming the accident occurred based on the passenger’s call for help, as opposed to just a scream, would have furthered Denny’s goal of “accurately identify[ing] the type of incident that has occurred and therefore enact a response that is appropriate for the specifically identified incident.” Denny, 11:9-26. For example, using key words such as “help me” or “call 911” would have ensured that only those incidents that actually require assistance would trigger a request for help from emergency services. On the other hand, screams of joy or fear that were not part of an incident that actually needed assistance would not trigger an event, ensuring the accuracy of incident reporting. Identifying speech and keywords would have advantageously given Denny’s incident reporting system another reference point to consider when identifying the type of incident and enacting an appropriate response.

197. A person of ordinary skill in the art would have found it obvious to apply Byers’ known keyword detection technique to improve Denny’s incident identification system in the same way. For example, it would have been obvious to implement Denny’s controller RSU, such as RSU 316, such that it would analyze received audio data comprising speech to determine if an incident occurred and make an appropriate response, as taught by Byers.

198. Further, a person of ordinary skill in the art would have been motivated to apply Byers' teachings of detecting an incident in response to a specific, predetermined keyword in implementing Denny's incident reporting system. Such an implementation would have advantageously increased the accuracy of Denny's system. For example, the system would accurately detect an incident or trigger an emergency response based on speech being present in the received signals. By using targeted keywords (such as "help me") rather than sound in general, applying Byers' teaching in implementing Denny's incident reporting system would improve the system to more accurately discern between acoustic data that requires a responsive action (e.g., "help me") from another acoustic data that does not require a responsive action (e.g., "I'm tired" or a relatively loud sound unrelated to an incident, such as a fearful scream when an accident does not occur).

199. As another example of increasing the accuracy of Denny's system, applying Byers' teaching in implementing Denny's incident reporting system would have also improved the system to discern between different types of incidents and the appropriate response thereto. For example, upon detection of the keyword "help me," a person of ordinary skill in the art would have understood the benefits in sending a notification to only the police department 374, unless other information indicated the need for another service, such as towing service 378 (*see* Denny, Figure

3). Upon detection of the keyword “help me, I have a flat tire,” a person of ordinary skill in the art would have understood the benefits in sending a notification (in lieu of or in addition to the police department 374) to towing service 378 so that the service is deployed to the location of the incident to assist with the flat tire.

200. A person of ordinary skill in the art would have had a reasonable expectation of success in applying Byers’ speech detection teachings in implementing Denny’s incident reporting system. As I discussed above in this Section, both references teach acoustic detection systems that use audio data to perform an appropriate response. Further, both Denny and Byers disclose using processors and memories in telephones to carry out their respective functionalities. Denny, 2:8-11 (“The remote sensing units also include a storage unit that stores the collected data, and a processor that may be used to analyze the collected data to determine if an incident has occurred.”); *see also* Denny, 2:62-3:16, 4:27-5:9, 5:35-52, 13:48-56, 14:23-31, 15:52-57, Figure 6; Byers, 6:51-58 (“Commercial software for consumer personal computers to perform speech recognition is readily available from many vendors.”), 6:63-7:26 (“The DSP 230 performs signal processing on the digital samples that are output by the plurality of analog to digital converters coupled to it, responsive to programming stored in the memory 235 and commands from the control microprocessor 240. . . . The control microprocessor 240 is coupled to a

memory 245. The control microprocessor is responsive to the output of the DSP 230 and to the programming stored in the memory 240 for controlling the DSP 230 and for controlling the device interfaces 270.”), Figure 2.

201. Implementing Byers’ teaching in Denny would have required only an additional sound pattern to be recognized by Denny’s controller RSU. For example, Denny discloses that it detects incidents using an audio recorder, which a person of ordinary skill in the art would have understood teaches and suggests that Denny’s RSUs recognize sound patterns. Applying Byers’ keyword detection teachings in implementing Denny’s incident reporting system would have required Denny’s RSUs to recognize only additional sound patterns, such as “help me.” Implementing Denny’s RSUs, which use processor and memories, to identify this keyword would have been straightforward, requiring Denny’s RSUs to be configured to recognize “help me.” Such an implementation would have advantageously improved Denny’s incident reporting system to detect incidents.

2. Claim 2

202. **Claim 2 recites “The system according to claim 1, wherein the operations further comprise: analyzing the speech for a keyword.”** This claim is met by Denny in view of Byers.

203. Byers discloses analyzing the speech for a keyword (*e.g.*, “performing speech recognition” on the “microphone signal” comprising the user’s “voice command” for a “valid match”). See my discussion of claim 1 above in Section IX.C.1 regarding such disclosure in Byers and for a discussion that a person of ordinary skill in the art would have been motivated to apply Byers’ teachings in implementing Denny’s system.

3. Claim 3

204. **Claim 3 recites “The system of claim 2, wherein the first set of sensor acoustic data and the second set of sensor acoustic data are received based on a triggering event.”** This claim is met by Denny in view of Byers.

205. See my discussion of claim 3 above in Section IX.B.3.c regarding Denny’s disclosure of claim 3. A person of ordinary skill in the art would have understood that applying Byers’ teachings of speech recognition to Denny’s incident reporting system would not impact the analysis of claim 3 and that Denny’s disclosure of claim 3 would not change when applying Byers’ teaching to Denny’s system. Therefore, the same analysis regarding Denny (Section IX.B.3.c) applies such that Denny in view of Byers render claim 3 obvious.

4. Claim 4

206. **Claim 4 recites “The system of claim 3, wherein the operations further comprise: determining a direction of measurement of at least one device of the subset of devices.”** This claim is met by Denny in view of Byers.

207. See my discussion of claim 4 above in Section IX.B.3.d regarding Denny’s disclosure of claim 4. A person of ordinary skill in the art would have understood that applying Byers’ teachings of speech recognition to Denny’s incident reporting system would not impact the analysis of claim 4 and that Denny’s disclosure of claim 4 would not change when applying Byers’ teaching to Denny’s system. Therefore, the same analysis regarding Denny (Section IX.B.3.d) applies such that Denny in view of Byers render claim 4 obvious.

5. Claim 5

208. **Claim 5 recites “The system of claim 1, wherein the operations further comprise: selecting the subset of devices based on geographic proximity to a user.”** Denny discloses claim 5. See my discussion in Section IX.A.2.i. Applying Byers’s teachings of speech recognition to Denny’s incident reporting system would not impact the analysis of claim 5. Therefore, the same analysis regarding Denny (Section IX.A.2.i) applies such that Denny in view of Byers render Claim 5 obvious.

6. Claim 6

209. **Claim 6 recites “The system of claim 2, wherein the operations further comprise: activating a sensor based upon the keyword.”** This claim is met by Denny in view of Byers.

210. Denny discloses that the controller (*e.g.*, RSU 316) activates a sensor based upon detected speech (*e.g.*, “activating additional sensors on one or more remote sensing units” based on “fearful screaming”).

211. As I discussed in Section IX.B.3.f, Denny discloses that the controller activates a sensor based upon detected speech.

212. See my discussion of claim 2 above in Section IX.B.3.b regarding Byers’s disclosure of claim 2, and the keyword, and for a discussion that a person of ordinary skill in the art would have been motivated to apply Byers’ teachings in implementing Denny’s system. A person of ordinary skill in the art would have understood that, in applying Byers’ teachings of speech recognition to Denny’s incident reporting system, the additional sensor or sensors would be activated based on the detected keyword triggering the response. For example, upon the controller RSU receiving audio data from an additional RSU such as a person saying “help me” or “call 911,” the controller RSU would activate an additional sensor, such as a

video camera, in the additional RSU and/or in the controller RSU to capture footage of the incident.

7. Claim 7

213. **Claim 7 recites “The system of claim 1, wherein the operations further comprise: generating an alert signal based upon an analysis of at least one of the first set of acoustic sensor data or the second set of acoustic data or a combination of both.”** Denny discloses claim 7. See my discussion in Section IX.A.2.j. Applying Byers’s teachings of speech recognition to Denny’s incident reporting system would not impact the analysis of claim 7. Therefore, the same analysis regarding Denny (Section IX.A.2.j) applies such that Denny in view of Byers render claims 7 obvious.

8. Claim 8

214. **Claim 8 recites “The system of claim 1, wherein the operations further comprise: analyzing at least one of the first set of acoustic sensor data or the second set of acoustic sensor data or a combination of both for animal sounds.”** Denny discloses claim 8. See my discussion in Section IX.A.2.k. Applying Byers’s teachings of speech recognition to Denny’s incident reporting system would not impact the analysis of claim 8. Therefore, the same analysis

regarding Denny (Section IX.A.2.k) applies such that Denny in view of Byers render claim 8 obvious.

9. Claim 9

215. **Claim 9 recites “The system of claim 1, wherein the operations further comprise: determining the locations of each of the selected subset of acoustic devices.”** Denny discloses claim 9. See my discussion in Section IX.A.2.l. Applying Byers’s teachings of speech recognition to Denny’s incident reporting system would not impact the analysis of claim 9. Therefore, the same analysis regarding Denny (Section IX.A.2.l) applies such that Denny in view of Byers render claim 9 obvious.

10. Claim 10

216. **Claim 10 recites “The system of claim 2, wherein the operations further comprise: determining which of the selected subset of acoustic devices is the closest acoustic device to a user that uttered the keyword.”** This claim is met by Denny in view of Byers.

217. See my discussion of claim 2 above in Section IX.C.3.b regarding Byers’s disclosure of claim 2 and for a discussion that a person of ordinary skill in the art would have been motivated to apply Byers’ teachings in implementing Denny’s system.

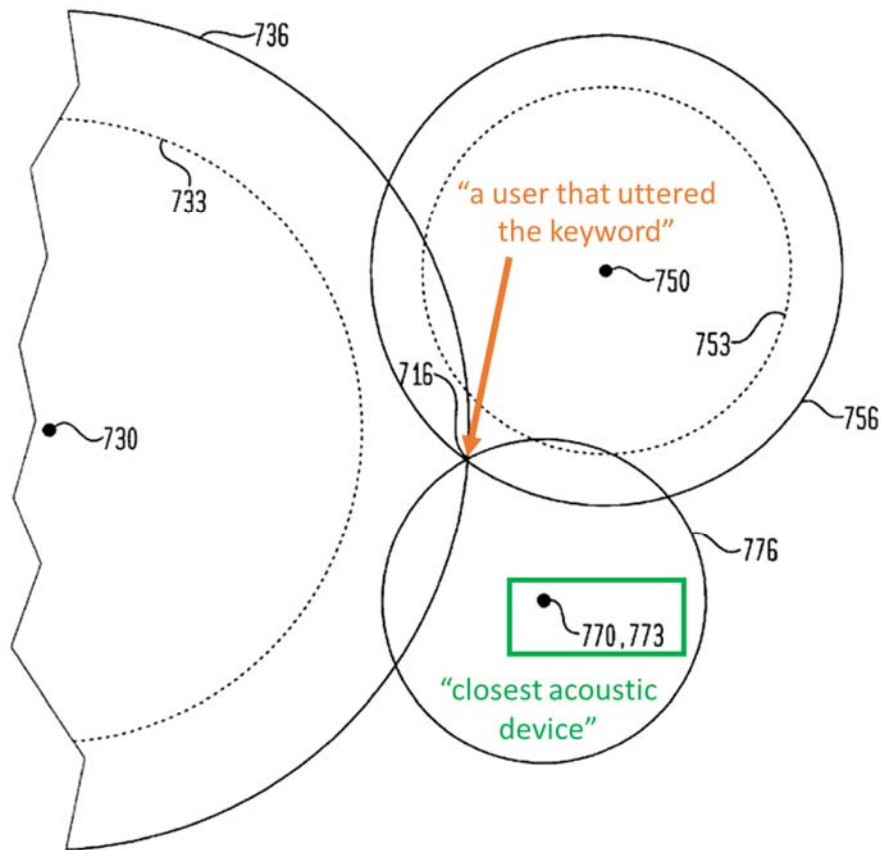
218. Denny discloses the selected subset of acoustic devices (*see* [1.b], [1.f], Section IX.A.2.d, h).

219. As I discussed in Section IX.A.2.d, h, Denny teaches that a controller RSU selects additional RSUs after detecting an incident, such as fearful screaming.

220. Byers discloses determining which of a set of acoustic devices (*e.g.*, “microphones 730, 750, and 770”) is the closest acoustic device to a user (*e.g.*, determining “closest microphone” to “user 710” by “detect[ing] . . . the first arrival of the sound pressure wave at microphone 770” and “detect[ing] the time interval between the first detecting at microphone 770 and the next detection[s]” by “microphone 750” and then “microphone 730”) that uttered the keyword (*e.g.*, “voice command”).

221. Byers discloses “triangulation techniques” using “microphones 730, 750, and 770” to locate “user 710” who issued a “voice command.” Byers, 13:11-30. When a user located at “location 716” “issues a voice command, a sound pressure wave travels from the user out in all directions at equal speed.” Byers, 13:11-14, 13:66-14:2. The “sound pressure wave” reaches “the closest microphone 770 first,” such that “[t]he system detects the event of the first arrival of the sound pressure wave at microphone 770.” Byers, 13:15-30. Figure 9, reproduced below, shows these components to which I added annotations:

FIG. 9



'329 patent, Figure 9 (annotated).

222. The system then stores the detected sound pressure wave and “detects the time interval between first detecting at microphone 770 and the next detection” at “microphone 750.” Byers, 13:19-24. The system then “detect[s] the time interval between detecting the sound pressure wave at microphone 770 and the third detection” at “microphone 730.” Byers, 13:24-30. The system then proceeds to use the determined “closest microphone” to the user in its triangulation technique to

determine “the location of the user.” Byers, 13:15-30, 13:61-14:2. For example, using the first detection at the closest microphone, e.g., microphone 770, and the time intervals for the other microphone, e.g., microphones 750 and 730, the system approximates a location of the user, which is then validated through the rest of the triangulation technique disclosed in Byers. Byers, 13:31-36.

223. A person of ordinary skill in the art would have been motivated to apply Byers’ teachings of determining the closest acoustic device to a user who uttered the keyword in implementing Denny’s system. Such an implementation would have advantageously increased the system’s accuracy when, for example, dispatching emergency services. For example, as discussed in connection with claim 9 (Section IX.A.2.1), Denny discloses that the controller RSU determines the location of the additional RSUs selected as having collected data related to the incident. It would have been advantageous to pinpoint the closest RSU to the user who uttered “help me” and use that closest RSU’s location data to determine, for example, where to send emergency services when the controller RSU sends a request to the police. For example, if RSU 316 (which is “built-in” the “first vehicle 310” involved in “an automobile accident”) and RSU 332 (which is “embedded” into a passerby “third vehicle . . . in the vicinity at the time of the accident”) both capture the driver of first vehicle 310 saying “help me” after an accident occurs, it would have been

advantageous to determine that RSU 316 is the closest acoustic device to the driver calling for help so that emergency services are sent to the location of RSU 316 and not the location of RSU 332, which would have been further from the location of the incident. *See Denny*, 9:43-64. For example, the RSU that is closest to a user is more likely to be associated with the user, and a person of ordinary skill in the art would expect the RSU closest to the user (in this case, RSU 316) to be the most likely RSU to provide information relevant to the user involved in the incident.

224. As another example, in the context of an accident involving a larger vehicle (such as a bus or train) where an RSU embedded in the vehicle detects the accident, becomes the controller RSU, and receives acoustic data (e.g., a rider saying “help me”) from other RSUs embedded in the personal devices of the passengers, it would have been advantageous for the vehicle’s controller RSU to determine the closest RSU to the rider calling for help and sending emergency services to that specific part of the vehicle (e.g., the back of the bus or a particular train car). A person of ordinary skill in the art would have understood the benefit in pinpointing where to specifically send emergency services when an accident involving a larger vehicle is detected and a passenger calls for help.

225. A person of ordinary skill in the art would have had a reasonable expectation of success in applying Byers’ teachings for determining the closest

acoustic device to a user in implementing Denny's incident reporting system. Both references teach acoustic detection systems that use audio data to perform an appropriate response. Further, Denny and Byers disclose using processors and memories to carry out their respective functionalities, as I mention above in connection with claim 1 in Section IX.C.1. Implementing Byers' teaching in Denny would have required merely updating program instructions performed by Denny's controller RSU such that the controller RSU determines which of the additional RSUs identified as having collected data related to the incident is closest to the user who uttered the keyword, such as "help me" or "call 911." See Denny, 2:8-11, 2:62-3:16, 4:27-5:9, 5:35-52, 13:48-56, 14:23-31, 15:52-57; Byers, 6:20-26, 6:63-7:5, 7:14-26. Implementing Denny's RSUs, which use processor and memories, to determine which RSU is closest to the user who uttered the keyword would have been straightforward. Such an implementation would have advantageously improved Denny's incident reporting system to make such a determination.

11. Claim 11

226. **Claim 11 recites "The system of claim 10, where the operations further comprise: determining a voice command from the keyword; and sending the voice command to the closest acoustic device."** This claim is met by Denny in view of Byers.

227. Byers discloses determining a voice command from the keyword (*e.g.*, “performing speech recognition” on the “microphone signal” comprising the user’s “voice command” for a “valid match”) and determining the closest acoustic device (*e.g.*, “closest microphone” to “user 710”).

228. See my discussion of claims 1, 2, and 10 above in Section IX.C.1, 2, 10.

229. Denny renders obvious sending the voice command to the closest acoustic device (*e.g.*, controller RSU directing the closest RSU to a user execute the voice command, such as calling 911).

230. As I discussed above in connection with claims 1 and 10 (Section IX.C.1, 10), Byers discloses a controller 50 that detects a user’s “voice command” and sends a “control command” to a target controlled device. Byers, 4:66-5:7, 8:38-47. As I discussed in connection with claim 1 in Ground 1 (Section IX.A.2.a-h), Denny discloses a controller RSU that receives acoustic data from other RSUs in the vicinity to confirm an incident occurred.

231. Denny further discloses that not all RSUs are capable of analyzing collected data. For example, Denny discloses that only “[s]ome...of the remote sensing units may include a capability for analyzing collected sensed data,” such that not all RSUs have the capability to detect speech themselves. Denny, 6:1-2. Denny

therefore teaches and suggests that, upon detection of an incident by the controller RSU, the controller RSU identifies an RSU closest to a user involved in the incident, whereby the identified RSU is not capable of performing speech or keyword detection. *See* Denny, 6:1-2; elements [1.a.2]-[1.b] (Section IX.A.2.c-d). For example, upon an incident occurring, a driver of vehicle 310 involved in an accident utters “call 911” to the closest RSU (e.g., RSU 312) that is incapable of detecting the voice command itself. In applying Byers’s teachings of determining the closest acoustic device (see my discussion of claim 10, Section IX.C.10) and detecting voice commands (see my discussion of claim 11 above) in implementing Denny’s incident reporting system, the controller RSU (e.g., RSU 352) would have received the voice command “call 911” from the RSU closest to the driver (e.g., RSU 312), performed speech recognition on the command, determined which RSU is closest to the driver (e.g., RSU 312 and not RSU 332), and sent a control signal back to the closest RSU to call 911 (e.g., RSU 352 sends a control signal to RSU 312 for RSU 312 to call 911).

232. Indeed, performing such speech recognition remotely was known in the art and a person of ordinary skill in the art would have been motivated remotely process voice commands in Denny’s system when an RSU is incapable of performing speech recognition on the voice command itself, as I discussed above.

See, e.g., U.S. Pat. No. 7,529,677 (“Wittenberg,” Ex. 1014), 5:32-45 (“Remote processor 130 includes at least a speech recognition processor and a voice recognition processor. Although not shown in FIG. 1, remote processor 130 also includes a receiver capable of receiving audio signals from communication link 140 and a transmitter for transmitting resulting command signals over communication link 150 (e.g., a modem). Upon reception of an audio signal, the speech recognition processor attempts to identify a voice command within the audio signal (operation 240 in FIG. 2).”); U.S. Pat. No. 7,769,591 (“White,” Ex. 1015), Abstract (“Such speech input may specify a command or a request by the user. The local device performs preliminary processing of the speech input and determines whether it is able to respond to the command or request by itself. If not, the local device initiates communication with a remote system for further processing of the speech input.”).

233. Further, in implementing Denny’s system to respond to a victim being in an accident and yelling “help me” or “call 911,” upon receipt of data by a controller RSU to further confirm an incident, it would have been obvious for the controller RSU to instruct the closest device to the user to call 911 so that the victim who called for help receives the assistance from 911 themselves. For example, when an accident occurs between two vehicles 310 and 320, it would have been obvious for a controller RSU (e.g., RSU 352) to instruct the closest RSU to the driver who

called for help (e.g., RSU 312, 314, 316 if the victim calling for help was in first vehicle 310) to receive a command to call 911, as opposed to some other RSU (e.g., RSU 332), so that the victim himself receives instructions on what to do and where to go while emergency services are dispatched to the incident.

234. As another example, Denny discloses that an “observer” RSU 332 “may end up being the [RSU] that identifies an incident,” thereby becoming the controller RSU for an incident involving a first vehicle 310 having its own RSU 316. *See* Denny, 11:64-12:24. In this example, controller RSU 332 would have identified other RSUs in the vicinity of the incident and requested their acoustic data, such as data from RSU 316, and controller RSU 332 would have performed “a second analysis” to confirm whether an incident occurred. Denny, 11:9-26. Upon receipt of the audio data from RSU 316 to confirm the incident occurred, such as “call 911,” controller RSU 332 would have recognized this utterance as a voice command, as taught by Byers. A person of ordinary skill in the art would have understood the benefits in the controller RSU 332 directing RSU 316 (the device closest to the user uttering keyword containing a voice command) to call 911, as the user of the controller RSU 332 may have minimal information regarding the accident and/or may be leaving the location where the accident occurred (e.g., because it is in another vehicle not involved in the accident).

235. Further, selecting only the closest RSU to the victim to call 911 would have advantageously avoided overburdening an emergency call center. For example, if each RSU in the vicinity of an incident had the capability to perform speech detection, and each of those RSUs recognized the voice command “call 911,” an emergency call center would receive various calls related to the same incident. By having only the closest RSU to the user call 911, the system would not overburden emergency services such that only the RSU closest to the person who uttered “call 911” would dial 911 for emergency services’ assistance.

D. Ground 4-5: Grounds 2-3 further in view of Green (Claim 4)

236. Claim 4 requires the controller device to be configured to determine a direction of measurement of at least one device of the subset of devices. As I discuss in connection with claim 4 in Sections IX.B.3.d and IX.C.4, Denny in view of Hirata or Byers renders obvious this claim. To the extent further disclosure is required, Green provides explicit teachings of determining a direction of measurement of at least one device of the subset of devices.

237. Green is directed to a “sensor system for event location and identification, particularly to a deployed sensor network for area monitoring.” Green, [0001]. Green discloses “a self organizing adaptive network” comprising sensor modules dispersed throughout a geographic area. Green, Abstract, [0006].

The modules “operate in a sensing mode to detect events” or a “controlling mode” to “receive data from [other] sensor modules for . . . analysis.” Green, Abstract, [0006]. Sensor modules use “an array of sensors” for “[a]coustic sensing,” such as the “sound of vehicle movement” or “artillery fire” that “give very distinctive acoustic signatures which can be detected.” Green, [0024]. The sensor modules have “a plurality of acoustic sensors which, when the sensor is deployed, form a spaced array” that gather “the direction of origin of an acoustic wavefront . . . as the acoustic wave will pass the different sensors at different times. Green, [0024]. The processor of the sensor module “use[s] this information to determine the location of an event.” Green, [0024]. Further, the “sensor modules themselves of course form a spaced array and so can be used to give directional information about the origin of an acoustic event.” Green, [0024]; *see also* Green, [0045] (discussing the modules having “microphones 8 are arranged in a spaced array so as to detect acoustic signals coming from any direction” such that “the direction of the source of the signal can be detected”). Green further discloses that the “module acting in control mode” determines the “type of event and its direction” based on receiving “raw data signal[s]” from the sensor modules containing such information. Green, [0046].

238. Like the '329 patent, Denny, Hirata, and Byers, Green's field includes acoustic data analysis, and Green is pertinent to the problem of detecting triggering

events purportedly addressed by the '329 patent. '329 patent, 1:25-29, 1:44-67; Green, Abstract (“The sensor module carries one or more sensor element, such as microphones or imaging devices, for detecting events in use. . . . The module also has a processor which is adapted such that, in use, the module communicates with other sensor modules and determines whether to operate in a sensing mode to detect events or a controlling mode.”), [0001] (“This invention relates to a sensor apparatus and sensor system for event location and identification, particularly to a deployed sensor network for area monitoring.”), [0006] (“The network comprises a plurality of sensor modules distributed across an area each detecting events in the vicinity. It is usual in sensor networks of this type to have at least two distinct types of module in the network; sensor modules which detect events and control modules which receive data from the sensor modules for possible analysis and transmission to a base station.”); *see also* Green, [0002]-[0005]; Denny, Abstract, 1:7-9, 5:55-60, 7:21-41, 16:61-17:10; Hirata, Abstract, [0044], [0208].

239. Like the '329 patent, Denny, Hirata, and Byers, Green further discloses an acoustic incident reporting system comprising a device, such as a sensor module, that collects and analyzes data for certain information in various applications, including emergencies. '329 patent, 4:42-49, 14:50-64, 16:47-65, 20:1-21:2; Green, [0002] (“There is a current desire to be able to identify and locate certain events in

an environment. This is especially true in military applications where it is wished to locate events on a battlefield. Such events could be, for example, movement of vehicles or personnel, artillery fire, aircraft movement etc.”), [0049] (“It will therefore be apparent that a variety of sensor packages can be rapidly deployed to form a self organising network for area monitoring. As discussed the invention has military applications and can perform various functions; weapon location, monitoring of troop movements, perimeter security etc.”), [0050] (“The invention can also be applied to civil applications. For instance perimeter security may be required at various events. Where an area needs to be rapidly secured or a large perimeter needs to be monitored sensor modules can be scattered around the perimeter to detect intruders.”), [0052] (“Another possible application for the sensor modules and network of the present invention is in disaster relief. Following disasters such as earthquakes, landslides or explosions there is a requirement to quickly locate casualties and trapped individuals for rescue.”); Denny, 9:57-64, 11:27-55, 16:61-17:10; Hirata, [0044], [0208]; Byers, Abstract, 1:14-17, 2:10-18, 4:20-5:7.

240. A person of ordinary skill in the art would have been motivated to apply Green’s teachings of direction determination in implementing Denny’s incident reporting system (as modified by Hirata, Section IX.B, or Byers, Section IX.C).

Green provides implementation details regarding how Denny's controller RSU, such as RSU 316, determines where to "redirect[] a video camera," such as its own video camera or the video camera of another RSU. Denny, 9:13-27. Denny does not disclose the details regarding how the controller RSU determines the direction to which the video camera is redirected. Thus, a person of ordinary skill in the art would have turned to Green to determine how to make such a determination, and recognized Green's teachings of using a "spaced array" of sensor modules that "give directional information about the origin of an acoustic event" are applicable to Denny's system. Green, [0024].

241. A person of ordinary skill in the art would have had a reasonable expectation of success in applying Green's details to implement Denny's incident reporting system (as modified by Hirata, Section IX.B, or Byers, Section IX.C). Applying Green's details in implementing Denny's system is a straightforward use of Green's teachings for its intended purpose of determining the location of a sound source using the direction of measurement of sensor modules. Such an implementation would have yielded predictable results of determining the direction measurement of an acoustic source from the sensor modules.

242. Further, both Denny and Green disclose using processors and memories to carry out their respective functionalities. Denny, 2:8-11 ("The remote sensing

units also include a storage unit that stores the collected data, and a processor that may be used to analyze the collected data to determine if an incident has occurred.”); *see also* Denny, 2:62-3:16, 4:27-5:9, 5:35-52, 13:48-56, 14:23-31, 15:52-57, Figure 6; Green, [0009] (“For instance the processor may compare the location of the module with the location of other modules. A module close to or within an area of interest may operate in a sensor mode whereas another module not so located may operate in a control mode. The processor may also be adapted to consider the density of sensor modules in certain areas.”), [0011] (“For instance the sensor module may be provided with one or acoustic sensors such as microphones. In which case, in sensing mode, the processor may simply monitor the output of the microphones until a particular signal is detected. . . . Once a signal that meets the criteria has been received it may be processed by the processor to try to determine the origin of the sound and identify the cause of the sound.”), [0012] (“In another embodiment the sensor module could be provided with a memory to store received data and periodically process and/or transmit received data to the module acting in the control mode.”); *see also* Green, Abstract, [0005], [0008]-[0009]. Implementing Green’s teachings in Denny’s system would have required merely updating the program instruction performed by the processor of Denny’s controller RSU such that, upon receipt of direction of measurement data, the controller RSU would have used such

data to determine the location of the incident and redirect the video camera to that location. Such an implementation would be a straightforward application of Green's teachings in a manner that advantageously improves Denny's incident reporting system (as modified by Hirata, Section IX.B, or Byers, Section IX.C).

E. Grounds 6-8: Grounds 1-3 further in view of Murata (Claim 8)

243. Claim 8 requires the controller device to be configured to analyze received acoustic data for animal sounds. As I discuss in connection with claim 8 above (Sections IX.A.2.k, IX.B.3.g, IX.C.8), Denny discloses, or in view of Hirata or Byers renders obvious, this claim. To the extent further disclosure is required, Murata provides explicit teachings of analyzing acoustic data for animal sounds.

244. Murata is directed to “analyz[ing] a vocalization of an animal and transmit[ting] the results of the vocalization analysis to an external device.” Murata, [0001]. Murata discloses an “animal care terminal” that “transmits the vocalizations of a dog 2 to a management server 200 as animal care status data D1.” Murata, Abstract, [0053]. Upon receipt of this data, the “management server 200 determines the emotion in the vocalization data of the dog 2” by “executing the animal vocalization analysis program” that “convert[s] the features of the animal vocalization data 132 into a predetermined vocalization pattern (for example, a sonograph),” which is “then compared and matched with reference vocalization

patterns to determine the emotions contained in the animal vocalization data.” Murata, [0084]. The determined emotions are “classified by emotion identification codes,” and “creates vocalization analysis result data D2 including human language (text, images, and sounds that humans can use to understand the meaning of the content),” which is transmitted to a user terminal 300. Murata, Abstract, [0053]-[0054].

245. Like the '329 patent, Denny, Hirata, and Byers, Murata's field includes acoustic data analysis, and Murata is pertinent to the problem of detecting triggering events purportedly addressed by the '329 patent. *See* '329 patent, 1:25-29, 1:44-67; Murata, Abstract, [0001], [0007]-[0009], [0053]-[0054], [0084], Figure 2; Denny, Abstract, 1:7-9, 5:55-60, 7:21-41, 16:61-17:10; Hirata, Abstract, [0044], [0208], Byers, Abstract, 1:14-17, 2:10-18, 4:20-5:7.

246. A person of ordinary skill in the art would have been motivated to apply Murata's teachings in implementing Denny (as optionally modified by Hirata, Section IX.B, or Byers, Section IX.C). Such an implementation would have advantageously enhanced Denny's system to detect incidents related to animals, such as a hurt dog's whimper or bark resulting from an automobile accident. Denny discloses an incident reporting system that uses acoustic data to detect an incident, such as “automobile accidents” or “fearful screaming.” Denny, 16:61-17:10. It

would have been advantageous to apply Murata's teachings in implementing Denny's system such that an automobile accident involving an animal would be detected based on the animal's vocalizations. For example, in the event of an accident involving an animal, such as a dog, the animal may vocalize in the form of a whimper or bark if it was injured or may vocalize to warn others of a person in danger, such as the driver or other passenger(s).

247. A person of ordinary skill in the art would have been further motivated to apply Murata's teachings in implement Denny's system (as optionally modified by Hirata, Section IX.B, or Byers, Section IX.C). Such an implementation would have advantageously increased the accuracy of Denny's system by analyzing animal vocalizations to confirm whether an automobile accident occurred, and determine the proper response to the accident. For example, after receiving the acoustic data from the other RSUs, including animal sound data, it would have been advantageous for the controller RSU to confirm an automobile accident involving an animal occurred based not only on fearful screaming or detected keywords (see [1.f], [2] (Sections IX.A.2.h, IX.B.3.a-b, IX.C.1-2)), but also on animal vocalizations, such as a dog's whimper that occurs in conjunction with other audio during the accident. Analyzing animal vocalizations would have advantageously given Denny's incident reporting system another reference point to consider when identifying the type of

incident and enacting an appropriate response, such as alerting a veterinarian or animal control in the event an accident involving an animal occurred, in addition to the other emergency services related to the accident.

248. A person of ordinary skill in the art would have had a reasonable expectation of success in applying Murata's animal sound analysis teachings in implementing Denny's incident reporting system (as optionally modified by Hirata, Section IX.B, or Byers, Section IX.C). Both Denny and Murata teach incident reporting systems that use audio data to perform an appropriate response. Further, both Denny and Murata disclose using processors and memories to carry out their respective functionalities. Murata, [0079] ("The management server 200 includes a CPU 220 that controls the management server 200 in an integrated manner via arithmetic processing, a RAM 230 in which the CPU 220, etc. can temporarily store programs and data, a ROM 240 that stores programs, data, etc. causing CPU 220 to perform various functions").

249. Implementing Murata's teaching in Denny would have required Denny's controller RSU to recognize only additional sound patterns. For example, Denny discloses that it detects incidents using an audio recorder, which a person of ordinary skill in the art would have understood teaches and suggests that Denny's RSUs recognize sound patterns. Applying Murata's animal sound detection

teachings in implementing Denny's incident reporting system would have required Denny's RSUs to recognize only an additional sound pattern, such as a bark from a dog. Implementing Denny's RSUs (as optionally modified by Hirata, Section IX.B, or Byers, Section IX.C), which use processor and memories, to identify this sound would have been straightforward, requiring Denny's RSUs to be configured to recognize the animal sounds. Such an implementation would have advantageously improved Denny's incident reporting system to detect such incidents.

X. SECONDARY CONSIDERATIONS

250. I have seen no evidence in the '329 patent's prosecution history or elsewhere supporting any secondary considerations arguments, or evidence of nexus to any of the Challenged Claims. *See generally* '329 File History. Indeed, per my discussion of the prior art referenced herein, any purported solutions to problems or unexpected results in the '329 patent were already well known. To the extent ST CasesTech, LLC asserts the existence of any secondary considerations in its responses, I reserve my right to address any such evidence.

XI. CONCLUSION

251. In summary, I have concluded that the Challenged Claims are anticipated or rendered obvious over the prior art references as discussed above.

Specifically, in my opinion, for at least the reasons above, the Challenged Claims of the '329 patent are disclosed and rendered obvious as follows.

Ground	Claims	Anticipation or Obviousness	Prior Art References
1	1, 5, 7-9	Anticipated and Obvious	Denny
2	1-9	Obvious	Denny in view of Hirata
3	1-11	Obvious	Denny in view of Byers
4-5	4	Obvious	Grounds 2-3 further in view of Green
6-8	8	Obvious	Grounds 1-3 further in view of Murata

252. To the extent it is argued that any further disclosure is required for an element in the Challenged Claims that I have identified as being disclosed, a person of ordinary skill in the art would certainly have found that element obvious to include based on the sample explicit disclosure or inherent disclosures and analysis I have identified above.

253. I reserve the right to supplement my opinions in the future to respond to any arguments that Patent Owner or its expert(s) may raise and to take into account new information as it becomes available to me.

254. In signing this declaration, I recognize that the declaration will be filed as evidence in a contested case before the Patent Trial and Appeal Board of the United States Patent and Trademark Office. I also recognize that I may be subject to cross-examination in the case and that cross-examination will take place within the

United States. If cross-examination is required of me, I will appear for cross-examination within the United States during the time allotted for cross-examination.

255. I reserve the right to supplement my opinions in the future to respond to any arguments that Patent Owner or its expert(s) may raise and to take into account new information as it becomes available to me.

256. 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 Section 1001 of Title 18 of the United States Code.

Executed this 30th day of August 2024, in Bend, Oregon.

Respectfully submitted,

A handwritten signature in cursive script, appearing to read "Sayfe Kiaei".

Sayfe Kiaei, Ph.D.

APPENDIX A

Dr. Sayfe Kiaei
School of Electrical, Computer and Energy Engineering
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Sayfe Kiaei

Professor, Motorola Endowed Chair Professor

School of Electrical, Computer and Energy Engineering, Arizona State University, Tempe, AZ

FIELDS OF SPECIALIZATION

- **Integrated Circuits (IC), Radio Frequency**, Analog & Digital IC, Mixed-Signal IC, VLSI, Processor, ASIC, RFIC, Receiver, Transmitter, Synthesizer, RF system, VLSI, Processor, DSP processor
- **Power Management**: Power Management IC, Battery Management, Energy System, Energy Management, Solar Energy
- **Sensors & Bioelectronics**: RFID, ZIGBEE, Bluetooth, Biosensors, Hearing Aid sensors, Implanted devices electronics, Medical Implanted Communication System (MICS)
- **Signal Processing**: Digital Signal Processing, Adaptive Signal Processing, Video & Audio and acoustic Signal Processing, Adaptive Audio and acoustic Array processing, Audio and acoustic and Acoustic & Speech processing.
- **Communication Systems**: 1G-5G, 2-way radio, BT, WIFI, Sensors, ZIGBEE, wireless sensors, CABLE, DSL, Optical

DEGREES

- **Ph.D.**, Electrical and Computer Engineering, Washington State University, 1987
- **M.S.**, Electrical and Computer Engineering, Washington State University, 1984
- **B.S.E.E.**, Electrical Engineering, Northeastern University, Washington State University, 1982

ACADEMIC POSITIONS

Fall 2001-Present: Professor, Motorola Endowed Chair Professor in Analog and RFIC School of Electrical, Computer and Energy Engineering, Arizona State University, Tempe, AZ

- **Research Projects:**
 - Integrated Circuits: Analog and digital IC, Radio Frequency IC, RF transceiver, VLSI, Processor System Architecture, ASIC
 - Power Management IC, Battery Management & Sensing, Integrated Power Electronics
 - Sensors, Bioelectronics, Biosensors, Hearing Aid Electronics, Implanted devices electronics
 - Digital Signal Processing, Audio and acoustic processing, adaptive signal processing, Array processing, Adaptive Audio and acoustic Array processing, Audio and Acoustic & Speech processing,
 - Communication system, 1G, 2G GSM, 3G (UMTA, WBCDMA), 4G LTE, 5G, wireless mobile system, LTE, WiFi, Bluetooth, Wireless system standards, MODEM standards, CABLE MODEM DOCSIS, DSL
- Research Funded by NSF, USAID, DARPA, JPL, NASA, Motorola Inc., Intel Inc., Broadcom, Qualcomm, Raytheon, General Dynamics, Texas Instruments, and over 10 other industries.

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2004-2020, Director and founder of NSF IUCRC Center Connection One, School of Electrical, Computer, and Energy Engineering, Arizona State University, Tempe, AZ; <https://connectionone.org>

- The NSF Connection One Industry/University Cooperative Research Center was established the center in 2002 with focus on communication system, integrated Circuits and Systems, wireless system, RF, sensors, and related areas. The center has five university member with over 30 industrial members. Total funding over \$10M.

2021-Present, Director and PI, USAID, Center of Excellence for Energy (COE) in Egypt , Funding \$22.5M

- Director and PI: COE - Energy Center funded by the USAID.
 - USIAD Centers of Excellence for Energy (COE) - established the Center of Excellence for Energy (COE/E) in Egypt with funding and support from the United States Agency for International Development (USAID/Egypt) in November 2021. COE/E is a partnership between ASU-US and three Egyptian partner universities (EPUs): Ain Shams University (ASU-EG), Aswan University (AU), and Mansoura University (MU).

2014-2020, Director, USAID, US-PCASE: Center for Advance Studies in Energy, Funding \$18M.
<https://uspcase.asu.edu/>

- **Director and PI:** PCASE - Partnership Center for Energy systems, Energy Center funded by the USAID.
- USIAD Centers for Advanced Studies in Energy program (USPCAS-E) is a partnership between Arizona State University and two leading Pakistani universities: the National University of Science and Technology (NUST) Islamabad and the University of Engineering and Technology in Peshawar (UET).
- PCASE has developed two new Graduate schools of Energy. Within 5 years, the center has over 1000 MS and PHD Students, with 14 new energy degrees in MS and PhD, two new building with 20+ energy labs in the power system, grid, power electronics, renewable energy, PV, Wind, Hydro, bio-fuel, fuel cell, batteries and storage, and thermal areas.

2008-2012: Associate Dean of Research, Ira A. Fulton Schools of Engineering, Arizona State University

Responsible for leading the research infrastructure, promoting and developing research programs with industry and federal agencies, leading large multi-university proposals, investing and providing seed funding to foster new research areas, and promoting graduate program in the college of engineering. Research Enterprise support included:

- Increase College of Engineering research funding from \$50M to over \$80M.
- Working with Vice President for Research, Dean's, and directors on University-wide research initiatives.
- Established the first NSF Engineering Research Center (ERC) at the ASU on Solar Energy QESST. Managed, organized and planned the ERC proposal process. ASU is the lead school partnering with MIT, Georgia Tech, U of Delaware, Cal-Tech, U of New Mexico, and UA.
- Lead several trans-disciplinary 4M research projects (4M: multi-million, multi-investigator, multi-disciplinary, multi-university grants) in energy, security, and related initiatives.
- Oversight of over 20 existing research centers in the college of Engineering.
- Engage with industry and federal government to establish new research collaborations.
- Organized workshops and supported proposals for NSF, NIH, DOE, DOD, DARPA, etc.
- Organized workshops for new assistant professors to apply for NSF CAREER Awards. ASU CAREER awards grew from 3 annual awards in 2008 to over 15 CAREER awards by 2012.

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- Research Administration and pre-award proposal administration for the schools. Developed a decentralized research administration and advancement team for the Schools supporting 5 schools, 12 departments, over 220 engineering faculty, with funding over \$70M.
- Annual budget over \$7M for supporting research centers, seed funding for new center, cost sharing, proposal support, equipment and infrastructure support, graduate scholarships, and research administration.
- ADR Staffs included, Director of industrial and government liaison, Director of research administration, and 14 research advancement staff.
- Graduate Programs: Recruiting, Fellowships, marketing, outreach, coordination with departments

1997-2001, Adjunct Professor, Electrical and Computer Engineering Dept., The University of Texas, Austin, Texas, Taught graduate courses at UT Austin on Introduction to Telecommunication System and Digital Communications. Co-advised two Ph.D. program committees in IC design and Telecomm (while at Motorola)

1987-1993, NSF Center For Digital / Analog IC (CDADIC) Co-Director, NSF IUCRC Center director at Oregon State University. The CDADIC was established the center in 1987 with focus on integrated circuits at WSU, UW, and OSU with over 20 industrial members - <https://cdadic.oregonstate.edu/>

1987-1993, Assistant / Associate Professor (Tenured) Electrical and Computer Engineering Department, Oregon State University, Corvallis, OR

- Research and classes in Electronics, DSP, Communication system and networks, Wireless systems, MODEMS. Graduated 30 MS and Ph.D. students.
- Faculty Chair, Computer Engineering Program, Developed a new Computer Engineering Program at OSU in 1987

INDUSTRIAL POSITIONS

1993-2001: Motorola Inc., Senior Member of Technical Staff, Personal Communication Sector, Austin, Texas - Worked projects related to wireless communications, two-way push-to-talk radios, wireless networks, ADSL and MODEM RF, and related areas.

- **Motorola Cellular Division, Wireless Technology Center (WITC), 1997-2002.** Responsible for development of integrated circuits and systems for wireless handset. Lead number of projects including cellular (2G, 3G, 4G), wireless connectivity (Bluetooth and WIFI transceiver), GPS and location Receiver, wireless networks, 2-way radios and related areas. Worked on the development of various subcomponents including system design, link budget, RF front-end, RF receiver, RF transmitter, digital audio and acoustic processing, audio and acoustic processing, DSP, frequency synthesizer, ADC, DAC, filtering, analog front-end, power management, battery management, and baseband processor, baseband circuits and systems.
- **Motorola Semi-conductor products sector (SPS), Broadband Products Operations, 1995-1997,** Worked on the development of XDSL (ADSL, VDSL, G.lite), MODEM, and Optical broadband communication systems including OFDM, modulation, synchronization, equalization and the development of a single chip ADSL transceiver (*CopperGoldTM*). The transceiver contained Analog Front End (A/D, D/A, Hybrid), custom DSP, baseband processor, DMT, modulation/demodulation, FFT, IFFT, echo canceler, time

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domain equalizer, front-end constellation mapping, Trellis code modulation, Viterbi decoder), audio and acoustic processing, DSP, signal processing, and an on-chip DSP core.

- **Land Mobile Products Sector LMPS 1993-1995**, Responsible for Wireless digital two-way radios, developed RFIC, RF receiver, RF transmitter, digital audio and acoustic processing, audio and acoustic custom IC, DSP, frequency synthesizer, ADC, DAC, hot spot wireless network, next generation of digital two-way radios, "*Talk about Radios*", Japanese cellular systems (PHS).
- **Standards**, Represented Motorola in various standards including 2G-4G, GPS, Bluetooth working group, WiFi, 802.11, and DSL standards including T1E1, International Telecommunication Unit (ITU), T1E1, ETSI, 3GPPP, Universal ADSL Working Group (UAWG), Bluetooth working group, G.Lite working group, etc.
- **University relations**, Responsible for the development of collaborative research programs with several universities. Responsible for funding research in the areas of Wireless Transceiver IC Design, RF, and mixed-signal and baseband system architecture.

1985-87: Member of Research Staff, Boeing Co., Bellevue, Wa, Flight Systems Research and Technology Center, summer. Design Engineer, Hardware and CAD tool development for system control.

AWARDS

- IEEE Fellow 2004-Present
- IEEE Fellows CAS Committee Chair, 2009-2012
- Global Standards Award, For contributions in the International Telecommunication Unit (ITU) for Asymmetric Digital Subscriber Line (ADSL) G.Lite Standards. Motorola Inc., 1999.
- 10X Cycle Reduction Award, for development of new IC design process from DSP algorithm to IC layout, Motorola Inc., 1995.
- IEEE Darlington best paper Award, IEEE Circuits and Systems Society Best Paper Award, 1995. For "Characterization and Comparison of CMOS FSCL Circuits with Conventional CMOS for mixed-signal ICs," Published at: *IEEE Trans. on Circuits and Systems II*, Sept. 93.
- Carter Best Teaching Award, College of Engineering Best Teacher Award, Oregon State University, 1992. For "*outstanding and inspirational teaching in the College of Engineering*". Award is selected by the confidential vote of all of the undergraduate students in the College of Engineering among over 125 professors in the College.
- Industrial University Fellowship (IUF) Award, National Science Foundation, 1993.
- Research Initiation Award, National Science Foundation, 1990-93.
- Outstanding Graduate Student Scholarship, Azur-Data Inc. WSU, 1984

RESEARCH PROJECTS

Partial list of Research Awards (1987-Present):

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- **2021-2026 – COE – Center of Excellence for Energy, U.S. Agency for International Development (USAID)**
 - PI and Director, \$22.5M.
- **2020-2022 - Center for Next Generation Wireless Spectrum Sharing (5-6G Spectral sharing) The National Science Foundation (NSF)**
 - SII Planning, PI, \$300K.
- **2002-2020 – Industry/University Cooperative Research Center (IUCRC), The National Science Foundation (NSF) - Connection One**
 - NSF contribution \$1.5M.
 - Annual Industry Contribution: Total over \$7M.
- **2015-2016 – Integration of Smart Dynamic Optical Communication, The National Science Foundation (NSF)**
 - Integration of Smart Dynamic Optical Communication Networks for Intelligent Distribution of Power Workload and Data in Disaster, \$200K
- **2015-2020 – U.S. Agency for International Development (USAID)**
 - PCASE – Center for Energy systems, PI and Director, \$18M.
- **2013-2014 Arizona Space Grant Consortium, NASA**
 - Goddard Space Flight Center, RADHARD electronics, \$200K
- **2012-2015 – Solar Energy, Private Donor**
 - Solar Energy Development on international projects, \$2M
- **2011-2014 – Self-Characterization for Calibration MEMS Sensors, Semi-Conductor Research Corporation**
 - Self-Characterization for Calibration and Process Feedback of MEMS Devices, bio-sensor , \$300K
- **2011-2013 - Bio-Sensors for Vital Signs Monitoring Device Design, The National Science Foundation (NSF)**
 - Remote wireless Bio-Sensors for Vital Signs Monitoring Device Design, \$250K
- **2010-2011 – Adaptive Compensation of Analog circuits, The National Science Foundation**
 - Adaptive Compensation of Analog circuits imperfections using DSP methods, \$150K,
- **2010-2011 – Adaptive Self-Healing Wireless Sensor, The National Science Foundation**
 - Autonomous Self-Healing Sensor Network Radio and Mixed-Signal Readout System Design National Science Foundation (NSF), \$300K
- **2010-2020 – Solar Testbed, The National Science Foundation (NSF), \$45M (**
 - QESST NSF ERC Center on Solar Energy, Testbed Director
- **2010-2015 – REU, undergraduate research projects, The National Science Foundation (NSF)**
 - Research Experience for Undergraduate Students, projects: adaptive audio and acoustic, Glucose Amp-meter and impedance meter, total \$400K

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- **2008-2013 - Solar System, The Science Foundation of Arizona (SFAZ)**
 - PEPER- Photovoltaic Environmental Performance and Reliability for the Arizona-Wide Electric Grid, \$1.2M.
- **2008-2009 - Medically implanted bio-sensor, The National Science Foundation (NSF)**
 - Medically implanted bio-sensor, wireless implanted bio-sensors, Wireless Glucose sensors, MICS, \$200K
- **2007-2011 – MEMS implanted hearing aid and bio-sensors, The National Science Foundation (NSF)**
 - Micro-Power Multi-Phase on-chip MEMS Hearing Aid, Adaptive hearing aid audio processor, 2007-2011, \$500K.
- **2007-2009 – Implantable Bio-Sensors, The National Science Foundation (NSF)**
 - High Efficiency Power Delivery and Front-End Module Design for Implantable Bio-Sensors \$480K
- **2005-2009 - MIMO Wireless network, The National Science Foundation (NSF)**
 - Cognitive MIMO Communications for Dynamic-Spectrum Wireless Networks \$150K
- **2005-2009 - Radio Network, The National Science Foundation (NSF)**
 - Autonomous Self-Healing Sensor Network Radio, , \$250K
- **2005-2008 Integrated LiDAR on a chip, BAE Systems**
 - Integrated on-chip Time Measurement Circuits LiDAR; \$650K
- **2005-2008 – Power Management Circuits, Freescale Semiconductor**
 - PWM, Battery & Power management, \$150K
- **2005-2006 – RADHARD Electronics, DOD: Defense Advanced Research Projects Agency (DARPA)**
 - Radhard by Design - MRC/DARPA, Total funding \$1.5M
- **2005-2010 - Wireless Integrated Nano Technology Center, State of Arizona**
 - WINTECH- Wireless Integrated Nano Technology Center Support, 450K annually, total \$2.5M
- **2004-2005 – RFIC, NASA**
 - Integration of Ultra-Low power RF CMOS, \$127K
- **2004-2008 – Implanted Neural-Enabled Prostheses bio-sensor, Deference Advance Research Project Agency (DARPA)**
 - Implanted Neural-Enabled Prostheses biosensor with Sensorimotor Integration, \$500K
- **2004-2008 – NEMS RF Filters, Deference Advance Research Project Agency (DARPA)**
 - Nano-Mechanical RF Band pass resonator for 2GHZ RF Applications, with JPL, \$2.2 M,
- **2003-2005 - Imllanted Neuro-Sensor, DOD-ARMY-ARL: Army Research Office (ARO)**
 - Implanted Neuro-sensor, \$175K
- **2002-2005 – RFIC, WiFi, Intel Corporation**
 - Design of Multi-Standard RF Front-End Circuits for Cellular and WiFi, \$300K

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- **2002 – Geo-location, GPS, SRC**
 - LOW POWER ULTRA - WIDE BAND GEOLACTION SYSTEMS, \$65K.
- **2001-2003 – UWB, WIFI, SRC (Semi-conductors research Corp)**
 - Ultra-Wideband Transceivers for cellular and WiFi 802.11, \$225K
- **1987-1993 - Design of Analog/Digital IC's, The National Science Foundation**
 - Center for the Design of Analog/Digital IC's (CDADIC) 1987-1995, At Oregon State, \$1.5M
- **1992-1994 – RFIC, Motorola Land Mobile Products Sector, LMPS**
 - Low Power IF processing for Direct Digital Transceivers, \$100K,
- **1993 – Mixed-Signal IC, Hewlett-Packard**
 - Hewlett-Packard Faculty Chair position in Mixed-Signal IC, HP, \$500K
- **1992-1993 - Faculty industry Fellowships, The National Science Foundation**
 - National Science Foundation, Motorola Inc. Faculty Industry Fellowship, \$250K,
- **1992-1993 - Research Initiation Award (RIA) , The National Science Foundation**
 - National Science Foundation, Research Initiation Award (RIA) (same as current CAREER Award), Synthesis and Automatic Derivation of Multi-Rate VLSI Arrays for DSP Algorithms, \$320K.
- **1988-1992 – Center for the Design of Analog/Digital IC's (CDADIC)**
 - CDADIC, various projects on Low-Noise Source Coupled Logic (SCL), Mixed-Mode IC's, CDACIC \$350K.
- **1988- Spectrum and time analyzers, Tektronix Inc.**
 - Decimation Filters for A/D Noise Enhancements, Tektronix, Inc., \$100K,
- **1987-1993 – DARPA, MOSIS, Tektronix, IT, Motorola**
 - Various grants for IC Fabrication (DARPA/MOSIS, VLSI)
 - Testing equipment (Tek, HP)
 - DSP system development (TI, Motorola)

PROFESSIONAL RECOGNITION

- IEEE Fellow, 2004-Present
- IEEE Fellow Committee Chair, CAS, 2008-2010
- IEEE Fellow Committee member, 2007-2010.
- IEEE Senior Member, 1993-Present, IEEE Member 1987-1992.
- IEEE Faculty Advisor, Oregon State University, 1987-1990

IEEE Editorials

- IEEE Microwave Magazine, Editor,

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- IEEE System Journal, Associate Editor, 2010-2011.
- IEEE Transactions on VLSI, Associate Editor, Jan 2001-2008.
- IEEE Communication Magazine, Editor, Feature Issues on “Circuits for Wireless and Wireline Communications,” April 1999.
- IEEE Transactions on Microwave Theory and Techniques, editor, Special Issue on: "Radio Frequency IC Design," Dec. 1998.
- IEEE Transactions on Circuits and Systems-II, editor, Special Issue on: “Low-Power Wireless Communication Systems,” June 1997.
- Associate Editor, IEEE Transactions on Circuits and Systems-II, 1993-1996.
- *Editor and Reviewer for many IEEE journals and conferences*
- *Founding member of IEEE RF Integrated Circuits Symposium*
- *Associate Editor, IEEE Communications, Tutorial & Surveys Magazine, 2006-2009.*

Conference Organizations

- RFIC Executive Committee members, 2000-2017
- RFIC Steering Committee Member, RFIC symposium, 1996-2017.
- RFIC Founding member, 1995-96.
- Technical Program Chair, IEEE International Sym. on Circuits and Systems, Phoenix, AZ, 2002.
- ISSCC Admin Council, Conferences Committee 2000-2005.
- General Chair, Radio Frequency IC (RFIC) Symposium, Seattle, WA, 2002.
- Technical Program Chair, RFIC Symposium, Phoenix, AZ, 2001.
- Finance Chair, RFIC symposium, Boston, MA, 2000.
- Publicity Chair, RFIC symposium, Los Angeles, CA, 1999.
- Transactions Chair, RFIC symposium, Baltimore, MD, 1998.
- General Chair, Int. Sym. on Low-Power Electronics and Design (ISLPED), Bio-Sensors, Monterey, CA, 97.
- Executive Committee Member, Int. Symp. On Low-Power Electronics and Design, 96-2000.
- Technical Program Committee Member of the following conferences:
 - International Conference on Circuits and Systems: 1996, 2000, 2001, 2004-2008
 - RFIC Symposium, 1996-2018
 - Application Specific Array Processing (ASAP): 2000-2002
 - Technical Program Chair, Int. Sym. on Low-Power Electronics and Design, Monterey, CA, 96.
 - Arizona Telecom Comm (ATIC)
 - GLS VLSI 1998, Lafayette, Louisiana, 1998
 - VLSI Design 98, Chennai, India, Jan. 1998.
 - ICECS, Lisbon, Portugal, 98.

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- Application Specific Array Processing, 1995-97, 2000
- Vehicular Technology Conference, 1995-97.
- Inter. Conf. on Intelligent Information Systems, D.C., 1994-95.
- IEEE Pacific Rim Conference on Communications & Computers, Victoria, BC, Canada, 1991.

Invited talks, Panelist, Session Chairs, Workshop Speaker

- Conference chair, Technical Program committee chair and TPC member, tutorials, workshops, session chair, etc. in RFIC, ISSCC, ISCAS, VLSI, ICASSP, Low-Power Symposium, ICC, Application Specific IC's, IMS, MTT, etc.

CONSULTANT

- Medtronic's, Analog bio-sensors, MICS, 2005.
- Intel Inc. Chandler, AZ, 2002-2006: Development of 3G-4G Wireless transceiver.
- Sony Inc., San Diego, CA and Tokyo, Japan, 2002-2004: Review and development of various telecom cellular system architecture including 3G system architecture, and GPS system.
- Motorola Inc. 2002-2005: Supporting development of BT, WiFi, E911, GPS integrated circuits and systems for the cellular and mobile handsets.
- Hewlett Packard, Corvallis, OR – 1990-1993: Various project on development of custom analog and digital IC's for printer and inkjet system. Some of this work was under consultation, and some under various research grants with Oregon State University.
- Tektronix Inc, Beaverton, OR - 1988-1990: Design and Implementation of Data acquisition system for Spectrum analyzer, development of custom DSP algorithm for the Tektronix spectrum analyzer including system architecture, simulation, analysis, and design of oversampled data acquisition system.
- Boeing Commercial Aircraft, BCAC, Renton, WA - 1985-1987: Development of Airplane Controller Model, Simulation and Implementation of Flight control, Model reduction, and system control.

EXPERT WITNESS (Patent, IP)

Patent litigation, patent validity, infringement, IPR, expert reports, deposition, testimony, and trade secrets at ITC, District court, and USPTO in the following areas (Complete list of cases available):

- **Electronics:** Analog and Digital IC, Radio Frequency Integrated Circuits RFIC, Power Management, Battery Management, PMIC
- **Bioelectronics:** Bi-sensors, Glucose monitoring system, Heart monitoring system, Hearing AID
- **Wireless communication:** 3G, 4G, 5G, OFDM, WiFi, 802.11, Bluetooth, Wireless LAN, Wi-Fi, 802.11, Bluetooth, ZIGBEE, Wireless Standards (ITU, ETSI, 3GPP, LTE) including AMPS, GSM, CDMA, WCDMA, LTE, 1G, 2G, 3G, 4G, BT, WiFi (802.11), Satellite communications, Satellite Transceiver, ECHO and Multi-path cancellation
- **Wireline Communications:** MODEM, Digital Subscriber Line, ADSL, VDSL, MODEM, Wireline standards including DSL, MODEM and DOCSIS, and related standards ITU/ETSI
- **GPS & Location:** GPS system, GPS receiver, location determination

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- **MEMS:** MEMS, Bulk Acoustic Wave Filters, SAW, MEMS resonators, MEMS sensors, MEMS accelerometer
- **Signal processing & Communication:** Audio and acoustic signal processing, Audio & acoustic Array processing, adaptive signal processing, Communication networks, Communication system

PATENTS, PUBLICATIONS

Patents and Patent Applications

ID	title	assignee	inventor/author
AU-2003222007-A8	Oscillator frequency correction in gps signal acquisition	Motorola Inc	Sayfe Kiaei, Thomas M King, George J Geier
WO-03093858-A3	Oscillator frequency correction in gps signal acquisition	Motorola Inc	Thomas M King, George J Geier, Sayfe Kiaei
WO-2004048909-A3	Compressed vector-based spectral analysis method and system for nonlinear rf blocks	Univ Arizona, Shahin Farahani, Sayfe Kiaei, Nazanin Darbian	Shahin Farahani, Sayfe Kiaei, Nazanin Darbian
US-2006226909-A1	Monolithic supply-modulated rf power amplifier and dc-dc power converter ic	Siamak Abedinpour, Sayfe Kiaei	Siamak Abedinpour, Sayfe Kiaei
US-7218085-B2	Integrated ZVS synchronous buck DC-DC converter with adaptive control	Arizona Board Of Regents	Siamak Abedinpour, Sayfe Kiaei
US-7372333-B2	Monolithic supply-modulated RF power amplifier and DC-DC power converter IC	Arizona Board Of Regents, Acting For And On Behalf Of Arizona State Univ	Siamak Abedinpour, Sayfe Kiaei
US-7528754-B1	Finite impulse response digital to analog converter	Arizona Board Of Regents	Bertan Bakaloglu, Sayfe Kiaei, Shahin Taleie
US-2018049703-A1	Wireless in-shoe physical activity monitoring	Timothy W. Markison, Sayfe Kiaei, Gary McCoy	Timothy W. Markison, Sayfe Kiaei, Gary McCoy
US-10264996-B2	Method and apparatus for wirelessly monitoring repetitive bodily movements	Sayfe Kiaei	Sayfe Kiaei
US-2019231226-A1	Method and apparatus for wirelessly monitoring repetitive bodily movements	Sayfe Kiaei	Sayfe Kiaei
US-10653337-B2	Local object detection system	Timothy W. Markison, Sayfe Kiaei, Gary McCoy	Timothy W. Markison, Sayfe Kiaei, Gary McCoy
US-2020266708-A1	Electronic circuit and method of controlling three-level switching converters	Arizona Board Of Regents On Behalf Of Arizona State University	Parisa Mahmoudidaryan, Sayfe Kiaei, Bertan Bakaloglu
US-11108325-B2	Electronic circuit and method of controlling three-level switching converters	Arizona Board Of Regents On Behalf Of Arizona State University	Parisa Mahmoudidaryan, Sayfe Kiaei, Bertan Bakaloglu
US11129547B2	Wireless in-shoe physical activity monitoring	Sigmatasense LLC	Timothy W. Markison, Sayfe Kiaei, Gary McCoy

Standards Contributions

1. “Spectral Compatibility of ADSL: Frequency Overlap vs. FDM,” T1E1, Dec. 97.
2. “Echo Cancellation for G.Lite Universal ADSL,” OFDM, Universal ADSL Working Group, Atlanta, GA, Jan 98.
3. “8-bit QAM Constellation effects on reach for universal ADSL,” OFDM, Universal ADAL Working Group, Atlanta, GA, Jan 98.
4. “Trellis Code Modulation coding gain for OFDM,” Universal ADSL Working Group, Atlanta, GA, Jan 98.
5. “Monte Carlo Modeling and simulation of twisted pair wiring for OFDM,” Universal ADAL Working Group, Atlanta, GA, Jan 98.
6. “Overlap Upstream/Downstream spectral allocation for OFDM ADSL ,” International Telecommunication Unit, Chicago, March 98.
7. “Echo Cancellation for ADSL OFDM,” International Telecommunication Unit, Antwerp, Belgium, 98.
8. “Performance of Echo Cancellation ADSL in OFDM system in the presence of Near End Cross Talk (NEXT),” International Telecommunication Unit, Honolulu, Hawaii, June 98.
9. Presentations and editorials at various XDSL and OFDM standards: ITU, ETSI, UAWG, and T1E1, 97-99.
10. Presentations and editorials at various 3G and 4G and wireless standards including ITU, 3GPPP, 802.11, BT,

Books

“Design, Modeling and Testing of Data Converters, P Carbone, S Kiaei,” F Xu - 2014 – Springer, © Springer-Verlag Berlin Heidelberg 2014

Refereed Journal Papers

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1. CMOS Full-Duplex Mixer-First Receiver With Adaptive Self-Interference Cancellation S. -A. Ayati; A. Alizadeh; S. Kiaei, IEEE Transactions on Circuits and Systems I, Jan 2021.
2. A 10-W X-Band Class-F High-Power Amplifier in a 0.25m GaAs pHEMT Technology, A. Alizadeh; M. Yaghoobi; M. Meghdadi; A. Medi; S. Kiaei, IEEE Transactions on Microwave Theory and Techniques, Jan 2021.
3. An X-Band Class-J Power Amplifier With Active Load Modulation to Boost Drain Efficiency A. Alizadeh; S. Hassanzadehyamchi; A. Medi; S. Kiaei, IEEE Transactions on Circuits and Systems I: Sep 2020
4. In-Field Recovery of RF Circuits from Wearout Based Performance Degradation D. Chang; J. N. Kitchen; S. Kiaei; S. Ozev, IEEE Transactions on Emerging Topics in Computing, Jun 2020
5. A 50-V Isolation, 100-MHz, 50-mW Single-Chip Junction Isolated DC-DC Converter With Self-Tuned Maximum Power Transfer Frequency, C. Liu; D. Mandal; Z. Yao; M. Sun; J. Todsén; B. Johnson; S. Kiaei; B. Bakkaloglu, IEEE Transactions on Circuits and Systems II: Express Brief, May 2019
6. Wideband Hybrid Envelope Tracking Modulator With Hysteretic-Controlled Three-Level Switching Converter and Slew-Rate Enhanced Linear Amplifier, P. Mahmoudidaryan; D. Mandal; B. Bakkaloglu; S. Kiaei, IEEE Journal of Solid-State Circuits, 2019.
7. Low-Power/Low-Voltage Integrated CMOS Sense Resistor-Free Analog Power/Current Sensor Compatible With High-Voltage Switching DC-DC Converter, S. Singh; D. Mandal; B. Bakkaloglu; S. Kiaei IEEE Transactions on Circuits and Systems I, 2019
8. Adaptively Biased Output Cap-Less NMOS LDO With 19 ns Settling Time, D. Mandal; C. Desai; B. Bakkaloglu; S. Kiaei, IEEE Transactions on Circuits and Systems II: Express Briefs, 2019
9. Chirag Desai; Debashis Mandal; Bertan Bakkaloglu; Sayfe Kiaei, "A 1.66 mV FOM Output Cap-Less LDO With Current-Reused Dynamic Biasing and 20 ns Settling Time," IEEE Solid-State Circuits Letters Year: 2018, Volume: 1, Issue: 2, Pages: 50-53
10. Debashis Mandal ; Chirag Desai ; Bertan Bakkaloglu ; Sayfe Kiaei, Adaptively Biased Output Cap-Less NMOS LDO with 19 ns Settling-Time;; IEEE Transactions on Circuits and Systems II: Feb 2019
11. Ayati, Mandal, Bakkaloglu, Kiaei, "Integrated Quasi-Circulator With RF Leakage Cancellation for Full-Duplex Wireless Transceivers," IEEE Trans of Microwave theory and techniques, Dec 2017.
12. "A 50-mA 99.2% Peak Current Efficiency, 250-ns Settling Time Digital Low-Dropout Regulator With Transient Enhanced PI Controller", ChaiYong Lim ; Debashis Mandal ; Bertan Bakkaloglu ; Sayfe Kiaei; IEEE Transactions on Very Large Scale Integration (VLSI) Systems; Year: 2017, Volume: 25, Issue: 8; Pages: 2360 - 2370
13. Doohwang Chang; Jennifer N. Kitchen; Sayfe Kiaei; "Sule Ozev, In-field Recovery of RF Circuits from Wearout Based Performance Degradation", IEEE Transactions on Emerging Topics in Computing, 2017.
14. Edgar Martí-Arbona; Debashis Mandal; Bertan Bakkaloglu; Sayfe Kiaei, A High-Voltage-Compliant Current-to-Digital Sensor for DC–DC Converters in Standard CMOS Technology, IEEE Transactions on Power Electronics, 2017, Volume: 32, Issue: 3. Pp. 2180 - 2188
15. Michael Cheah ; Debashis Mandal ; Bertan Bakkaloglu ; Sayfe Kiaei, "A 100-mA, 99.11% Current Efficiency, 2-mVpp Ripple Digitally Controlled LDO With Active Ripple Suppression", Aug 2016.
16. Marti-Arbona, E.; Mandal, D.; Bakkaloglu, B.; Kiaei, S., "A High-Voltage Compliant Current-to-Digital Sensor for DC-DC Converters in Standard CMOS Technology," *IEEE Transactions on Power Electronics*, no. 99, 2016.
17. Chang, D.; Kitchen, J.N.; Bakkaloglu, B.; Kiaei, S.; Ozev, S., "Monitor-Based In-Field Wearout Mitigation for CMOS LC Oscillators," in *IEEE Transactions on Device and Materials Reliability*, vol. 16, no. 2, pp. 183-193, 2016.
18. Chang, D.; Kitchen, J.N.; Bakkaloglu, B.; Kiaei, S.; Ozev, S., "Design-Time Reliability Enhancement Using Hotspot Identification for RF Circuits," in *IEEE transactions on Very Large Scale Integration (VLSI) Systems*, -vol. 24, no. 3, pp. 1179-1183, 2016
19. Seungkee Min; Copani, T.; Kiaei, S.; Bakkaloglu, B., "A 90-nm CMOS 5-GHz Ring-Oscillator PLL With

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- Delay-Discriminator-Based Active Phase-Noise Cancellation," *Solid-State Circuits, IEEE Journal of*, vol.48, no.5, pp.1151,1160, May 2013
20. Junghan Lee; Tino Copani; Terry Mayhugh Jr.; Bhaskar Aravind; Sayfe Kiaei; Bertan Bakkaloglu.; , "A 280 mW, 0.07% THD+N class-D audio amplifier using a frequency-domain quantizer," *Analog Integrated Circuits and Signal Processing*, 173-186, 2012.
 21. Seungkee Min; Copali, T.; Kiaei, S.; Bakkaloglu, B.; , "A 90nm CMOS 5GHz ring oscillator PLL with delay-discriminator based active phase noise cancellation," *Radio Frequency Integrated Circuits Symposium (RFIC), 2012 IEEE*, pp. 173-176, 2012
 22. Deligoz, I.; Naqvi, S.R.; Copani, T.; Kiaei, S.; Bakkaloglu, B.; Sang-Soo Je; Junseok Chae; , "A MEMS-Based Power-Scalable Hearing Aid Analog Front End," *Biomedical Circuits and Systems, IEEE Transactions on*, vol.5, no.3, pp.201-213, June 2011
 23. Copani, T.; Seungkee Min; Shashidharan, S.; Chakraborty, S.; Stevens, M.; Kiaei, S.; Bakkaloglu, B.; , "A CMOS Low-Power Transceiver With Reconfigurable Antenna Interface for Medical Implant Applications," *Microwave Theory and Techniques, IEEE Transactions on*, vol.59, no.5, pp.1369-1378, May 2011
 24. Khalil, W.; Shashidharan, S.; Copani, T.; Chakraborty, S.; Kiaei, S.; Bakkaloglu, B.; , "A $700\text{-}\mu\text{A}$ 405-MHz All-Digital Fractional- N Frequency-Locked Loop for ISM Band Applications," *Microwave Theory and Techniques, IEEE Transactions on*, vol.59, no.5, pp.1319-1326, May 2011
 25. Lashkarian, N.; Nassiri-Toussi, K.; Jula, P.; Kiaei, S.; , "Performance Bound on Ergodic Capacity of MIMO Beam-Forming in Indoor Multi-Path Channels," *Communications, IEEE Transactions on*, vol.58, no.11, pp.3254-3264, November 2010
 26. Hyungseok Kim; Junghan Lee; Copani, T.; Bazarjani, S.; Kiaei, S.; Bakkaloglu, B.; , "Adaptive Blocker Rejection Continuous-Time $\Sigma\Delta$ ADC for Mobile WiMAX Applications," *Solid-State Circuits, IEEE Journal of*, vol.44, no.10, pp.2766-2779, Oct. 2009
 27. Kitchen, J.N.; Chu, C.; Kiaei, S.; Bakkaloglu, B.; , "Combined Linear and Δ -Modulated Switch-Mode PA Supply Modulator for Polar Transmitters," *Solid-State Circuits, IEEE Journal of*, vol.44, no.2, pp.404-413, Feb. 2009
 28. Sang-Soo Je; Rivas, F.; Diaz, R.E.; Jiuk Kwon; Jeonghwan Kim; Bakkaloglu, B.; Kiaei, S.; Junseok Chae; , "A Compact and Low-Cost MEMS Loudspeaker for Digital Hearing Aids," *Biomedical Circuits and Systems, IEEE Transactions on*, vol.3, no.5, pp.348-358, Oct. 2009
 29. Taleie, S.M.; Copani, T.; Bakkaloglu, B.; Kiaei, S.; , "A Linear Digital IF to RF SD DAC Transmitter With Embedded Mixer," *Microwave Theory and Techniques, IEEE Transactions on*, vol.56, no.5, pp.1059-1068, May 2008
 30. Wing-Yee Chu; Bakkaloglu, B.; Kiaei, S.; , "A 10 MHz Bandwidth, 2 mV Ripple PA Regulator for CDMA Transmitters," *Solid-State Circuits, IEEE Journal of*, vol.43, no.12, pp.2809-2819, Dec. 2008.
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134. "Hierarchical Estimation Algorithms," Proc. of IEEE Conference on Man, Cybernetics, and Systems, Tucson, AZ, October 1985. [U. Desai S. Kiaei]
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GRADUATE STUDENT ADVISEES & RESEARCH PROJECT

(Partial list of Students graduated, current employment to the best of my knowledge)

1. J. Durgam, VLSI Design of Dynamically Reconfigurable Array Processors, MSEE, 1988. Intel.
2. J. Gilbert, Minimization Techniques for PLAs, MSEE, 1988, Tektronix Inc.
3. L. Luo, CCA Methods for ARMA Spectral Estimation, MSEE, 1989. Berkeley Research Center
4. E. Zahl, Enhancement Methods for A/D Noise Reduction, MSEE, 1989. AT&T
5. L. Aihua, Synthesis of MRAs, MSEE, 1990. Intel.
6. F. Aslam, Image Restoration Methods, MSEE, 1990.
7. S.H. Chee, FSCL Circuits for Mixed-Mode IC's, MSEE, 1990. Linear Tech.
8. C. Dawson, MSEE, 1990. Boeing
9. A. Chow, Source-Coupled Logic ALU, MSEE, 1990. Intel
10. S. Maskai, Decimation Filters Using FSCL Circuits, MSEE, 1991. Intel
11. L. Louis, VLSI Implementation of Toeplitz Matrices, MSEE, 1991.
12. R. Badyal, Bit/Serial VLSI Design of IIR Filters, MSEE, 1992, HP
13. Lap Mui, Piece-Wise Linear Schedule for VLSI Arrays, MSEE, 1992. HP
14. S. Abdennadher, Adaptive Sigma-Delta Modulators, MSEE, 1992. Level One / Intel.
15. H. Bribech, Second Order Adaptive A/D Schemes, MSEE, 1992.
16. B. Hickman, MSEE, 92. Tektronix
17. M. Maleki, Current-Mode Flash A/D, MSEE, 1992. University of Oregon
18. Man Wong, Low-Noise Decimation Filter for Mixed-Mode ICs, MSEE, 1993, Motorola.
19. Anu Krishna Swamy, Low Noise IC Blocks for Mixed-mode IC's, MSEE, 1993, Ph.D., 1997.
20. Manu Srivastava, Comparison of Differential Logic (FSCL, CVSL, DSLL), MSEE, 1994, Intel.
21. Joel Oren, VLSI Design of Asynchronous FIR Filters, MSEE thesis, Feb. 1994. E-Systems.
22. Y. Zheng, VLSI Design and Synthesis of Multi-Rate Arrays, Ph.D. March 94, Hughes Research.
23. Satish Kulkarni, Low-Sensitivity Filters, MSEE, 1995, Motorola.
24. Amit Dutta, Multi-user Interference Cancellation, Ph.D, Dec. 97, Faculty, India.
25. Dwight Poplin, Multiplierless MPEG Decoder, MSEE, 1996. HP.
26. Maxim Scarpa, Adaptive I/Q Miss-match Correction for Direct Conversion Receivers, MSEE 1998.
27. Jeff McNeal, Sigma-Delta Frequency-to-Time Conversion, MSEE, 1998. Level One Comm.
28. Julia Vogel, Adaptive DC offset Cancellation, MSEE, 1998. Faculty in Germany.
29. Takao Inoue, MS, Echo Cancellation for ADSL, 1998. MSEE, The U of Texas at Austin.
30. Navid Lashkarian, Frequency off-set estimation and Synchronization of OFDM systems, Ph.D., June 1999. Broadcom Inc. & Faculty at UC San Jose.

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31. Guner Arslan, (co-advisor with B. Evans), "Fast Equalization for DMT systems, with applications to ADSL," Ph.D. The University of Texas at Austin, 2000
32. Salem Abdennadher, I/Q Mismatch Correction for RF Wireless transceivers, Ph.D., Level One Comm/Intel.
33. Can Sandalci, DSL Line Driver, Ph.D., 2001, Intel.
34. Dean Badillo, Low-Cost VCO Ring Oscillators, PhD, 2004, Intel, Chandler,
35. Siamak Abedinpour, PhD, 2005 Freescale, Tempe, Arizona
36. Hemanth Shivalingaiah, Multi-Band Low Noise Amplifiers, Ph.D., 2006, Intel,
37. Shahin Farahani, PhD, 2006, Qualcomm Inc,
38. Nazanin Darbanian, M.S. Freescale, Tempe, Arizona
39. *Joe Rutkowski, Joseph, MS, 2004, Phillips.*
40. *Chaudhuri, Bikram, Synthesizer, MS/PhD, MS 2004.*
41. *Zhang, Jiandong, MEMs, MEMS, December-04*
42. *Afsahi, Ali, MS/PHD, UC San Diego, QUALCOMM, Connection One*
43. *Chen, Xiaomin, UWB, PHD, 2007, SRC/Motorola*
44. *Jali, Hilda, Power Management, MS, June-05,*
45. *Xuejin Wang, RF Optimization, 2006 CAD tools, PhD, Neo-Linear*
46. *Umar Lyles, Power Amplifier, MS, 2006. Texas Instruments*
47. MS, Erika Munoz, RADHARD, 2007, Intel
48. Waleed Khali, (Co-Advisor), Professor at Ohio State
49. Jennifer Kitchen, PhD, 2009, Professor at ASU
50. Shahin Mehdizad Taleie, RFDAC, PhD, 2009, Qualcomm
51. Ilker Deligoz, PHD, 2009, Qualcomm
52. Hyung Kim, PhD, Jan 2010, Intel
53. Jung Le, PhD 2010, Intel, TI
54. Syed Naqvi, PhD, 2012, Intel.
55. Todd Martin, MS, 2011, TI
56. Seungkee Min, PhD, 2011, Intel
57. Ali Meamar, Post Doc, RFIC 2013
58. Hitesh Khunti, MS 2013, Qualcom
59. Debashis Mandal, Post Doc, Research faculty 2015-2018
60. Edgar Martinez, PhD, 2015, Qualcomm
61. Chirag Desai, MS, 2016, Qualcom
62. Sanjay Avasarala, MS, 2016

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- 63. Li Ming, MS, 2017
- 64. Qirong Peng, MS, 2017,
- 65. Yu Geng, PhD, 2018
- 66. Amir Ayati, PhD Aug 2018; Qualcomm
- 67. Pasisa Mahmoudi, PhD, May 2019, Qualcomm
- 68. Chai Yong, MS: 2015, PHD: 2019, Qualcomm
- 69. Shrikant Singh, MS: 2016, PhD, 2019, Movandi
- 70. Amir Alizadeh, Research Faculty 2019-Present
- 71. Ata S. PhD, 2021, Ata Sarrafinejad, PhD, 2021

UNIVERSITY COMMITTEES

Various Committees at ASU, Oregon State University, etc.

INDUSTRY COMMITTEES

- Arizona Telecommunications and Information Council (ATIC), Board Member
- CAS Fellows Committee (ends December 31, 2006)
- *IEEE CAS Phoenix Chapter Organizers (the committee is in the process of determining new chair – current chair not active)*
- *Executive Committee, RFIC 2006.*
- *Technical Program Comm, IEEE RFIC 2006.*
- *Executive Committee, Conferences, International Solid State System's Conference.*
- *IEEE CAS Society, VLSI Technical Comm. Member*
- *Editorial Board, IEEE Communications Surveys & Tutorials*
- *Radio Frequency Integrated Circuits- RFIC 2006*
- *IEEE RF Integrated Circuits Conference, Committee Chair for two workshops*
- *International Microwave Symposium, IMS-MTT 2006*
- *Int. Symposium on Circuits and Systems - ISCAS 2006*
- *Wireless Networks & Emerging Technologies, WNET06*
- *Midwest Symposium on Circuits and System*
- *Arizona Governor IT Advisory Committee – GITA*
- *Arizona Telecom – ATIC*

INSTRUCTIONAL SUMMARY

- Digital IC Design, Analog IC Design, Advance CMOS Analog IC, VLSI, RFIC Design
- Wireless Transceiver Design, Wireless Communications, GPS, Telecomm Systems, Digital Communication

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- Signal Processing, Advance digital signal processing, Communication, Digital Communication, Digital Processing, Adaptive array processing
- Computer Architecture, Microprocessor System Architecture, Pipeline Array Processing

APPENDIX B

Appendix B

List of Materials Considered

Exhibit No.	DESCRIPTION
1001	U.S. Patent No. 11,589,329
1002	File History of U.S. Application No. 17/235,130
1004	U.S. Patent No. 7,570,158 (“Denny”)
1005	U.S. Patent Application Publication No. 2008/0132199 (“Hirata”)
1006	U.S. Patent Application Publication No. 2007/0038395 (“Green”)
1007	Certified Translation of Japanese Patent Application Publication No. 2004/212544 (“Murata”)
1008	Japanese Patent Publication No. 2004/212544
1009	U.S. Patent No. 6,219,645 (“Byers”)
1012	Excerpts of A.S. Tanenbaum, Introduction to Computer Networks, 3d. ed. 1997
1013	Excerpts of Specification of the Bluetooth System, Vol. 1, Version 1.2, Nov. 5, 2003
1014	U.S. Patent No. 7,529,677 (“Wittenberg”)
1015	U.S. Patent No. 7,769,591 (“White”)
1016	File History of U.S. Application No. 16/736,820 (related to the ’329)
1017	File History of U.S. Application No. 16/055,488 (related to the ’329)
1018	File History of U.S. Application No. 13/976,636 (related to the ’329)