

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent of: Andrew William Wright
U.S. Patent No.: 10,198,879 Attorney Docket No.: 36137-0027IP2
Issue Date: February 5, 2019
Appl. Serial No.: 15/454,952
Filing Date: March 9, 2017
Title: METHOD AND SYSTEM FOR LOGGING
VEHICLE BEHAVIOUR

DECLARATION OF DR. WILLIAM R. MICHALSON

I hereby declare that all statements made of my own knowledge are true and that all statements made on information and belief are believed to be true. I further declare 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 the Title 18 of the United States Code.

Dated: 28 April 2023

By: 

William R. Michalson, Ph.D

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I, William R. Michalson of Worcester, Massachusetts, declare that:

I. ASSIGNMENT

1. I have been retained on behalf of United States Automobile Association (“USAA”) to offer technical opinions related to U.S. Patent No 10,198,879 (“the ’879 patent”) (USAA-1001). I understand that USAA is requesting that the Patent Trial and Appeal Board (“PTAB” or “Board”) institute an *inter partes* review (“IPR”) proceeding of the ’879 patent.

2. I have been asked to provide my independent analysis of the ’879 patent based on the prior art publications cited in this declaration.

3. I am not and never have been, an employee of USAA. I received no compensation for this declaration beyond my normal hourly compensation based on my time actually spent analyzing the ’879 patent, the prior art publications cited below, and issues related thereto, and I will not receive any added compensation based on the outcome of any IPR or other proceeding involving the ’879 patent.

II. QUALIFICATIONS

4. I am over the age of 18 and am competent to write this declaration. I have personal knowledge, or have developed knowledge of these technologies based upon education, training, or experience, of the matters set forth herein.

5. I earned a B.S. in Electrical Engineering from the Syracuse University in 1981, an M.S. and a Ph.D. Electrical Engineering from the Worcester Polytechnic Institute (WPI) in 1985 and 1989, respectively.

6. I am currently a Professor in the Department of Robotics Engineering at WPI. Additionally, I have appointments as a Professor of Computer Science, Electrical and Computer Engineering, and Mechanical Engineering. At WPI, I perform research and teach in the areas of navigation, communications, and computer system design. I supervise the WPI Center for Advanced Integrated Radio Navigation (CAIRN), where I am developing a Public Safety Integration Center focused on the integration of communications, navigation, and information technologies for public safety applications. My research focuses on the development, testing, and evaluation of systems for both civilian and military applications with a special emphasis on techniques focused on indoor, underground, or otherwise GPS-deprived situations. My interests in communication, navigation, and computing have led me to play an active role in the development of the Robotics Program at WPI, where I teach robotics courses at the graduate and undergraduate level.

7. Prior to joining the faculty of WPI, I worked at the Raytheon Company from 1981-1991, with a leave of absence between 1985-1988 to complete my Doctoral Degree (Ph.D.) in Electrical Engineering from the

Worcester Polytechnic Institute. Prior to my leave of absence, I worked as an Engineer in the Cursive Displays Department and VLSI Design Department of the Computer and Displays Laboratory within Raytheon's Equipment Division. After receiving my Ph.D., I returned to the Equipment Division of the Raytheon Company where I was promoted to a title of Engineer, Design and Development. I was subsequently selected to sit on the engineering staff of the newly-formed System Engineering Department of the Division's Computer and Displays Laboratory. In this capacity, I acted primarily as a consultant to other departments within the laboratory, and my responsibilities ranged from leading the hardware and software development of supercomputer-class computer systems to performing applied research into the exploitation of new technology.

8. I have more than 40 years of experience in the field of computer technology, specifically in the specialized field of signal and data processing. I have consulted and served, including being qualified by courts, as an expert for numerous patent cases, including in patent cases involving motion sensing, positioning, map navigation technologies, and wireless communications a listing of which is set forth in my current curriculum vitae which is attached to this Declaration as Appendix A. I hold a commercial General Radio Operator's license (with Ship RADAR Endorsement), an Extra Class Amateur Radio operator's license, and have held a Commercial Radiotelegraph Operators license. I was first

licensed as a Radio Amateur in 1974 and have been involved in the design, implementation, and repair of radio systems, including radio controlled systems, since that time.

9. I have been involved with numerous projects involving the tracking and control of remote objects, including flying objects. Starting with my work at Raytheon Company I was involved with the tracking of aircraft in both military and civilian air traffic control systems. I have worked on the guidance and control systems for multiple missile systems as well as the guidance and tracking systems for fire control systems and on spaceborne systems for tracking ballistic missiles. In my work at WPI, I have been involved with numerous projects related to tracking land, sea, and air vehicles using the GPS and/or inertial guidance systems. Some of this work has involved the use and control of rotorcraft for applications, such as firefighting and landmine detection and destruction.

10. I am a named inventor on nine patents, including patents on map navigation devices, geolocation systems, and high resolution and precision location systems. I have authored, or co-authored, over 100 journal papers and conference publications, including papers and publications regarding positioning and navigation systems and methods. I am also the co-author of a chapter entitled “An Approach for Implementing a Reconfigurable Optical Interconnection Network for Massively Parallel Computers” in Optical Interconnection – Foundations and

Approaches by C. Tocci and H. J. Caulfield Eds., Artech House, 1994. I am currently under contract to write a book tentatively entitled “Radionavigation and the Global Positioning System,” which covers the physical principles upon which radionavigation system are based as well as the hardware and software required to perform navigation. At WPI I have taught courses in Sensors, Circuits, and Systems, Digital Circuit Design, Embedded Computing, Computer Architecture, Controls, Engineering Design, and Navigation. In addition, I have advised projects involving computer, navigation, and communications for a large variety of applications in the air, on land, and on the sea.

11. I have received numerous awards and recognition for my work, including becoming an Elected Senior Member of the IEEE. In addition, I was awarded the Joseph Samuel Satin Distinguished Fellowship for the 1994-1995 academic year, and the Aldo Miccioli Fellowship from the Raytheon Company’s Equipment Division. I am also a member of the Institute of Navigation, the Royal Institute of Navigation, the American Society of Engineering Educators, The Society of Automotive Engineers, the National Marine Electronics Association, and the National Academy of Inventors.

12. My *curriculum vitae*, attached as Exhibit A, includes a list of publications on which I am a named author. It contains further details regarding

my experience, education, publications, and other qualifications provide to an expert opinion in connection with this proceeding.

III. SUMMARY OF CONCLUSIONS FORMED

13. This Declaration explains the conclusions that I have formed based on my analysis. To summarize those conclusions:

- **Ground 1A:** Based upon my knowledge and experience and my review of the prior art publications in this declaration, I believe that claims 1-3, 5, 8, 16-23, 25, 28, 34, and 37-54 of the '879 patent are made obvious by Peng and Chatterjee;
- **Ground 1B:** Based upon my knowledge and experience and my review of the prior art publications in this declaration, I believe that claims 4 and 24 of the '879 patent are made obvious by Peng, Chatterjee, Katayama, and Tamir;
- **Ground 1C:** Based upon my knowledge and experience and my review of the prior art publications in this declaration, I believe that claims 6, 9, 10, 14, 15, 26, 32, 33, 35, 36 of the '879 patent are made obvious by Peng, Chatterjee, and Katayama;
- **Ground 1D:** Based upon my knowledge and experience and my review of the prior art publications in this declaration, I believe

that claims 7 and 27 of the '879 patent are made obvious by Peng, Chatterjee, Katayama, and Balachandran;

- **Ground 1E:** Based upon my knowledge and experience and my review of the prior art publications in this declaration, I believe that claims 11-13 and 29-31 of the '879 patent are made obvious by Peng, Chatterjee and Riemer; and
- **Ground 1F:** Based upon my knowledge and experience and my review of the prior art publications in this declaration, I believe that claim 55 of the '879 patent are made obvious by Peng, Chatterjee, and Berkobin.

IV. LEVEL OF ORDINARY SKILL IN THE ART

14. I have been informed that a person of ordinary skill in the art (“POSITA”) is a hypothetical person who is presumed to have the skill and experience of an ordinary worker in the field at the time of the alleged invention. The '879 patent was filed March 9, 2017 (“Critical Date”), and claims priority to several applications, including PCT Application No. PCT/GB2011/052491, filed on 12/15/2011. Counsel has informed that the Critical Date of the '879 patent is March 9, 2017. For this reason, I have applied this Critical Date as the point in time for claim interpretation purposes. My opinion does not change if the invention date is earlier, e.g., as early as December 15, 2010.

15. Based on my knowledge and experience in the field and my review of the '879 patent and file history, I believe that a person of ordinary skill in the art in this matter would have had at least a Bachelor's of Science Degree (or equivalent) in an academic area emphasizing electrical engineering, computer engineering, computer science, or a related technical field, and about 2-3 years of experience in the field of telematics systems (e.g., familiarity with control and diagnostic systems, navigation systems and wireless communication technology). A greater amount of education, i.e., a doctorate in an academic area emphasizing electrical engineering, computer engineering, computer science, or a related technical field, would compensate for fewer years of work experience. Based on my experiences, I have a good understanding of the capabilities of a POSITA. Indeed, I have taught, mentored, advised, and collaborated closely with many such individuals over the course of my career.

V. LEGAL PRINCIPLES

16. I am not a lawyer and I will not provide any legal opinions in this IPR. Although not a lawyer, I have been advised that certain legal standards are to be applied by technical experts in forming opinions regarding the meaning and validity of patent claims.

A. Claim Interpretation

17. I understand that claim terms are generally given their plain and ordinary meaning based on the patent's specification and file history as understood by a person of ordinary skill in the art at the time of the purported invention. In that regard, I understand that the best indicator of claim meaning is its usage in the context of the patent specification as understood by a POSITA. I further understand that the words of the claims should be given their plain meaning unless that meaning is inconsistent with the patent specification or the patent's history of examination before the Patent Office. I also understand that the words of the claims should be interpreted as they would have been interpreted by a POSITA at the time of the invention was made (not today).

B. Priority

18. I understand that a continuation application is a later-filed application that has the same disclosure (specification and figures) as an earlier filed application to which the later-filed application claims priority. A continuation is generally entitled to the same priority date as the later-filed application to which it claims priority.

C. Anticipation

19. I understand that a patent claim is invalid as anticipated if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference. I also understand that, to anticipate, the

reference must teach all of the limitations arranged or combined in the same way as described in the claim. I do not rely on anticipation in this declaration.

20. With respect to inherency, I understand that the fact that a certain result or characteristic may occur or be present in the prior art is not sufficient to establish the inherency of that result or characteristic. Instead, the inherent characteristic must necessarily flow from the teaching of the prior art.

D. Obviousness

21. I understand that a patent claim is invalid if the claimed invention would have been obvious to a person of ordinary skill in the field at the time of the purported invention, which is often considered the time the application was filed. Even if all of the claim limitations are not found in a single prior art reference that anticipates the claim, the claim can still be invalid.

22. To obtain a patent, a claimed invention must have, as of the priority date, been nonobvious in view of the prior art in the field. I understand that an invention is obvious when the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art.

23. I understand that, to prove that prior art or a combination of prior art makes a patent obvious it is necessary to: (1) identify the particular references that,

singly or in combination, make the patent obvious; (2) specifically identify which elements of the patent claim appear in each of the asserted references; and (3) explain a motivation, teaching, need, market pressure or other legitimate reason that would have inspired a person of ordinary skill in the art to combine prior art references to solve a problem.

24. I also understand that certain objective indicia can be important evidence regarding whether a patent is obvious or nonobvious. Such indicia include:

- Commercial success of products covered by the patent claims;
- A long-felt need for the invention;
- Failed attempts by others to make the invention;
- Copying of the invention by others in the field;
- Unexpected results achieved by the invention as compared to the closest prior art;
- Praise of the invention by the infringer or others in the field;
- The taking of licenses under the patent by others;
- Expressions of surprise by experts and those skilled in the art at the making of the invention; and
- The patentee proceeded contrary to the accepted wisdom of the prior art.

25. To the extent these factors have been brought to my attention, if at all, I have taken them into consideration in providing my opinions and conclusions.

VI. MATERIALS CONSIDERED

26. My analysis and conclusions set forth in this declaration are based on my educational background and experiences in the field (*see* Section II). Based on my knowledge and experience, I believe that I am considered to be an expert in the

field. Also, based on my knowledge and experience, I understand and know of the capabilities of persons of ordinary skill in the field during the early 2000s–2011s, and I taught, participated in organizations, and worked closely with many such persons in the field during that time frame.

27. As part of my independent analysis for this declaration, I have considered the following: the background knowledge/technologies that were commonly known to persons of ordinary skill in this art during the time before the earliest claimed priority date for the '879 patent; my own knowledge and experiences gained from my work experience in the field of the '879 patent and related disciplines; and my experience in working with others involved in this field and related disciplines.

28. In addition, I have analyzed the following publications and materials, which I believe disclose material representative of the knowledge known by POSITAs as of the Critical Date:

- USAA-1001 U.S. Patent No. 10,198,879 to Wright (“the '879 Patent”)
- USAA-1002 Excerpts from the Prosecution History of the '879 Patent (“the Prosecution History”)
- USAA-1004 Original Complaint for Patent Infringement in *Auto Telematics Ltd. v. United Services Automobile Association*, 6:22-cv-00474 (W.D. Tex. May 11, 2022)
- USAA-1005 US Pat. Appl. Pub. No. 2011/0307188 (“Peng”)
- USAA-1006 U.S. Pat. Appl. Pub. No. 2010/0131691 (“Chatterjee”)

- USAA-1007 U.S. Patent No. 6,073,004 to Balachandran (“Balachandran”)
- USAA-1008 Thompson et. al, “Using Smartphones to Detect Car Accidents and Provide Situational Awareness to Emergency Responders,” Mobilware 2010, LNICST 48, pp. 29–42, 2010 (“Thompson2010”)
- USAA-1009 International Publication No. WO 2007/114716 (“Willis”)
- USAA-1010 U.S. Patent Application Publication No. 2008/0255888 (“Berkobin”)
- USAA-1011 Cheng et. al, “An Android System Design and Implementation for Telematics Services,” 2010 IEEE International Conference on Intelligent Computing and Intelligent Systems. Vol. 2. IEEE, 2010 (“Cheng2010”)
- USAA-1012 U.S. Patent No. 7,821,421 to Tamir et. al (“Tamir”)
- USAA-1013 U.S. Pat. No. 8,682,399 to Rabu (“Rabu”)
- USAA-1014 U.S. Pat. App. Pub. No. 2010/0208070 to Haynes (“Haynes”)
- USAA-1015 U.S. Pat. App. Pub. No. 2002/0105423 to Rast (“Rast”)
- USAA-1016 U.S. Pat. App. Pub. No. 2009/0192705 to Golding (“Golding”)
- USAA-1017 U.S. Pat. No. 7,765,058 to Doering (“Doering”)
- USAA-1018 European Pat. Pub. No. EP1614585A1 to Christian (“Christian”)
- USAA-1019 U.S. Pat. No. 5,906,393 to Mazur (“Mazur”)
- USAA-1020 Richard C. Hunt, “Emerging Communication Technologies in Emergency Medical Services,” Prehospital Emergency Care, 2002; 6:1, 131-136 (“Hunt2002”)
- USAA-1021 Kanianthra, Joseph, et al. “Enhancing post-crash vehicle safety through an automatic collision notification system,” No. 2001-06-0085. SAE Technical Paper, 2001 (“Kanianthra”)
- USAA-1022 Megalingam R.K. et al., “Wireless vehicular accident detection and reporting system.” 2010 International

Conference on Mechanical and Electrical Technology (ICMET 2010)
("Megalingam2010")

- USAA-1023 Farris, P. et al., "General Motors OnStar", Darden Case No. UVA-M-0659 ("Farris")
- USAA-1024 European Pat. App. Pub. No. EP 1,914,691 to Katayama et al. ("Katayama")
- USAA-1025 U.S. Pat. App. Pub. No. 2012/0074770 to Lee ("Lee")
- USAA-1026 International Publication No. WO 2010/042545 to Curry et. al ("Curry")
- USAA-1027 Linda Null and Julia Lobur, Excerpts from The Essentials of Computer Organization and Architecture (2d ed. 2003) ("Null")
- USAA-1028 U.S. Pat. Publication No. 2010/0216509A1 to Riemer et al. ("Riemer")
- USAA-1029 Langle, et al. "Are you a safe driver?" 2009 International Conference on Computational Science and Engineering. Vol. 2. IEEE, 2009 ("Langle")
- USAA-1030 U.S. Pat. Publication No. 2006/0053038 to Warren et al. ("Warren")
- USAA-1031 U.S. Pat. Publication No. 2007/0027585 to Wulff ("Wulff")
- USAA-1032 Mohan, Prashanth et al., "Nericell: rich monitoring of road and traffic conditions using mobile smartphones," Proceedings of the 6th ACM conference on Embedded network sensor systems, 2008 ("Mohan")
- USAA-1033 U.S. Pat. No. 5,274,560 to LaRue ("LaRue")
- USAA-1034 Declaration of Nathaniel E. Frank-White re Exhibits USAA-1077 (Ex. A) and USAA-1078 (Ex. B)
- USAA-1036 Declaration of Nathaniel E. Frank-White re Exhibits USAA-1079 (Ex. A), USAA-1080 (Ex. B), and USAA-1081 (Ex. C)
- USAA-1037 U.S. Pat. Publication No. 2012/0014659 to Hugosson ("Hugosson")
- USAA-1038 U.S. Pat. Publication No. 2011/0225284 to Savolainen ("Savolainen")
- USAA-1039 U.S. Pat. Publication No. 2010/0174449 to Kim ("Kim")

- USAA-1041 Zhao, Yilin, “Telematics: safe and fun driving,” IEEE Intelligent systems 17.1 (2002): 10-14 (“Zhao2002A”)
- USAA-1042 Del Rosso, Christian, “The method, the tools and rationales for assessing dynamic memory efficiency in embedded real-time systems in practice,” 2006 International Conference on Software Engineering Advances (ICSEA'06), IEEE, 2006 (“Christian”)
- USAA-1043 Wakihara, Masataka, “Recent developments in lithium ion batteries,” Materials Science and Engineering: R: Reports 33.4 (2001): 109-134 (“Wakihara”)
- USAA-1044 Toledo, Tomer, et. al, “In-vehicle data recorders for monitoring and feedback on drivers’ behavior,” Transportation Research Part C: Emerging Technologies 16.3 (2008): 320-331 (“Toledo”)
- USAA-1045 International Publication No. WO 2010/062899 (“Callopy”)
- USAA-1046 Zhao, Yilin, “Vehicle Location and Navigation Systems,” Artech House, Boston (1997) (“Zhao1997”)
- USAA-1047 Conover, Gerald D. “ITS Technology in Automotive—Who's on First?” SAE International (2006): 1-11 (“Conover2006”)
- USAA-1048 Skog, Isaac, et. al, “A versatile PC-based platform for inertial navigation,” Proceedings of the 7th Nordic Signal Processing Symposium-NORSIG 2006. IEEE, 2006 (“Skog2006”)
- USAA-1049 Work, D. B., et al. “Impacts of the mobile internet on transportation cyberphysical systems: traffic monitoring using smartphones,” National Workshop for Research on High-Confidence Transportation Cyber-Physical Systems: Automotive, Aviation, & Rail. 2008 (“Work2008”)
- USAA-1050 Flinchbaugh, B., “Smart Camera Systems Technology Roadmap” Real-Time Vision for Human-Computer Interaction (2005), 285-297 (“Flinchbaugh2005”)
- USAA-1051 LeBlanc, David J., “Road departure crash warning system field operational test: methodology and results,” Vol. 1: Technical Report, University of Michigan, Ann Arbor, Transportation Research Institute, 2006 (“LeBlanc2006”).

- USAA-1052 Reddy, Sasank et al., “Determining transportation mode on mobile phones,” 2008 12th IEEE international symposium on wearable computers. IEEE, 2008 (“Reddy2008”)
- USAA-1053 Zhao, Yilin, “Standardization of mobile phone positioning for 3G systems,” IEEE Communications magazine 40.7 (2002): 108-116 (“Zhao2002B”)
- USAA-1054 Strömmer, Esko et al., “Ultra-low power sensors with near field communication for mobile applications,” Wireless Sensor and Actor Networks: IFIP WG 6.8 First International Conference on Wireless Sensor and Actor Networks, WSN’07, Albacete, Spain, September 24–26, 2007. Springer US, 2007 (“Strömmer2007”)
- USAA-1055 Schott, Christian, et al., “CMOS single-chip electronic compass with microcontroller,” IEEE Journal of Solid-State Circuits 42.12 (2007): 2923-2933 (“Schott2007”)
- USAA-1056 Liutkauskas, V. et al., “Location based services,” Elektronika ir elektrotechnika 52.3 (2004) (“Liutkauskas2004”)
- USAA-1057 Ealey, Lance, et al. “Are automobiles the next commodity?” The McKinsey Quarterly 4 (1996): 62 (“Ealey1996”)
- USAA-1058 Zhao, Yilin, “Efficient and reliable data transmission for cellular-and-GPS-based mayday systems,” Proceedings of Conference on Intelligent Transportation Systems, IEEE, 1998 (“Zhao1998B”)
- USAA-1059 Young, Richard A., “Association between embedded cellular phone calls and vehicle crashes involving airbag deployment,” Proceedings of the First International Driving Symposium on Human Factors in Driver Assessment, Training and Vehicle Design , Vol. 1. No. 2001, University of Iowa, 2001 (“Young2001”)
- USAA-1060 De Fabritiis, Corrado et al., “Traffic estimation and prediction based on real time floating car data,” 2008 11th international IEEE conference on intelligent transportation systems, IEEE, 2008 (“DeFabritiis2008”)
- USAA-1061 Schäfer, Ralf-Peter, et al., “A traffic information system by means of real-time floating-car data” (2002) (“Schäfer2002”)

- USAA-1062 Kerner, B. S., et al., “Traffic state detection with floating car data in road networks,” Proceedings of the 8th International IEEE Conference on Intelligent Transportation Systems, 2005, (“Kerner2005”)
- USAA-1063 Leduc, Guillaume, “Road traffic data: Collection methods and applications,” Working Papers on Energy, Transport and Climate Change 1.55 (2008): 1-55 (“Leduc2008”)
- USAA-1064 Troncoso, Carmela, et al, “PriPAYD: privacy friendly pay-as-you-drive insurance,” IEEE Transactions on Dependable and Secure Computing, Vol. 8, No. 5, October 2011
- USAA-1077 Internet Archive of Waze User Manual
- USAA-1078 Internet Archive of iPhone User Guide
- USAA-1079 Internet Archive of iPhone 3G Technical Specification
- USAA-1080 Internet Archive of iPhone User Guide for iPhone and iPhone 3G
- USAA-1081 Internet Archive of Instruction Sheet for iPhone 3G
- USAA-1500 International Publication No. WO 2012/036809 (“Bourque”)
- USAA-1501 U.S. Pat. Appl. Pub. No. 2012/0071151 (“Abramson et al.”)
- USAA-1502 U.S. Pat. Appl. Pub. No. 2006/0145039 (“Shawver”)
- USAA-1503 Priority Document GB 1021292.6 filed Dec. 15, 2010 (“P1”)
- USAA-1504 Priority Document GB 1101259.8 filed Jan. 25, 2011 (“P2”)
- USAA-1505 Priority Document GB 1109759.9 filed Jun. 10, 2011 (“P3”)
- USAA-1506 Priority Document GB 1118777.0 filed Oct. 31, 2011 (“P4”)
- USAA-1507 Balasubramanian, et al. "Energy consumption in mobile phones: a measurement study and implications for network applications." Proceedings of the 9th ACM SIGCOMM Conference on Internet Measurement. 2009. (“Balasubramanian”)

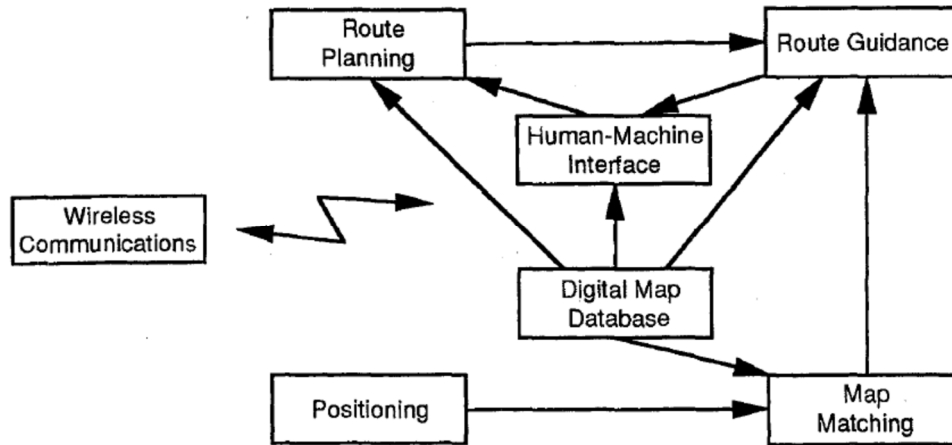
- USAA-1508 Carroll, et al. "An analysis of power consumption in a smartphone." USENIX annual technical conference. Vol. 14. 2010 ("Carroll")
- USAA-1509 Miyaji, et al. "Analysis of driver behavior based on traffic incidents for driver monitor systems." 2008 IEEE Intelligent Vehicles Symposium. IEEE ("Miyaji")
- USAA-1510 U.S. Patent No. 7,505,784 to Barbera ("Barbera")
- USAA-1511 Mitrovic, "Reliable method for driving events recognition." IEEE transactions on intelligent transportation systems 6.2 (2005): 198-205 ("Mitrovic")
- USAA-1512 Boonmee, et al., "Portable reckless driving detection system." 2009 6th International Conference on Electrical Engineering/Electronics, Computer, Telecommunications and Information Technology. Vol. 1. IEEE, 2009 ("Boonmee")
- USAA-1513 Singleton, et al., "Automobile event data recorder forensics," Advances in Digital Forensics IV 4. Springer US, 2008 ("Singleton")
- USAA-1514 Correia, et al, "Utilizing data from automotive event data recorders," Proceedings of the Canadian Multidisciplinary Road Safety Conference XII, London Ontario, 2001 ("Correia")
- USAA-1515 Flowers, et al, "Prediction of Accident Likelihood Using Poisson Regression," Traffic Accident Research and Evaluation Program, Texas Transportation Institute, The Texas A&M University System, 1980 ("Flowers")
- USAA-1516 U.S. Pat. Appl. Pub. No. 2014/0114696 ("Amigo")

29. My analysis and conclusions set forth in this declaration are based on the perspective of a POSITA.

VII. TECHNOLOGY OVERVIEW

30. Techniques for incorporating electronics into vehicles to improve driver experience, including by providing mapping, accident detection and other

features, were conventional and well known by the Critical Date. For example, Zhao1997 described the basic modules for performing vehicle location and navigation as early as 1997. USAA-1046 (Zhao1997), 22-25.



USAA-1046 (Zhao1997), 23

Zhao1997 also demonstrates that there was consumer interest in emergency features, such as the “Mayday” functionality, stolen vehicle recovery, navigation, roadside assistance, and other functions. *Id.*, 27.

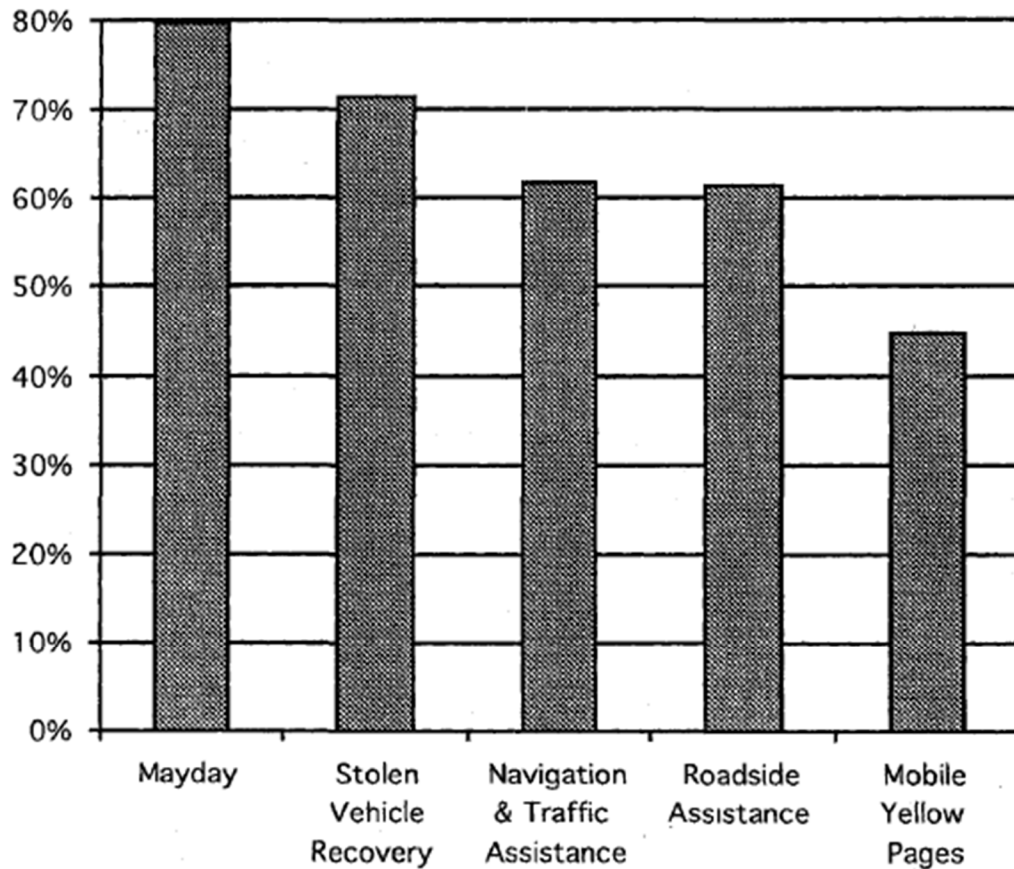


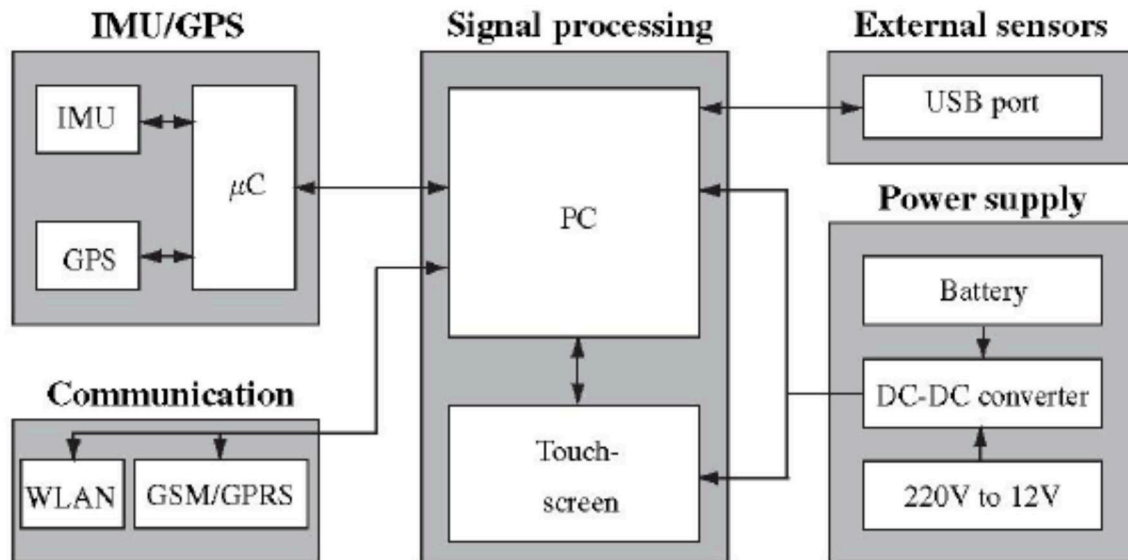
Figure 1.5 American consumer interest in location-based mobile services.

USAA-1046 (Zhao1997), 25

31. Zhao1997 also described sensing devices for facilitating performing vehicle location and navigation. Examples of sensors include odometers, gyroscopes, compasses, and the Global Positioning System (GPS), which were used for methods to fuse “measurements from multiple sensors to provide both an estimate of the current state of a system and a prediction of the future state of the system. *See id.*, 57-95.

32. By 2006, the early concepts discussed in Zhao1997 were expanded to workers in the field of Intelligent Transportation Systems (ITS). For example, Conover2006 recognized the need to include “navigation, telematics, vehicle dynamics control, parking aids, adaptive cruise control, lane departure warning, active safety systems, predictive safety systems (e.g., braking assist, collision warning, and collision avoidance), and vehicle-to-vehicle and vehicle-to-roadside communications” in automotive systems. USAA-1047, 1.

33. Around 2006, there were also systems being fielded for enabling a portable device with well-known hardware elements (e.g., accelerometers, positioning sensors, touch screen display, processor, memory) to wirelessly communicate with an external server. For example, Skog2006 disclosed a portable system that included the essential elements for determining driver behavior that are used in modern smartphones today. USAA-1048, 1-2.



USAA-1048, Fig. 2

34. In addition to the components internal to the mobile device shown above, the Skog system also had the ability to interface with external sensors to facilitate supplementing the internal sensors with other sources of data. *Id.*, 2-3. This configuration of the Skog2006 system is similar to the '879 patent's disclosure that: "[p]referably, the mobile device is arranged to interface with an external device to receive external driving information from said external device. It will be appreciated that the sensor set onboard the mobile device may be supplemented by a sensor set external to the mobile device." USAA-1001, 9:57-61.

A. Sensors

35. The sensors used in the '879 patent include, for example, image sensors, audio sensors, accelerometers, a positioning module (e.g., GPS receiver,

inertial measurement unit). These sensors are used to detect the driving behavior of the operator of a vehicle. As discussed in Section X, these sensors were described in several prior art references that render the claims of the '879 patent obvious. *See, generally* USAA-1005; USAA-1007; USAA-1008; USAA-1011; USAA-1013; USAA-1028; USAA-1029; USAA-1030; USAA-1031; USAA-1032.

36. Additionally, by the Critical Date, several types of mobile devices existed for performing the types of sensing capabilities described in the '879 patent. By 2008, the literature often referred to mobile devices as “smartphones” and these devices included all of the sensing features described in the '879 Patent. USAA-1049, 1. Work2008 is one example that included the following description:

Smartphones such as the Nokia N96 now include a video camera, numerous sensors (accelerometers, light sensors, GPS, microphone), wireless communication outlets (GSM, GPRS, WiFi, Bluetooth, infrared), computational power and memory. This phone can be used to listen to the radio, to watch digital TV, to browse the internet, to do video conferencing, to scan barcodes, to read pdfs, etc. The rapid penetration of GPS in smartphones is enabling device geopositioning and context awareness, which in turn is causing an explosion of Location Based Services (heavily relying on mapping) on the devices. USAA-1049, 1.

1. Image Sensors

37. The '879 patent describes use of image sensors, such as a camera: “[p]referably, the sensor set comprises an image sensor such as a camera[,]” and

“the corresponding sensor data may comprise images and/or a sequence of images generated from the image sensor.” USAA-1001, 8:32-35.

38. By the Critical Date, cameras were ubiquitous on devices such as hand-held mobile phones. For example, in 2005, Flinchbaugh²⁰⁰⁵ included the following description:

Perhaps the single trend with the most far-reaching implications yet to be comprehended is the embedding of smart cameras in wireless phones. This trend began almost instantaneously in 2003 when the number of cellular camera phones exceeded the number of digital still cameras sold.”

USAA-1050, 5. Further, around this time, “[c]ellular phones with digital still camera, digital video recording, and interactive videoconferencing features [were] rapidly evolving.” *Id.*, 8.

In 2006, LeBlanc²⁰⁰⁶ described an experimental road departure crash warning system that used a camera similar to those found in cellular telephones to detect when a vehicle was crossing lanes.

LeBlanc²⁰⁰⁶ included the following description:

39. The forward-looking LDW camera was a small “thumb” camera mounted inside the cabin near the top of the windshield just to the passenger side of the rear-view mirror. The camera was mounted behind a composite shroud to reduce reflections and to discourage tampering by the participants.

USAA-1051,37. The reference also described monitoring lane position:

The LDW alerts were issued when the lane position of the vehicle at some point in the near future was expected to exceed a threshold. The threshold was modulated to reflect both the driver's selection of sensitivity for the LDW, as well as the presence of currently- or previously-observed objects alongside the original lane of travel.

Id., 44. Based on these descriptions, both the addition of cameras to cellular telephones and the use of such cameras inside a vehicle for detecting driving incidents were well known by the Critical Date.

2. *Audio Sensors*

40. The '879 patent includes use of audio sensors and, specifically, “[p]referably, the sensor set comprises an audio sensor such as a microphone.” USAA-1001, 9:5-6. However, the Nokia N96 cellular phone (which predates the Critical Date) had a microphone, which would have been understood as a necessary component for the device to operate as a cellular telephone. Indeed, Mohan2008 stated that “[a]ll phones have a microphone that can serve as a readily available sensor.” USAA-1032 (Mohan), 10.

41. Indeed, by 2008, Mohan2008 described a Nericell system that was “a system that performs rich sensing by piggybacking on smartphones that users carry with them in normal course.” *Id.*, 1. It also described that “Nericell uses honk detection to identify noisy and chaotic traffic conditions like that at an unregulated intersection.” *Id.* Based on these descriptions, the addition of a microphone to a

cellular phone, and the use of such microphones inside an automobile to detect traffic conditions or incidents was well known by the Critical Date.

3. *Accelerometers*

42. The '879 patent describes use of accelerometers:

The accelerometer 23 is arranged to provide information regarding the motion of the automobile 3 along all three dimensional axes. For example, the accelerometer 23 provides information regarding the pitch, yaw and roll of the automobile 3. Sensor data captured from the accelerometer 23 may be used to determine the g-forces the automobile has been subjected to.

USAA-1001, 15:63-16:2.

43. By the Critical Date, mobile devices, such as smartphones, were known to contain multi-axis accelerometers. For example, in the Nericell system described in Mohan2008, “[a] phone might include any or all of a microphone, camera, GPS, and accelerometer, each of which could be used for traffic sensing functions.” USAA-1032 (Mohan), 1. As another example, Reddy2008 described a system that used “the Nokia N95 for [] data collection, which contains a three axis accelerometer with a sensitivity of $\pm 2G$ and bandwidth of 35 Hz and a built-in GPS receiver that can sample at 1 Hz.” USAA-1052, 2. This mobile phone was used “to determine the transportation mode of an individual – whether the user is stationary, walking, running, biking or in motorized transport.” *Id.*, 1. Based on these descriptions, both the addition of accelerometers to cellular telephones and

the use of such accelerometers inside a vehicle for detecting driving incidents were well known by the Critical Date.

4. *Positioning Devices*

44. One of the sensors identified in the '879 patent specification is a positioning module. The specification provides two examples of a positioning module, one using the Global Positioning System (GPS) and another using positioning techniques based on cell towers. It includes the following description:

Preferably, the sensor set comprises a positioning module arranged to determine the position of the mobile device. The positioning module may comprise a GPS module. The positioning module may be arranged to utilise the wireless telecommunication module to self-localise, for example by determining a position relative to one or more mobile telecommunication cell tower.

USAA-1001, 9:10-16. Additionally, “the corresponding sensor data may comprise latitude, longitude, elevation, speed and other data obtainable from positioning modules such as GPS modules as is known in the art.” *Id.*, 9:20-23. The '879 patent admits that such positioning modules were already known in the art.

45. By the Critical Date, multiple technologies were known to determine the position of a mobile device. For example, by 2002, Zhao2002B described several techniques for determining the location of a mobile phone, including “cell-ID-based, assisted GPS, and TDOA-based methods, such as OTDOA, E-OTD, and A-FLT.” USAA-1053, 1. Zhao2002B recognizes that “[t]here are three most

commonly used location technologies: standalone, satellite-based, and terrestrial-radio-based...” including “a typical standalone technology is dead reckoning; a typical satellite-based technology is GPS; and a typical terrestrial radio-based technology is the ‘C’ configuration of the Long Range Navigation (LORAN-C) system.” *Id.*, 2.

46. The addition of positioning modules in cellular telephones and the use of such positioning modules inside a vehicle for detecting driving incidents were well known by the Critical Date. For example, by 2008, Mohan²⁰⁰⁸ described a system where “[a] phone might include any or all of a microphone, camera, GPS, and accelerometer, each of which could be used for traffic sensing functions.” USAA-1032 (Mohan), 1.

5. *Proximity Sensors*

47. The ’879 patent also a registration module to determine if a mobile device is located in a vehicle, and includes the following description:

To this end, the adapter and/or the mobile device may comprise a registration module configured to register the installation of the mobile device to the vehicle and/or the adapter. The registration module may comprise a proximity sensor to detect the proximity of the mobile device to the vehicle. The registration module may comprise a NFC (near field communication) device.

USAA-1001, 3:48-55.

48. By the Critical Date, near-field communications (NFC) were used by mobile devices to communicate with external devices. For example, by 2007, Strömmer2007 described that NFC “support[ed] the use of mobile handsets by touch-based interaction, which is an intuitive and user-friendly way of establishing connections and exchanging information between mobile handsets and other devices. USAA-1054, 1-2. Based on these descriptions, the use of proximity sensors were well known by the Critical Date.

6. *Orientation Sensors*

49. The '879 patent describes use of an orientation sensor:

Preferably, the sensor set comprises an orientation sensor for determining the orientation of the mobile device. Said orientation sensor may comprise an electronic compass for determining a bearing, and so the direction in which the mobile device is facing.

USAA-1001, 9:24-28.

50. The use of orientation sensors in mobile devices were well known by the Critical Date. For example, Schott2007 described the details of an electronic compass suitable for inclusion in a mobile phone and that “[p]ossible host systems for such a miniature complete electronic compass system range from watches to mobile phones to automobiles.” USAA-1055, 11.

B. Accident Detection

51. By the Critical Date, several systems were known to detect vehicular accidents based on data from mobile phones. For example, Liutkauskas2004 described a number of location-based services that could be provided by mobile phones. USAA-1056, 1. Liutkauskas2004 also recognized that:

The most relevant class of Commercial Assistance Services based on wireless location systems is represented by Driver Assistance services. The attention has been focused on breakdown assistance, car accident detection and rescue and car theft recovery.

USAA-1056, 5. Other examples of mobile device accident detection systems included Thompson2010 and Cheng2010, which are discussed in at least Section XI below. *See* USAA-1008, 1-7, Fig. 2; USAA-1011, 1-3, Figs. 4, 5

C. Emergency Response Services

52. Commercial vehicle emergency systems were available by the Critical Date. Examples of such systems included the Ford Motor Company RESCU system and the General Motors OnStar system. These systems were built into vehicles. The interest in providing emergency services for mobile device-based systems were similarly well known by the Critical Date. *See, e.g.*, USAA-1057; USAA-1058; USAA-1059.

D. Mobile Vehicle Monitoring

53. Systems and techniques for monitoring vehicles using a mobile device were well known by the Critical Date. One example is “Floating Car Data” (FCD),

which refers to a technique of using data collected from mobile phones to assess/predict driving conditions, driver behavior and insurance adjustments. The interest in using mobile devices for vehicle monitoring was similarly well known by the Critical Date. *See, e.g.*, USAA-1060; USAA-1061; USAA-1062.

E. Insurance Adjustment

54. Systems and techniques for adjusting insurance plans for users based on monitoring vehicle activity were well known by the Critical Date. One example is “Floating Car Data” (FCD), which refers to a technique of using data collected from mobile phones to assess/predict driving conditions, driver behavior and insurance adjustments. Additionally, the prior art (Curry, USAA-1026) described that driving safety scores can be used by “insurance agencies to determine insurance premiums for related drivers.” USAA-2003, 7:5-22. The interest in using vehicle monitoring to determine and/or adjust insurance was similarly well known by the Critical Date. *See, e.g.*, USAA-1045; USAA-1063.

VIII. OVERVIEW OF THE '879 PATENT

A. Specification

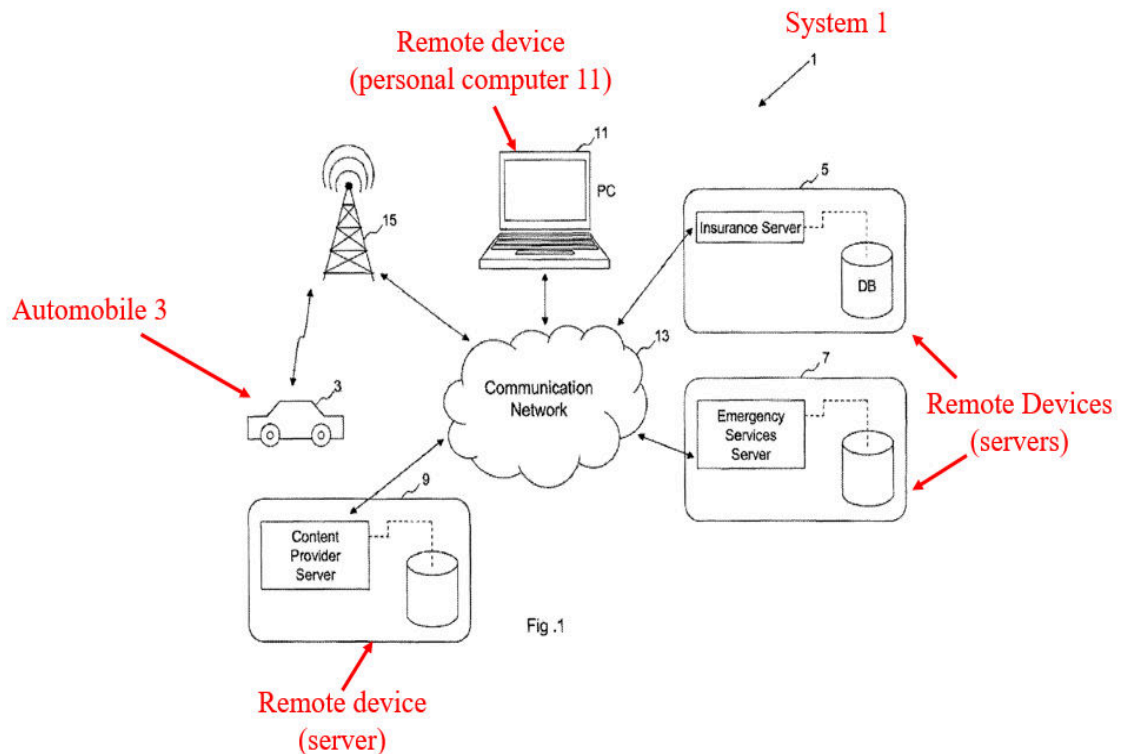
55. The '879 patent is directed to “methods and systems for logging driving information associated with a vehicle when driven...” USAA-1001, Abstract. A mobile device is “adapted for installation to a vehicle” and logs driving information, such as “video footage associated with how a vehicle is driven.” *Id.*, 1:21-30. The driving information can be used to “determine the cause of an

accident,” “modify driver behaviour” or “determine insurance premiums.” *Id.*

While the ’879 patent purports that “data logging devices for road vehicles are less prevalent,” it otherwise acknowledges that “uptake of data logging devices that can be retrofitted to road conditions” are “known in the art.” *Id.*, 1:49-60. This is consistent with the existence of several well-known vehicle monitoring technologies that were conventional by the Critical Date.

56. Various embodiments described in the ’879 patent generally relate to a “mobile telecommunications device adapted for installation to a vehicle and configured to log driving information associated with the vehicle when driven...” USAA-1001, 11:26-29; *see also* 11:61-2:11. The device is “loaded with an application,” i.e., a “mobile app,” that is “arranged to record and document events,” such as a “vehicle collision.” *Id.*, 13:9-17. The mobile application is referenced throughout the ’879 patent specification as the “Witness application.” *See, e.g., id.*, 13:56-63, 23:16-24:63.

57. Figure 1 shows a system 1 placed in automobile 3:



USAA-1001 ('879 patent), Fig. 1 (annotated)

58. System 1 includes “a mobile telecommunications device executing the Witness application...” USAA-1001, 13:18-56. The mobile telecommunications device can “communicate with one or more remotely located devices or systems[,]” such as “an insurance server 5, an emergency services server 7, a content provider server 9, and a personal computer 11.” *Id.* The mobile telecommunications device is configured to “monitor and process sensor data” to “derive driving information associated with the moving automobile 3.” *Id.*, 13:36-56. The “driving information” can be used to “determine if a driving incident or event has occurred.” *Id.* The term “driving incident” relates to an “event,” such as

“a collision, a near-miss, dangerous driving, erratic driving or similar[,]” or “a means for monitoring a driver's driving performance,” such as “a driving characteristic, or user profile for the subject driver.” *Id.* Additionally, the sensor data and/or the driving information may be used for determinations, such as “if the driver is a cautious driver, or a reckless driver[,]” and “to conduct a risk assessment and to tailor an insurance premium to the subject driver on the basis of a determined driving characteristic.” *Id.*

B. Claims

59. The table below includes identifiers for the '879 patent claims and limitations, which are referenced throughout.

Claim	Identifier	Claim Language
1	[1.1]	A mobile telecommunications device configured to log driving information associated with a vehicle, the mobile telecommunications device comprising:
	[1.2]	a sensor set comprising an image sensor, an audio sensor, an accelerometer or a positioning module, or a combination thereof;
	[1.3]	a user interface;
	[1.4]	a processor; and
	[1.5]	a memory;
	[1.6]	the mobile telecommunications device being configured to: determine, based on at least one of the inputs received by the user interface and sensor data from the device's sensor set, a start of a driving period during which the mobile device is removably attached to the vehicle and the vehicle

Claim	Identifier	Claim Language
		is in use;
	[1.7]	process the sensor data from the sensor set during the driving period to derive driving information associated with how the vehicle is driven; and
	[1.8]	store a selection of the driving information to the memory;
	[1.9]	wherein the driving information is derived without data from the vehicle sensors, and
	[1.10]	the mobile telecommunications device is controlled by a downloaded application to control the mobile device to process the driving information to generate a driving score associated with a particular driver.
2	[2]	A mobile telecommunications device according to claim 1, wherein the mobile telecommunications device is controlled by the downloaded application to control the mobile device to detect occurrence of a predetermined event and in response take at least one predetermined action.
3	[3]	A mobile telecommunication device according to claim 2, wherein predetermined action is storing driving information associated with that event to the memory.
4	[4]	A mobile telecommunication device according to claim 2, wherein predetermined action is storing driving information captured at a higher sampling rate than when an event is not detected.
5	[5]	A mobile telecommunication device according to claim 2, wherein predetermined action is transmitting driving information via a wireless telecommunication module of the mobile telecommunication device to a remote system.
6	[6.1]	A mobile telecommunications device according to

Claim	Identifier	Claim Language
		claim 2, wherein the predetermined action comprises providing feedback to a user to indicate that an event has been detected,
	[6.2]	the mobile telecommunications device being configured to receive a user interaction to confirm or deny whether the detected event has actually occurred following said feedback.
7	[7.1]	A mobile telecommunications device according to claim 6, wherein the feedback comprises notifying a user that a further action has been scheduled, and will be taken within a predetermined period,
	[7.2]	the mobile telecommunications device being further configured to receive a user interaction to confirm or deny whether the further scheduled action should be taken within a predetermined period.
8	[8.1]	A mobile telecommunications device according to claim 2, wherein the predetermined action comprises communicating to a remote system that an event has been detected,
	[8.2]	the mobile telecommunications device being further configured to receive from the remote system a request to transmit to the remote system selected portions of the driving information associated with the detected event.
9	[9.1]	A mobile telecommunications device according to claim 2, wherein the memory comprises: a long term memory for persistently storing driving information and a short term memory for transiently storing driving information,
	[9.2]	wherein the short term memory receives driving information at a higher update rate than the long term memory,
	[9.3]	the mobile telecommunications device being

Claim	Identifier	Claim Language
		further configured to: write driving information to the short term memory at a predetermined update rate during the driving period in a predetermined sequence; and,
	[9.4]	overwrite the driving information previously written to the short term memory in accordance with the predetermined sequence.
10	[10.1]	A mobile telecommunications device according to claim 9, wherein the mobile telecommunications device is controlled by the downloaded application to control the mobile device to detect an occurrence of a predetermined event and
	[10.2]	in response transfer data from the short term memory to the long term memory.
11	[11]	A mobile telecommunications device according to claim 2, wherein the device is controlled by the downloaded application to manage voice-calls incoming to the mobile telecommunications device during a driving period.
12	[12]	A mobile telecommunications device according to claim 2, wherein the device is controlled by the downloaded application to enable a hands-free mode of operation on detection of the driving period.
13	[13]	A mobile telecommunications device according to claim 12, wherein the hands-free mode of operation comprises enabling voice-activated commands on the mobile device.
14	[14.1]	A mobile telecommunications device according to claim 2, wherein the device is controlled by the downloaded application to detect the occurrence of a predetermined event of significance, such as a crash, and
	[14.2]	in response to store driving information associated

Claim	Identifier	Claim Language
		with that event to the memory.
15	[15.1]	A mobile telecommunications device according to claim 2, wherein the device is controlled by the downloaded application to detect the occurrence of a predetermined event of significance, such as a crash, and
	[15.2]	in response to transmit driving information associated with that event via the wireless telecommunication module to a remote data-logging system.
16	[16]	A mobile telecommunications device according to claim 2, wherein the at least one predetermined action comprises providing the user with options to control the mobile device to take further actions.
17	[17]	A mobile telecommunications device according to claim 1, further configured to: interface with an external device, the external device having access to external driving information associated with a condition of the vehicle; and, to receive at least a portion of the external driving information from the external device.
18	[18]	A mobile telecommunications device according to claim 17, further arranged to interface with the external device wirelessly.
19	[19]	A mobile telecommunications device according to claim 1, wherein the mobile telecommunications device utilizes its own power supply.
20	[20]	A mobile telecommunications device according to claim 1, wherein the mobile telecommunications device is a smartphone.
21	[21.1]	A non-transitory computer readable medium having instructions comprising a software application stored thereon, wherein the instructions are configured to be executed on a processor of a

Claim	Identifier	Claim Language
		mobile telecommunications device to enable the mobile telecommunications device to log driving information associated with a driver of a vehicle, the mobile telecommunications device including
	[21.2a]	a display;
	[21.3]	a sensor set comprising an image sensor, an audio sensor, an accelerometer or a positioning module, or a combination thereof;
	[21.4]	the processor; and
	[21.5]	a memory, wherein the instructions, upon execution by the processor, enable the mobile telecommunications device to:
	[21.2b]	present a user interface on the display;
	[21.6]	determine, based on at least one of the inputs received by the user interface and/or sensor data from the sensor set, a start of a driving period during which the mobile telecommunications device is removably attached to a vehicle and the vehicle is being driven by the driver;
	[21.7]	process the sensor data from the sensor set during the driving period to derive driving information associated with how the vehicle is driven;
	[21.8]	store a selection of the driving information to the memory; and
	[21.9]	generate a driving score associated with the driver,
	[21.10]	wherein the driving information is derived without data from vehicle sensors.
22	[22]	A non-transitory computer readable medium according to claim 21, wherein execution of the instructions further enables the mobile telecommunications device to detect occurrence of a predetermined event and in response take at least one predetermined action.

Claim	Identifier	Claim Language
23	[23]	A non-transitory computer readable medium according to claim 22, wherein predetermined action is storing driving information associated with that event to the memory.
24	[24]	A non-transitory computer readable medium according to claim 22, wherein predetermined action is storing driving information captured at a higher sampling rate than when an event is not detected.
25	[25]	A non-transitory computer readable medium according to claim 22, wherein predetermined action is transmitting driving information via a wireless telecommunication module of the mobile telecommunication device to a remote system.
26	[26.1]	A non-transitory computer readable medium according to claim 22, wherein the predetermined action comprises providing feedback to a user to indicate that an event has been detected,
	[26.2]	the mobile telecommunications device being configured, via execution of the instructions, to receive a user interaction to confirm or deny whether the detected event has actually occurred following said feedback.
27	[27.1]	A non-transitory computer readable medium according to claim 26, wherein the feedback comprises notifying a user that a further action has been scheduled, and will be taken within a predetermined period,
	[27.2]	the mobile telecommunications device being further configured to receive a user interaction to confirm or deny whether the further scheduled action should be taken within a predetermined period.
28	[28.1]	A non-transitory computer readable medium

Claim	Identifier	Claim Language
		according to claim 22, wherein the predetermined action comprises communicating to a remote system that an event has been detected,
	[28.2]	wherein execution of the instructions further enables the mobile telecommunications device to receive from the remote system a request to transmit to the remote system selected portions of the driving information associated with the detected event.
29	[29]	A non-transitory computer readable medium according to claim 22, wherein execution of the instructions further enables the mobile telecommunications device to manage voice-calls incoming to the mobile telecommunications device during a driving period.
30	[30]	A non-transitory computer readable medium according to claim 22, wherein execution of the instructions further enables the mobile telecommunications device to enable a hands-free mode of operation on detection of the driving period.
31	[31]	A non-transitory computer readable medium according to claim 30, wherein the hands-free mode of operation comprises enabling voice-activated commands on the mobile device.
32	[32.1]	A non-transitory computer readable medium according to claim 22, wherein execution of the instructions further enables the mobile telecommunications device to detect the occurrence of a predetermined event of significance, such as a crash, and
	[32.2]	in response to store driving information associated with that event to the memory.
33	[33.1]	A non-transitory computer readable medium

Claim	Identifier	Claim Language
		according to claim 22, wherein execution of the instructions further enables the mobile telecommunications device to detect the occurrence of a predetermined event of significance, such as a crash, and
	[33.2]	in response to transmit driving information associated with that event via the wireless telecommunication module to a remote data-logging system.
34	[34]	A non-transitory computer readable medium according to claim 22, wherein the at least one predetermined action comprises providing the user with options to control the mobile device to take further actions.
35	[35.1]	A non-transitory computer readable medium according to claim 21, wherein the memory comprises: a long-term memory for persistently storing driving information and a short-term memory for transiently storing driving information,
	[35.2]	wherein the short-term memory receives driving information at a higher update rate than the long-term memory,
	[35.3]	wherein execution of the instructions further enables the mobile telecommunications device to: write driving information to the short-term memory at a predetermined update rate during the driving period in a predetermined sequence; and,
	[35.4]	overwrite the driving information previously written to the short-term memory in accordance with the predetermined sequence.
36	[36]	A non-transitory computer readable medium according to claim 35, wherein execution of the instructions further enables the mobile

Claim	Identifier	Claim Language
		telecommunications device to detect an occurrence of a predetermined event and in response transfer data from the short-term memory to the long-term memory.
37	[37]	A non-transitory computer readable medium according to claim 21, wherein execution of the instructions further enables the mobile telecommunications device to: interface with an external device, the external device having access to external driving information associated with a condition of the vehicle; and, receive at least a portion of the external driving information from the external device.
38	[38]	A non-transitory computer readable medium according to claim 37, further arranged to interface with the external device wirelessly.
39	[39]	A non-transitory computer readable medium according to claim 21, wherein the mobile telecommunications device utilizes its own power supply.
40	[40]	A non-transitory computer readable medium according to claim 21, wherein the mobile telecommunications device is a smartphone.
41	[41]	A non-transitory computer readable medium according to claim 21, wherein the processing step comprises determination of at least one of: vehicle acceleration events and vehicle braking events.
42	[42.1]	A non-transitory computer readable medium according to claim 41, wherein processing step comprises determination of vehicle swerving events and
	[42.2]	the determination of such events occurs when data

Claim	Identifier	Claim Language
		from the sensor set accords with preset parameters.
43	[43]	A non-transitory computer readable medium according to claim 21, wherein the processing step comprises determination of both vehicle acceleration events and vehicle braking events.
44	[44.1]	A non-transitory computer readable medium according to claim 43, wherein processing step comprises the determination of vehicle swerving events and
	[44.2]	the determination of such events occurs when data from the sensor set accords with preset parameters.
45	[45.1]	A non-transitory computer readable medium according to claim 21, wherein the mobile telecommunications device further comprises a proximity sensor and
	[45.2]	the instructions, upon execution by the processor, enable the mobile telecommunications device to detect the proximity of the mobile telecommunications device to the vehicle.
46	[46.1]	A mobile telecommunications device configured to log driving information associated with a vehicle, the mobile telecommunications device comprising:
	[46.2]	a sensor set comprising an image sensor, an audio sensor, an accelerometer or a positioning module, or a combination thereof;
	[46.3]	a user interface;
	[46.4]	a processor and;
	[46.5]	a memory;
	[46.6]	the mobile telecommunications device being configured to: determine, based on at least one of the inputs received by the user interface and sensor data from the device's sensor set, a start of a driving period during which the mobile device is

Claim	Identifier	Claim Language
		removably attached to the vehicle and the vehicle is in use;
	[46.7]	process the sensor data from the sensor set during the driving period to derive driving information associated with how the vehicle is driven; and
	[46.8]	store a selection of the driving information to the memory;
	[46.9]	wherein the driving information is derived without data from the vehicle sensors and
	[46.10]	the mobile telecommunications device is configured to process the sensor data by determination of at least one of: vehicle acceleration events; and vehicle braking events;
	[46.11]	wherein the determining of such events occurs when data from the sensor set accords with predefined threshold values; and
	[46.12]	wherein the mobile telecommunications device is controlled by a downloaded application to control the mobile device to process the driving information to generate a driving score associated with a particular driver.
47	[47.1]	A mobile telecommunications device according to claim 46, wherein the mobile telecommunications device is configured to process the sensor data by determination of vehicle swerving events and
	[47.2]	the determination of such events occurs when data from the sensor set accords with preset parameters.
48	[48]	A mobile telecommunications device according to claim 46, wherein the mobile telecommunications device is configured to process the sensor data by determination of both vehicle acceleration events and vehicle braking events.
49	[49.1]	A mobile telecommunications device according to

Claim	Identifier	Claim Language
		claim 48, wherein the mobile telecommunications device is configured to process the sensor data by determination of vehicle swerving events and
	[49.2]	the determination of such events occurs when data from the sensor set accords with preset parameters.
50	[50.1]	A mobile telecommunications device according to claim 46, wherein the mobile telecommunications device further comprises a proximity sensor and
	[50.2]	the mobile telecommunications device is configured, upon execution of the instructions by the processor, to enable the mobile telecommunications device to detect the proximity of the mobile telecommunications device to the vehicle.
51	[51.1]	A non-transitory computer readable medium having instructions comprising a software application stored thereon, wherein the instructions are configured to be executed on a processor of a mobile telecommunications device to enable the mobile telecommunications device to log driving information associated with a driver of a vehicle, the mobile telecommunications device including
	[51.2a]	a display;
	[51.3]	a sensor set comprising an image sensor, an audio sensor, an accelerometer or a positioning module, or a combination thereof;
	[51.4]	the processor; and
	[51.5]	a memory, wherein the instructions, upon execution by the processor, enable the mobile telecommunications device to:
	[51.2b]	present a user interface on the display;
	[51.6]	determine, based on at least inputs received by the user interface and sensor data from the sensor set,

Claim	Identifier	Claim Language
		a start of a driving period during which the mobile telecommunications device is removably attached to a vehicle and the vehicle is being driven by the driver;
	[51.7]	process the sensor data from the sensor set during the driving period to derive driving information associated with how the vehicle is driven;
	[51.8]	store a selection of the driving information to the memory; and
	[51.9]	generate a driving score associated with the driver,
	[51.10]	wherein the driving information is derived without data from vehicle sensors and comprises the determination of at least one of: vehicle acceleration events; and vehicle braking events;
	[51.11]	wherein the determination of such events occurs when data from the sensor set accords with predefined threshold parameters.
52	[52.1]	A non-transitory computer readable medium according to claim 51, wherein the derived driving information may further comprise the determination of vehicle swerving events and
	[52.2]	the determination of such events occurs when data from the sensor set accords with predefined threshold parameters.
53	[53.1]	A non-transitory computer readable medium according to claim 51, wherein the mobile telecommunications device further includes a proximity sensor, and
	[53.2]	the instructions, upon execution by the processor, further enable the mobile telecommunications device to detect the proximity of the mobile telecommunications device to the vehicle.
54	[54.1]	A mobile telecommunications device configured to

Claim	Identifier	Claim Language
		log driving information associated with a vehicle, the mobile telecommunications device comprising:
	[54.2]	a sensor set comprising an image sensor, an audio sensor, an accelerometer or a positioning module, or a combination thereof;
	[54.3]	a user interface;
	[54.4]	a processor and;
	[54.5]	a memory;
	[54.6]	the mobile telecommunications device being configured to: determine, based on at least one of the inputs received by the user interface and sensor data from the device's sensor set, a start of a driving period during which the mobile device is removably affixed to the vehicle and the vehicle is in use;
	[54.7]	process the sensor data from the sensor set during the driving period to derive driving information associated with how the vehicle is driven; and
	[54.8]	store a selection of the driving information to the memory;
	[54.9]	wherein the driving information is derived without data from the vehicle sensors, and
	[54.10]	the mobile telecommunications device is controlled by a downloaded application to control the mobile device to process the driving information to generate a driving score associated with a particular driver.
55	[55.1]	A mobile telecommunications device configured to log driving information associated with a vehicle, the mobile telecommunications device comprising:
	[55.2]	a sensor set comprising an image sensor, an audio sensor, an accelerometer or a positioning module, or a combination thereof;

Claim	Identifier	Claim Language
	[55.3]	a user interface;
	[55.4]	a processor and;
	[55.5]	a memory;
	[55.6]	the mobile telecommunications device being configured to: determine, based on at least one of the inputs received by the user interface and sensor data from the device's sensor set, a start of a driving period during which the mobile device is removably affixed to the vehicle and the vehicle is in use;
	[55.7]	process the sensor data from the sensor set during the driving period to derive driving information associated with how the vehicle is driven,
	[55.8]	the processing involving the use of a neural network on the mobile telecommunications device to determine whether the driving information represents an acceptable or unacceptable driving pattern; and,
	[55.9]	store a selection of the driving information to the memory;
	[55.10]	wherein the driving information is derived without data from the vehicle sensors,
	[55.11]	and the mobile telecommunications device is controlled by a downloaded application to control the mobile device to process the driving information to generate a driving score associated with a particular driver.

C. Prosecution History

60. During prosecution of the '879 patent, the Examiner rejected the claims over U.S. Pub. Nos. 2010/0030540 ("Choi"), 2010/0157061 ("Katsman"),

and 2012/0166583 (“Koonce”). *See* USAA-1002, 117-36. Features to which arguments were directed in distinguishing this art (and all other record prior art) during prosecution are addressed in a new manner by combinations proposed in this declaration that leverage Peng, Chatterjee, Balachandran, Katayama, Tamir, Riemer and Berkobin, none of which were cited in prosecution.

D. Effective Filing Date of the ’879 Patent

61. Peng is prior art to the ’879 patent because the ’879 patent’s effective filing date does not precede Peng’s earliest filing date (June 29, 2011).

62. The ’879 patent claims priority to three foreign priority documents (referred hereinafter as “the priority documents” or P1-P3). The ’879 patent claims the benefit of and priority to GB 1021292.6 filed Dec. 15, 2010 (“P1”), GB 1101259.8 filed Jan. 25, 2011 (“P2”), GB 1109759.9 filed 10 Jun. 10, 2011 (“P3”), and GB 1118777.0 (“P4”), filed Oct. 31, 2011. In my analysis below, I did not consider the fourth foreign priority document, P4, because it has a later filing date than Peng. However, none of the priority documents provide written description support for the claims of the ’879 patent.

63. None of the priority documents (P1-P3) provide support for multiple elements of each of independent claims 1, 21, 46, 51, 54, and 55 of the ’879 patent. First, the priority documents do not provide support for “**wherein the driving information is derived without data from vehicle sensors**” (hereinafter referred

to as element “[1.9]”¹). I am informed by Counsel that by requiring the driving information to be derived without data from vehicle sensors, Patent Owner has structured this clause as a negative limitation. I have also been informed that support for negative limitations requires explicit support in the specification and that mere silence is insufficient to meet the support required under 35 U.S.C. 112. *Novartis v. Accord Healthcare*, Docket No. 2021-1070 (June 21, 2022) (noting exception where disclosure of negative limitation is inherent). There is no support for this negative limitation in any of the three foreign priority documents P1-P3 for the ‘879 patent. Also, there is no support for this limitation in ‘879 specification itself and the non-provisional U.S. Application Nos. 13/994,455 (“the ‘455 application”) and 15/061,910 (“the ‘910 application”), to which the ‘879 patent claims priority. As such, Peng is prior art with its priority date of on Jun. 29, 2011. And, for the reason discussed hereinafter, Peng is part of an obvious-based combination that renders the Challenged Claims invalid.

64. Second, the priority documents do not provide support for a mobile telecommunications device that includes an application to control the mobile

¹ The limitations recited in elements [1.9] of claim 1 are also recited by and representative of element [21.10] of claim 21, element [46.9] of claim 46, element [51.10] of claim 51, element [54.9] of claim 54, and element [55.10] of claim 55.

device to process the driving information to “generate a driving score associated with a particular driver” (hereinafter referred to as element “[1.10]”)². The phrase and/or functionality of a driving score are not even mentioned in the the priority documents.

a) Overview of Case Law on Written Description Support and Negative Limitations

65. I have been informed by Counsel that in order to satisfy the written description requirement, a patent's specification must “reasonably convey[] to those skilled in the art that the inventor had possession of the claimed subject matter as of the filing date.” *Ariad Pharms., Inc. v. Eli Lilly & Co.*, 598 F.3d 1336, 1351 (Fed. Cir. 2010) (*en banc*). I have also been informed that such possession must be “shown in the disclosure” and that it is not enough that a claimed invention is “an obvious variant of that which is disclosed in the specification.” *Lockwood v. Am. Airlines, Inc.*, 107 F.3d 1565, 1572 (Fed. Cir. 1997).

² The limitation “generate a driving score associated with a particular driver” or substantially similar language recited in element [1.10] of claim 1 is also recited by and representative of language found in elements [21.9] of claim 21, element [46.12] of claim 46, element [51.9] of claim 51, element [54.10] of claim 54, and element [55.11] of claim 55.

66. Counsel has informed me about the Novartis decision, which is the most recent case to require that there be explicit support for a negative limitation. *Novartis Pharmaceuticals Corp. v. Accord Healthcare Inc.*, No. 21-1070 (Fed. Cir. 2022). I have been informed that this court considered the case of a multiple sclerosis drug where the independent claim required administration of a daily dosage “absent an immediately preceding loading dose” and held that there was no explicit written description support for a limitation. *Id.* at 2, 12. It was also communicated to me that the court also held the there was no implicit or inherent support for this limitation in a specification that only described daily dosing regimens. *Id.* at 10.

67. Counsel has also informed me that the failure or omission of reference to a claimed object does not constitute disclosure of the negative limitation. See *Seabed Geosolutions (US) Inc. v. Magseis FF LLC*, 8 F.4th 1285, 1288 (Fed. Cir. 2021) (“[S]ilence does not support reading the claims to exclude gimbaled geophones.”; MPEP § 2173.05(i) (9th ed. Rev. 10.2019, June 2020) (“The mere absence of a positive recitation is not a basis for an exclusion.”)).

68. I have also been informed that while a written description's silence about a negative claim limitation is a useful and important clue and may often be dispositive, it is possible that the written description requirement may be satisfied when a skilled artisan would understand the specification as inherently disclosing

the negative limitation. For example, Counsel has informed me that if the record established that in a particular field, the absence of mention of a limitation necessarily excluded that limitation; written description could be satisfied despite the specification's silence. See *Tronzo v. Biomet, Inc.*, 156 F.3d 1154, 1159 (Fed. Cir. 1998) (“[M]issing descriptive matter must necessarily be present in the specification such that one skilled in the art would recognize such a disclosure.” (citing *Cont'l Can Co. USA v. Monsanto Co.*, 948 F.2d 1264, 1268 (Fed. Cir. 1991))); see also *In re Robertson*, 169 F.3d 743, 745 (Fed. Cir. 1999). I have been informed that when the specification is itself silent regarding a negative limitation, testimony from a skilled artisan as possibilities or probabilities that the recited element would be excluded would not suffice, lest such testimony could effectively eliminate the written description requirement. Counsel has further informed of the language in *Novartis v. Accord Healthcare*, which states: “[i]f silence were generally sufficient, all negative limitations would be supported by a silent specification. If, however, a patent owner could establish that a particular limitation would always be understood by skilled artisans as being necessarily excluded from a particular claimed method or apparatus if that limitation is not mentioned, the written description requirement would be satisfied despite the specification's silence.” *Novartis*, No. 21-1070 at 7.

69. I have been informed that under 35 U.S.C. 119(a) or (e), the claims in a U.S. application are **only** entitled to the benefit of a foreign priority date or the filing date of a provisional application if the corresponding foreign application or provisional application supports the claims in the manner required by 35 U.S.C. 112(a) or pre-AIA 35 U.S.C. 112, first paragraph. *In re Ziegler*, 992 F.2d 1197, 1200, 26 USPQ2d 1600, 1603 (Fed. Cir. 1993); *Kawaiv Metlesics*, 480 F.2d 880, 178 USPQ 158 (CCPA 1973); *In re Gosteli*, 872 F.2d 1008, 10 USPQ2d 1614 (Fed. Cir. 1989).

b) The Challenged Claims of the '879 Patent are Not Entitled to Claim Priority to the Priority Documents Antedating Peng.

70. Each of the P1-P3 priority documents before the filing date of Peng are silent as to the whether the driving information is derived without data from vehicle sensors. It would not have been apparent to a POSITA to have understood that these disclosures *exclude* the use of vehicle sensors when deriving driving information. Furthermore, a POSITA would not have understood from these disclosures that the invention requires at least elements [1.9]-[1.10] of claim 1 (in addition to the equivalent elements of independent claims 21, 46, 51, 54, and 55). Accordingly, the three foreign priority documents filed before the Peng's filing date cannot be relied upon for providing support for the claimed limitations found in claims 1, 21, 46, 51, 54, and 55 of the '879 patent.

***i.* First Priority Document P1 (GB1021292.6) fails to provide support.**

71. The First Priority Document, P1, is a two-page disclosure directed to the use of video loops in the “Witness” application. USAA-1503 (P1), 5 (describing loops lasting between one and ten minutes). As the video is recorded, “the GPS facility on the phone records speed and location of the vehicle” and “[t]his information is also embedded within the video.” *Id.*, 6. P1 discloses “In the event of a sudden deceleration or acceleration (set to be triggered by a collision at the front or from the rear), the phone will continue to record for a short period and then stop and save the data.” *Id.* P1 also notes, “The phone is attached to a car's power source via the cigarette lighter. The phone senses the change of power source from the phone battery to the car battery/alternator and automatically switches on the ‘Witness’ phone application. Otherwise, the driver simply starts the programme *before driving away.*” USAA-1503 (P1), 5.

72. Nowhere in the disclosure is any discussion that the driving information is derived without data from vehicle sensors as required by element [1.9] of independent claims 1, nor the corresponding elements of claims 21, 46, 51, 54, and 55. Furthermore, nowhere does P1 disclose the limitations of “generat[ing] a driving score” found in [1.10] of claim 1, [21.9] of claim 21, [46.12] of claim 46, [51.9] of claim 51, [54.10] of claim 54, and [55.11] of claim 55. *Id.* Instead, the Witness video application only discloses merely that the “‘app’ begins recording

video in a loop of a variable amount of time (between one minutes and ten depending on available memory).” *Id.* This disclosure fails to teach the any of the limitations required by [1.9]-[1.10], nor the corresponding elements found in independent claims 21, 46, 51, 54, and 55. *Id.*

***ii.* P2 (GB201101259) fails to provide support.**

73. The second priority document, P2, fails to disclose at least elements [1.9]-[1.10], nor the corresponding elements found in independent claims 21, 46, 51, 54, and 55. P2 retains its focus on the “Witness” application. USAA-1504 (P2), *passim*. P2 is marginally longer with five substantive pages of description. P2 states, “[t]he Witness application can receive the following sensor/data inputs, as is typical for modern smart-phones ... • G-force accelerometer, Microphone (Audio), Camera (Picture/Video), GPS module (Speed, location, elevation etc), 3D compass (Orientation: Pitch, Roll and Yaw), Time/date.” USAA-1504 (P2) 5. The second page of disclosure speaks to “data processing” with ways to determine “events of significance”, for example, through “Tyre Squeal”, “The crumple zone being crushed,” and “breaking glass.” USAA-1504 (P2), 6. The disclosure then describes, “Benchmarking” to train the system to develop a benchmark for a particular driver. USAA-1504 (P2), 7. Upon detecting a crash, the Witness application can launch actions that include, announcing an accident, call emergency services and provide a checklist. *Id.*, 7-8. The checklist can include

reminders to take photographs of the vehicles and collect information for 3rd parties involved in the accident. *Id.*

74. First, the provisional application fails to provide support for the negative limitation. While it is true that P2 describes the use of sensors located on a mobile device, however the identified sensors are also commonly used as vehicle sensors, and nowhere does P2 exclude the use of this other sensor information. Furthermore, P2 does not expressly describe or list any disadvantages of using other sensor information such as vehicle sensors. Counsel has informed me that silence is not sufficient for showing support for a negative limitation. Furthermore, there is no inherent reason for why data from vehicle sensors would be necessarily absent.

75. Second, there is no discussion that the memory comprises a long term memory for persistently storing driving information and a short term memory for transiently storing driving information, nor the writing and overwriting details to satisfy [1.9]-[1.10]. USAA-1504, 5-8, 13.

***iii.* P3 (GB201109759) fails to provide support.**

76. The third priority document, P3, also fails to disclose at least elements [1.9]-[1.10] of claim 1, nor the corresponding elements found in independent claims 21, 46, 51, 54, and 55. USAA-1505 (P3), *passim*. Patent Owner expanded their outline of the Witness application this a foreign priority document. The first

paragraph of P3 notes, “the present invention relates to a mobile device loaded with an application - a 'mobile app' - which is arranged to record and document the events surrounding an incident involving the vehicle such as a vehicle crash.”

USAA-1505 (P3), 5. P3 continues to emphasize the video looping by noting that, “Witness interfaces with the hardware on a mobile device, such as a smart-phone, to provide an event recording device that can capture information in the lead up to, during and after a vehicle incident. In use, the mobile device is mounted adjacent the vehicle windscreen so that a camera on the mobile telephone can see the road ahead.” *Id.*

77. P3 continues to expand upon the video recording configuration and storage information. See, e.g., USAA-1505 (P3), 16 (“Accident Advice/What to do”), 10 (“File Management Screen”). But none of these sections lend support for either limitation recited above.

78. Nowhere does P3 provide support for the negative limitation recited in [1.9]. While P3 describes the use of sensors located on a mobile device, nowhere does P3 exclude the use of other sensor information (e.g., a vehicle sensor) or provide reasoning for why one would exclude the use of other sensor information.

79. In fact, the Patent Owner added an additional section in the detailed description that makes clear that Applicant intended the mobile device to work

with other sensors. First, P3 notes that the mobile device includes a NFC interface, which is used to interface with a “smartholster.”

Other measures can be implemented in conjunction with the Witness application to guarantee that the application is enabled whenever a given vehicle is being driven. For example, the mobile device on which the Witness application is installed may comprise a near-field communication (NFC) device, such as an RFID tag. The NFC device may be compatible with a complementary device on a so-called 'smartholster' into which the mobile device may be fitted during operation.

USAA-1505 (P3), 20.

80. Through this NFC smartholster, P3 notes that mobile device interfaces with the *engine management system of the vehicle*.

The smart-holster positions and holds the mobile device correctly so that the video camera on the mobile device can clearly view the road ahead via of the front windscreen of the vehicle. However, the smart-holster also interacts with the NFC device on the smart-phone to determine whether or not the smart-phone is inserted into the smart-holster. *The smart-holster can then be interfaced with the engine management system of the vehicle so that the vehicle may be activated and driven only when the mobile device is in place within the smart-holster.*

USAA-1505 (P3), 20.

81. Thus, not only does the disclosure in P3 not include “statements in the specification expressly listing the disadvantages of using” the negative limitation per *Santarus*, it instead expressly discloses the *advantages* of connecting the mobile device to a smartholster system in order to connect the mobile device to the

engine management system for the purposes of limiting activation of the vehicle to those circumstances to when the mobile device is connected to the engine management system. Instead of teaching a supporting embodiment, P3 instead describes this as a sole embodiment. This sole embodiment indicates that the mobile device should be connected to the engine management system in order to make a determination to allow the vehicle to be driven. A POSITA would have understood this embodiment as **requiring the mobile telecommunications device to receive data from vehicle sensors**, which in this case is the engine.

82. With regard to element [1.10], P3 provides no discussion of a mobile telecommunications device controlled by a downloaded application to control the mobile device to process the driving information to generate a driving score associated with a particular drive to satisfy [1.10], nor the corresponding elements found in independent claims 21, 46, 51, 54, and 55. USAA-1504, 5-8, 13.

83. Thus, P3 fails to provide support for at least elements [1.9]-[1.10], nor the corresponding elements found in independent claims 21, 46, 51, 54, and 55. *Id.* Accordingly, P3 cannot be relied upon to establish a priority date. Thus, Peng is prior art that can be relied upon.

- c) **The '879 Specification and the U.S. Priority Document, U.S. Application No. 13/994,455 (“the ‘455 application”) also fail**

to provide support and reinforces the lack of written description for the negative limitation. ³

84. Not only is there no support for the negative limitation in the three foreign priority documents for the negative limitation (e.g., [1.9]), but one would find that this same theme extends even to the '879 specification itself as well as U.S. Application Nos. 13/994,455 and 15/061,910, from which the '879 patent claims priority. There is no support for this limitation in any of the '879, '455, and '910 specifications and their respective prosecution histories demonstrate that this limitation was introduced by the Patent Owner only during prosecution.

85. Further, even looking past this fatal defect, the specification makes clear that Patent Owner intended mobile the telecommunications device to receive data from vehicle sensors in each and every embodiment. The '879 specification lists six embodiments in the section entitled Summary of the Invention. See, e.g., USAA-1001 ('879 patent), 1:64 (“According to a first aspect of the present invention ...”). The first four embodiments are directed to mobile devices. *Id.*, 12:12-15 (“The remote mobile device may be a mobile device in accordance with one of the first to fourth aspects of the present invention.”). The fifth and sixth

³ This application, now Pat. No. 9,311,271, was also filed as No. PCT/GB2011/052491 on Dec. 15, 2011.

embodiments are directed to “a method of logging driving information” and “a data-logging system”. *Id.*, 11:58-12:12.

86. The first embodiment is described as preferably being integrated with “a sensor sets external to the mobile device.” For example, the specification notes in Cols. 9 and 10:

Preferably, *the mobile device is arranged to interface with an external device to receive external driving information from said external device.* It will be appreciated that the sensor set onboard the mobile device may be supplemented by a sensor set external to the mobile device. For example, the external device may be an engine management system of the vehicle and/or the external device may be arranged to connect to the on-car data network of the *vehicle.* *Thus, external device may have access to information associated with the behaviour of the vehicle (for example, the speed of the vehicle, how much the brake pedal is being pressed, etc).* Such driving information can be processed and/or stored by the mobile device under control of the executed application in a manner similar to driving information derived from sensor data internal to the mobile device.

Preferably, the mobile device is arranged to interface with an external device wirelessly, for example via a Bluetooth ® connection. Advantageously, this removes the need for the mobile device to be physically connected to the external device.

USAA-1001 ('879 patent), 9:57-10:9.

87. The second embodiment note that the mobile telecommunications device is “adapted for installation to a vehicle and configured to log driving information associated with the vehicle when driven.” USAA-1001 ('879 patent), 10:52-53. This description of the embodiment provides no further information as to how the mobile communications system is adapted to the vehicle. However,

elsewhere the specification makes clear that being adapted to the vehicle includes interfacing with external sensors. For example, the specification notes that the mobile telecommunications device may also be configured to interface and communicate directly with a vehicles native telemetry systems.

The mobile telecommunications device may also be configured to interface and communicate directly with a vehicles native telemetry systems. For example, the majority of modern cars have inbuilt electronic control systems or engine management systems, arranged to collect data regarding vehicle system performance. This data may be communicated to the mobile telecommunications device either via a wired physical connection, such as USB (Universal Serial Bus), or via a wireless communication protocol such as Bluetooth R. This data may subsequently be used by the mobile telecommunications device to complement sensor data captured directly by the telecommunications device. For example, native vehicle telemetric systems may comprise electronic tyre pressure sensors, and are able to detect if a tyre is under and/or over-inflated. This information may be communicated to the mobile telecommunications device and may help to explain the causes for a driving incident, such as a sudden loss of traction resulting from a burst tyre.

USAA-1001 ('879 patent), 22:62-23-15.

88. The third embodiment is similarly limited notes:

Preferably, **the sensor interface is arranged to receive sensor data from a sensor set external to the mobile device.** Preferably, the sensor interface is arranged to interface with an external device as described in relation to the first aspect of the present invention. Advantageously, this enables a mobile device to utilise a richer or better equipped sensor set than that local to the mobile device.

USAA-1001 ('879 patent), 11:19-25.

89. The fourth embodiment is similarly limited as Col. 11 notes:

Preferably, the mobile device comprises *a sensor interface arranged to receive sensor data from an external sensor set.* The mobile device may comprise an internal sensor set.

USAA-1001 ('879 patent), 11:29-31.

90. These repeated references to external sensor sets indicate that Patent Owner intended to integrate the mobile telecommunications device with external sensors in each and every embodiment. The fifth embodiment is silent as to the negative limitation and the sixth embodiment appears to be focused on server systems.

91. There are certain portions of the specification that deal with the challenges of aftermarket blackboxes. These portions, however, do not address vehicle sensors. For example, the Background section notes, “[s]ome of these data logging devices can be integrated with the car data network, and so may take inputs from sensors integrated with the vehicle. Such as those measuring the speed of the vehicle.” USAA-1001 ('879 patent), 1:49-58. “Others having their own internal sensor set 50 are more readily **retrofitted** to a vehicle.” *Id.* However, the specification is speaking to integrated/retrofitted devices beyond those present in the vehicle itself. These types of applications are quite different from applicant’s desire to integrate a removably attached mobile telecommunications device with the vehicle itself. No additional integrated/retrofitted device would be required to integrate the mobile device with vehicle sensors.

92. Similarly, a portion in the “Summary of the Invention”, describes integration of third party black box sensors – not those resident in a vehicle. It states: “Mobile telecommunication devices such as ‘smart-phones’ are becoming increasingly widespread, and these devices tend to have the requisite sensor sets to capture data concerning vehicle behaviour.” USAA-1001 (’879 patent), 2:15-21. It also states: “Thus, a generic mobile telecommunication device already owned by a driver of the vehicle can be loaded with the application to provide such data logging functionality that would otherwise necessitate a dedicated black-box.” USAA-1001 (’879 patent), 2:21-25. However, these disclosures have no bearing on the integration of vehicle sensor sets with the mobile telecommunications device. Indeed, the specification describes the challenges of third party systems that must be retrofitted to vehicles, (e.g., a black box) and not those already integrated within the vehicle itself. USAA-1001 (’879 patent), 1:49-60 (“**Some of these data logging devices can be integrated** with the car data network, and so may take inputs from sensors integrated with the vehicle, such as those measuring the speed of the vehicle. **However, these can be difficult and costly to install. Others having their own internal sensor set are more readily retrofitted to a vehicle.** Nonetheless, such data logging devices for road vehicles are less prevalent perhaps due to their unjustifiable expense. Accordingly the uptake of data logging devices that can be retrofitted to road vehicles, as are known in the art, has been

minimal. ... It is the object of the present disclosure to alleviate the above-mentioned problems, at least in part.”)

93. Thus, neither the '879 specification nor its priority documents can be relied upon for supporting the negative limitation. First, there is no literal or implicit support for this limitation. Second, the specification makes clear that the Patent Owner intended the mobile telecommunications device to receive data from vehicle sensors in each and every embodiment.

IX. INTERPRETATION OF THE '879 PATENT CLAIMS

94. I understand that, for purposes of my analysis in this *inter partes* review proceeding, the terms appearing in a patent claim should be interpreted according to their “ordinary and customary meaning of such claim as understood by one of ordinary skill in the art and the prosecution history pertaining to the patent.” 37 C.F.R. § 42.100(b). In that regard, I understand that the best indicator of claim meaning is its usage in the context of the patent specification as understood by a POSITA. I further understand that the words of the claims should be given their plain meaning unless that meaning is inconsistent with the patent specification or the patent’s history of examination before the Patent Office. I also understand that the words of the claims should be interpreted as they would have been interpreted by a POSITA at the time of the invention was made (not today). Because I do not know at what date the invention as claimed was made, if ever, I

have used the Critical Date of the '879 patent as the point in time for claim interpretation purposes. My opinion does not change if the invention date was as early as December of 2010.

95. No express constructions are needed for this patent because the Challenged Claims are obvious under any reasonable interpretation. For example, claim 1 recites “determine, based on at least one of the inputs received by the user interface and sensor data from the device's sensor set, a start of a driving period during which the mobile device is removably attached to the vehicle and the vehicle is in use.”⁴ Based on plain meaning, a POSITA would have understood phrase “driving period” refers to a time period “during which [a] mobile device is removably attached to the vehicle and the vehicle is in use.” Even though “driving period” has a name that implies driving, because the two claim parameters defining the “driving period” are “removably attached...and the vehicle is in use,” the claim leaves open the possibility of the driving period corresponding to any portion, e.g., the beginning, middle or end of, a vehicle’s operation. The '879 patent

⁴ Indep. claims 21, 46, 51, and 54-55 recite the same/similar language. Claim 21 recites substantially similar language except that “the vehicle is in use” is replaced with “the vehicle is being driven by the driver.” Also, claims 54 and 55 recite substantially similar language except that “attached” is replaced with “affixed.”

specification is consistent with this interpretation because it expressly recognizes several driving period options that are unassociated with, e.g., the beginning of the user driving the vehicle: “the mobile device [] register[s] the start of a driving period in response to an initialisation input,” which may be “the user manually executing the application on the mobile device[,]” and “the mobile device being installed to the vehicle and/or the vehicle being driven.” USAA-1001, 3:32-62.

96. Thus, for the reasons I discussed above, this claim term establishes just two “driving period” attributes: (1) “the mobile device is removably attached to the vehicle” and (2) “the vehicle is in use.” Furthermore, it would be possible to satisfy these attributes by starting a data collection period regardless of whether collection starts at the onset of vehicle driving, or before/after driving commences.

X. SUMMARY OF RELEVANT PRIOR ART

A. Ground 1

1. Overview of Peng

97. Peng is directed to “collecting and evaluating driving behavior data and/or driving environment data, and providing feedback based on such evaluated data” using “a handheld mobile device [(or “HDM”)], e.g., a smart phone” for “a variety of applications.” USAA-1005 (Peng), [0001], [0165]; *see also* Abstract, [0019].

98. Peng’s Fig. 1 (reproduced below), illustrates an exemplary “handheld mobile device 10 located in a vehicle 12.” *Id.*, [0019], [0010], Fig. 1. “The

handheld mobile device 10 may be configured to provide one or more features of a driving analysis system, such as (a) collection of driving data (e.g., data regarding driving behavior and/or the respective driving environment), (b) processing of collected driving data, and/or (c) providing feedback based on the processed driving data.” *Id.*, [0020]. “Accordingly, handheld mobile device 10 may include one or more sensors, a driving analysis application, and a display.” *Id.* User inputs may be received via “an interactive display (e.g., a touch screen)” and “input/output devices 38.” *Id.*, [0030]-[0031]. Handheld mobile device 10 can “perform[] continuously” steps such as “collect driving data,” “process driving data,” “display feedback,” and/or “store data” during a collection session to, e.g., provide “real time feedback.” USAA-1005, [0072]-[0073], Fig. 3.

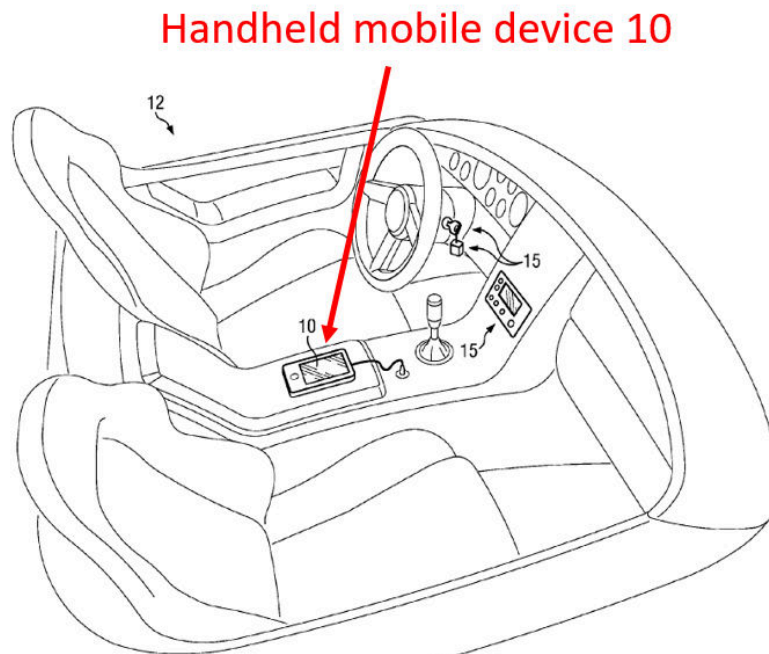
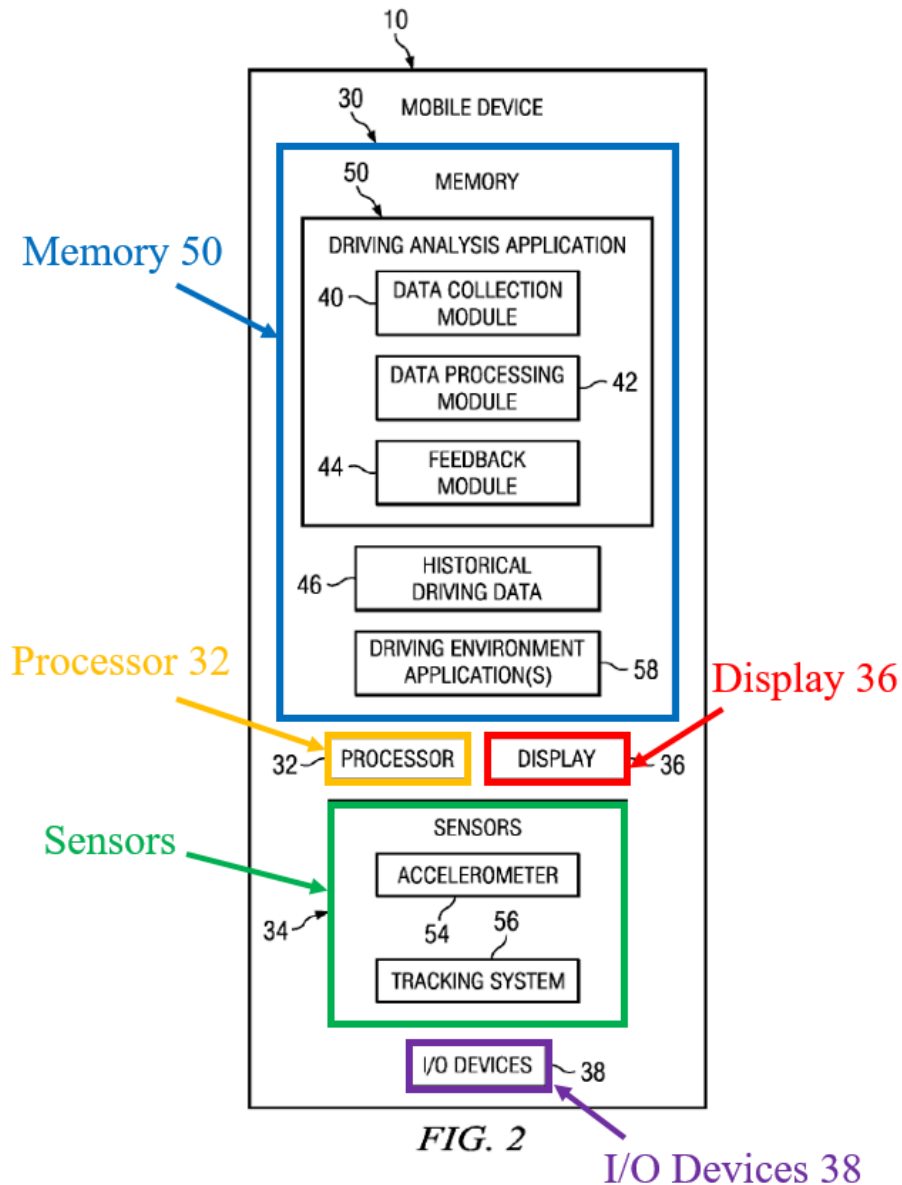


FIG. 1

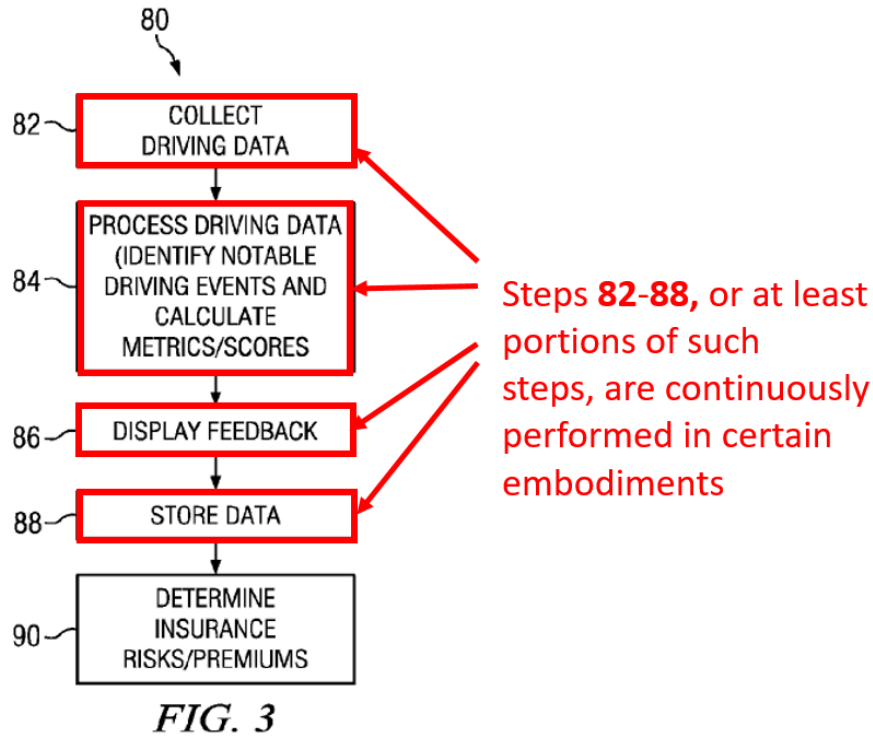
USAA-1005 (Peng), Fig. 1 (annotated)

99. As shown in Fig. 2 (reproduced below) Peng's "handheld mobile device 10 may include a memory 30, processor 32, one or more sensors 34, a display 36, and input/output devices 38." *Id.*, [0025], Fig. 2. Sensors 34 can "collect one or more types of data regarding driving behavior and/or the driving environment" that is distinct of data from vehicle sensors. *Id.*, [0021]. Although Peng does describe but does not require input or consideration of vehicle sensor data, a POSITA would understand from Peng's description that these driving behavior metrics and/or scores can be derived without data from vehicle sensors. *Id.*, [0033]. Handheld mobile device 10's "sensors 34" can include, e.g., a "built-in accelerometer 54" and "a location tracking system 56" "such as a GPS tracking system." *Id.*, [0077], [0029], [0034]. Memory 30 of handheld mobile device 10 can be configured for "short-term storage...and long-term storage of certain data" of "any data," "including raw or filtered data...and/or any of the metrics, scores, or other data calculated..." *Id.*, [0058].



USAA-1005 (Peng), Fig. 2 (annotated)

100. Fig. 3 (reproduced below) shows various steps, of which steps 82-88, or portions thereof, can be “perform continuously” by handheld mobile device 10, to provide driver feedback, e.g., “real time feedback.” USAA-1005, [0071]-[0073], Fig. 3.



USAA-1005, Fig. 3 (annotated)

101. Fig. 4 (reproduced below) shows various steps performed by HMD 10. USAA-1005, [0075]-[0077], [0152]-[0153], [0057]-[0065], Figs. 4, 6A. Among them, device 10 first ensures proper orientation (step 102) when determining whether it is ready to collect driving data (step 104). *Id.* In doing so, based on sensor data and leveraging user input, HMD 10 “interact[s] with the user to adjust the [HMD] 10 such that the orientation...is suitable for collecting driving data.” USAA-1005, [0076], Fig. 4. Furthermore, HMD 10 can “initiate and/or manage the storage of any of the data collected...at step 104 (e.g., raw data or filtered raw data) and/or any of the metrics, scores, or other data calculated or

processed by data processing module 42 at steps 106-112,” USAA-1005, [0142].

For example, HMD can “store data in local volatile memory for display, in local non-volatile memory as historical driving data 46....” USAA-1005, [0142]. HMD 10 may “display any of the data collected...at step 104 (e.g., raw data or filtered raw data) and/or any of the metrics, scores, or other data calculated or processed by data processing module 42 at steps 106-112.” USAA-1005, [0142].

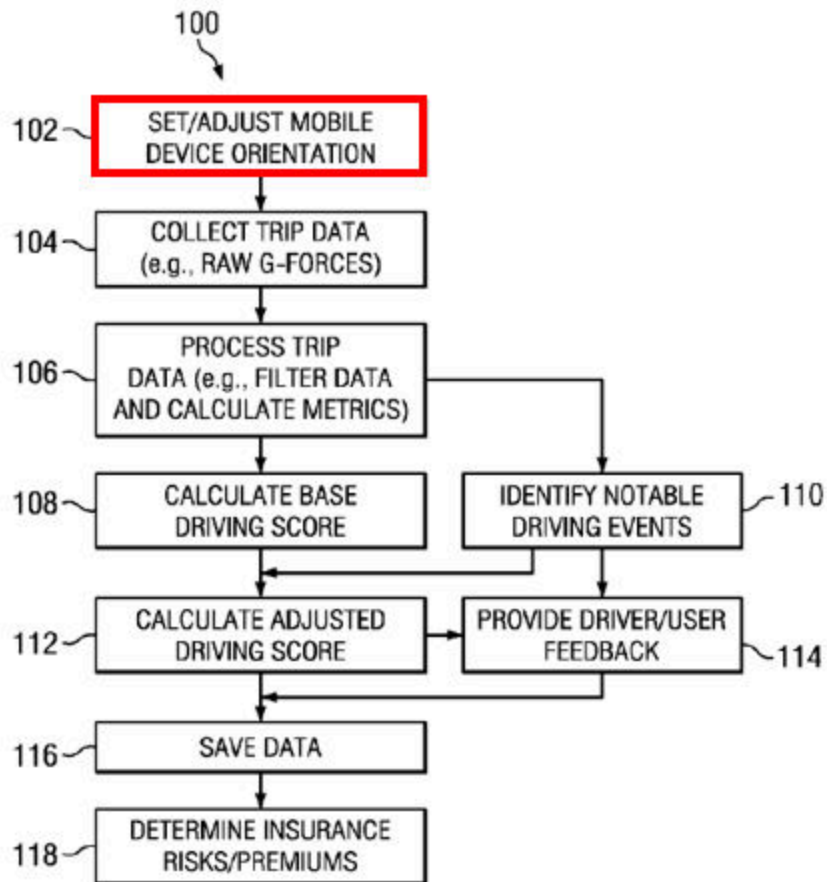


FIG. 4

USAA-1005, Fig. 4 (annotated)

102. As shown in Fig. 6A (reproduced below), a POSITA understand that user may be prompted for user input through its display by “a screen 200 of a device orientation feature” to position the device, e.g., “place [the] device...in a cup holder,” to ensure proper orientation suitable for collecting driving data, which starts only upon a determination of proper orientation. USAA-1005, [0151], [0077], [0036], Fig. 6A.

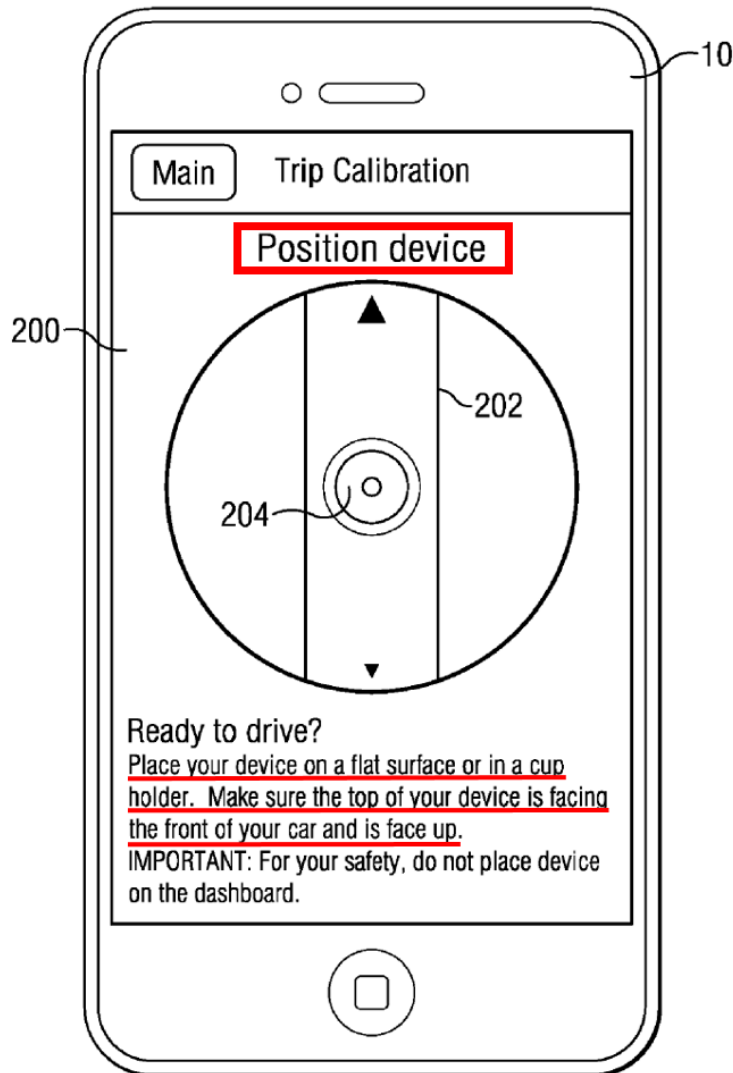


FIG. 6A

USAA-1005, Fig. 6A (annotated)

103. HMD 10 can also determine if it is “being properly oriented” based on the mobile device’s sensor data using, e.g., “GPS and position information.”

USAA-1005, [0037], [0152], [0040], [0067], [0036], [0029], [0077], Fig. 6A.

Using its sensors, the device 10 also “continue[s] to monitor the orientation of [HMD] 10 relative to the vehicle” during driving. USAA-1005, [0037]. In certain circumstances, interruptions can occur if device sensors detect that the device is not properly oriented during data collection. USAA-1005, [0036]-[0037], [0040]-[0041], [0152]-[0153].

104. The “handheld mobile device 10 may include...a driving analysis application,” which “may be downloaded via the Internet,” to “process any or all of [the] driving data collected by handheld mobile device 10...[and] to calculate one or more driving behavior metrics and/or scores based on such collected driving data,” while the vehicle is in use. *Id.*, [0020], [0022]-[0023], [0026], [0044], [0068]. For example, Peng’s “driving analysis application may calculate acceleration, braking, and cornering metrics based on driving behavior data collected by the built-in accelerometer,” “calculate scores based on such calculated metrics, e.g., an overall driving score,” and “identify ‘notable driving events,’...as well as the severity of such events.” *Id.*, [0020], [0022]-[0023], [0026], [0068], [0044]-[0054], [0069], [0074], [0136]-[0143], [0145], [0155]-[0156]. HMD can

further process driving data (e.g., metrics/scores) to determine NDE occurrences/severities. USAA-1005, [0022]. As Peng does not require input or consideration of vehicle sensor data, a POSITA would understand from Peng that these driving behavior metrics and/or scores can be derived without data from vehicle sensors. “[T]he driving analysis application may communicate some or all of such data via a network or other communication link for display by one or more other computer devices,” such as “a parent or driving instructor...monitor[ing] the driving behavior of a teen or student driver,” or “an insurance company...access[ing] driving behavior data...and us[ing] [the] data for risk analysis of a driver and determining appropriate insurance products or premiums for the driver[.]” *Id.*, [0024]; *see also Id.* [0004], [0074], [0143], [0165].

105. Regarding data storage, Peng explains that “raw or filtered data collected by data collection module 40 and/or any of the metrics, scores, or other data calculated or proceed [sic] by data processing module 42” can be stored “such that the data may be subsequently accessed, e.g., for display or further processing.” USAA-1005 (Peng), [0058]. For example, Peng discloses that certain data can be stored in short term memory of handheld mobile device 10 (e.g., in volatile memory), and certain data can be stored in long term memory of handheld mobile device 10 as historical driving data 46 (e.g., in non-volatile memory). *Id.*, [0058]. As an example of non-real time implementation, Peng states that “collected raw

data may be stored in first memory (e.g., cache or other volatile memory) during the data collection session; and then after the end of the data collection session, the collected data may be processed, displayed, [and] stored in second memory (e.g., stored in non-volatile memory as historical driving data 46).” USAA-1005 (Peng), [0073].

106. Peng acknowledges that “motor vehicle crashes are the number one cause of death for American teens” and “driving safety remains a critical issue in today's society.” *Id.*, [0002], [0003]. Peng recognizes that data can be “useful for predicting the occurrence of accidents as well as the amount of damage likely to result from such accidents” and “educat[ing] drivers about safe driving behaviors.” *Id.*, [0004], [0165].

2. *Overview of Chatterjee*

107. Chatterjee is directed to a system that includes a “docking station...for a computing device,” “such as a cellular or wireless telephony/messaging device.” USAA-1006 (Chatterjee), Abstract. Chatterjee also describes that its system integrates an accessory device by its description of using “two devices that are inductively coupled,” in which the devices “correspond to a mobile computing device (also referred to as an MCD) and an accessory device” such as “a dock or docking station” and “other types of devices” (e.g., “sticky (or piggy)-back accessory, a light projector, a speaker set, or headset station”). USAA-1006

(Chatterjee), [0064], [0057], FIGS. 1A-1B, 16A-20, 25, 29-34C. Chatterjee explains that “[a]n inductive signal transfer interface is included with the housing to inductively signal at least one of power or data to the [MCD].” USAA-1006 (Chatterjee), [0057]. Chatterjee explains that MCD can be “a mobile telephony/data messaging computing device, such as a cellular phone or mobile device with voice-telephony capabilities,” e.g., a “smart phone.” USAA-1006 (Chatterjee), [0090]-[0091]. Furthermore, Chatterjee teaches that the dock may be used as a “vehicle's docking station” in certain embodiments. USAA-1006 (Chatterjee), [0270], [0047], Fig. 33 (reproduced below).

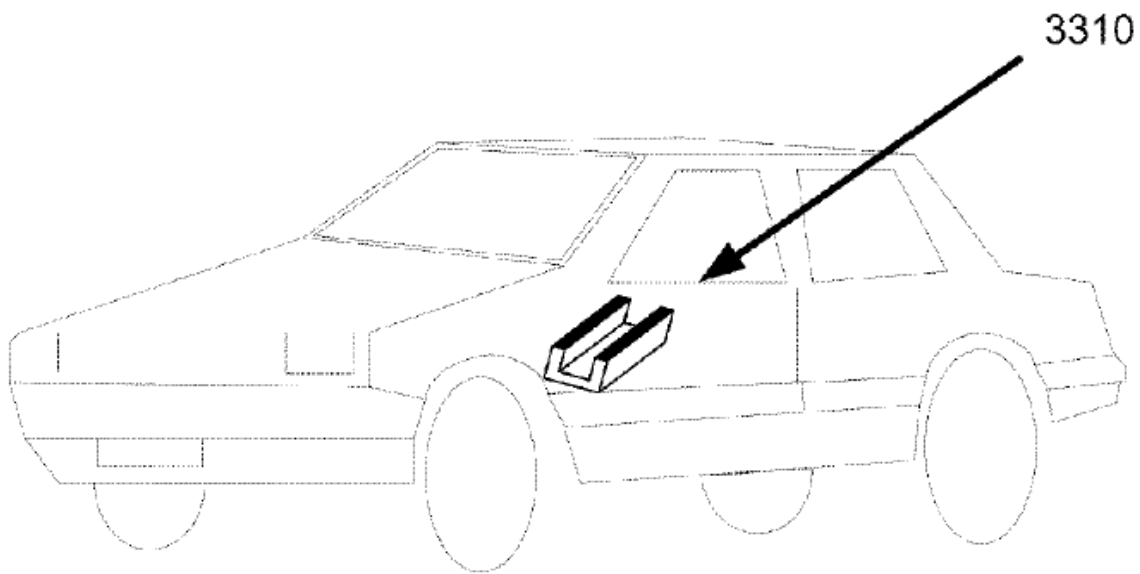
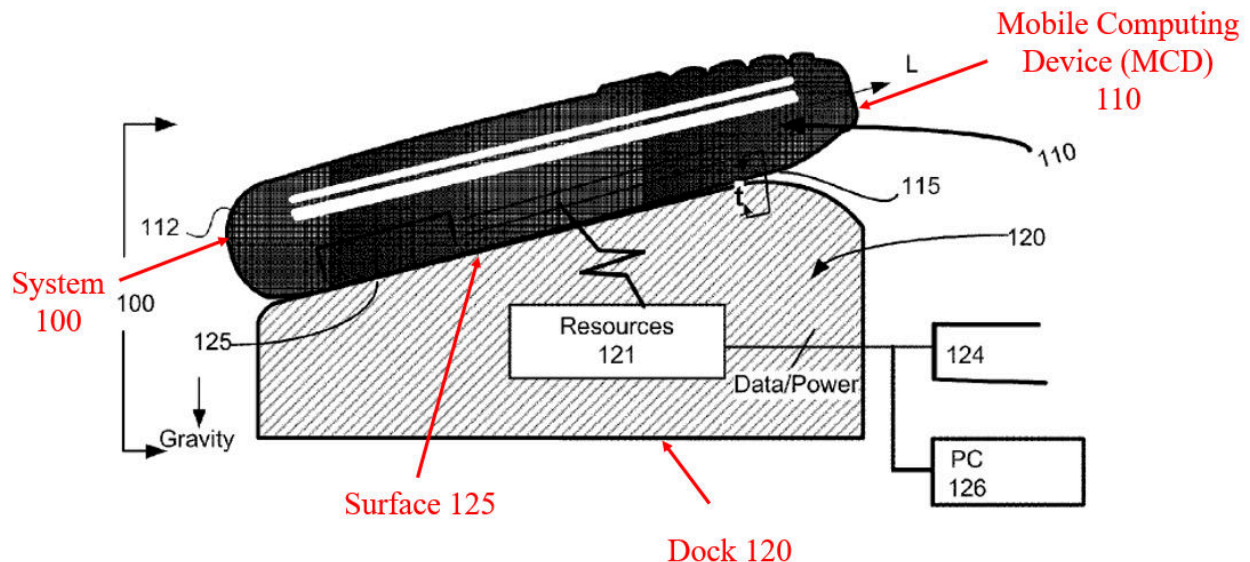


FIG. 33

USAA-1006 (Chatterjee), FIG. 33.

108. In an example, as shown in FIG. 1A (reproduced below), Chatterjee’s system 100 includes a MCD 110 retained by dock 120. USAA-1006 (Chatterjee), [0065]; *see also* FIGS. 1B, 5-6, 16A-20, 25, 29-34C. Chatterjee’s “docking station includes a housing comprising a receiving surface top” (e.g., surface 125), that “receive[s] and retain[s] the mobile computing device,” e.g., MCD 110. USAA-1006 (Chatterjee), Abstract, [0057]. “[D]ock 120 utilizes physical support structures...to retain the MCD 110 in a docked or mated position,” “such as “magnetic clasps, “shelves, platforms, hooks or mechanical retention features.”

USAA-1006 (Chatterjee), [0066], [0201]-[0214]. The MCD and/or the dock can detect when MCD is docked. USAA-1006 (Chatterjee), [0151]-[0152] (“the dock successfully detects the MCD 500”); [0182] (“MCD 1620 may include sensors or detectors that detect contact with the dock.”). In Chatterjee’s system, MCD can also “include[] one or more detectors 560 (or sensors) for detecting orientation or position of the MCD 500 when the device is docked to the accessory device.” USAA-1006 (Chatterjee), [0092].



USAA-1006 (Chatterjee), Fig. 1A (annotated)

109. In another example, Chatterjee describes that “an accessory device may be provided in the form of a ‘sticky-back’ device.” USAA-1006 (Chatterjee), [0107], Figs. 25, 5-6.

3. *Overview of Tamir*

110. Tamir is a U.S. patent focused on a traffic information system that evaluates driver behavior in a vehicle. USAA-1012 (Tamir), Abstract. It discloses a data collection technique in which “samples are collected at a dynamically adjusted rate[,]” by determining sampling rate “according to the location of the driving...” *Id.*, 9:10-20. For example, data collection can involve “accumulating more samples at areas where there are many accidents or near intersections.” *Id.* The sampling rate can also be adjusted according to “the time of day, date, and/or external conditions, such as weather conditions,” and “the driving behavior of the vehicle,” e.g., “increasing the sampling rate when reckless driving is identified.” *Id.*; *see id.*, 20:52-21:11.

4. *Overview of Katayama*

111. Katayama is a European patent application that describes a “driving recorder” that records “situation data” relevant to driving behavior, including sensor data indicating the “surrounding situation or the like of a motor vehicle during a certain period before and after a time of an accident or...risk incident” in which “a driver...is close to [being] involved in an accident....” USAA-1024 (Katayama), [0001]. Through “after-the-fact analysis” of recorded data the recorder can, for example, determine the cause of an accident. *Id.*, [0001]-[0002].

After-the-fact analysis of recorded data similarly allows for insights into driving behavior that may have contributed to the occurrence of a given “risk incident.” USAA-1024 (Katayama), [0001]-[0002]. The driving recorder can “prevent an accident by making [an] after-the-fact analysis on an ordinary driving or collect an objective evidence of a cause of the accident when the accident occurs.” *Id.*, [0002]. Figure 1 shows the driving recorder 1 is mounted on a vehicle.

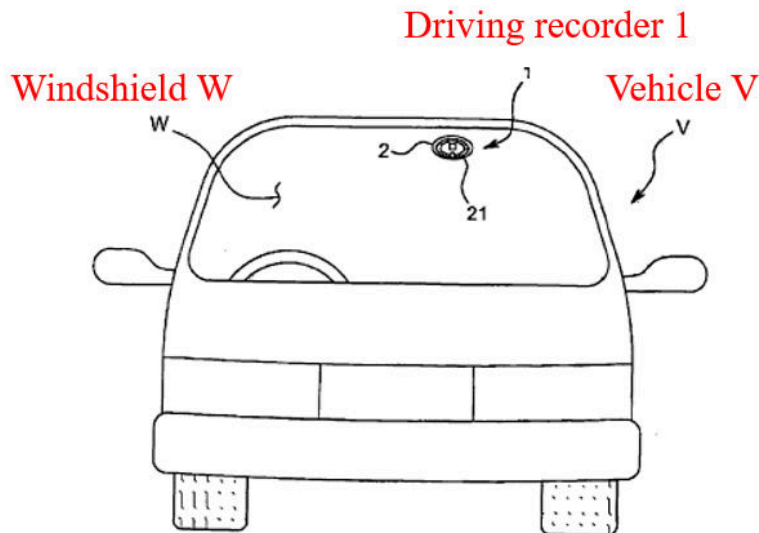


Fig.1

USAA-1024 (Katayama), Fig. 1

112. Figure 2 (below) shows an external perspective view of an exemplary driving recorder 1.

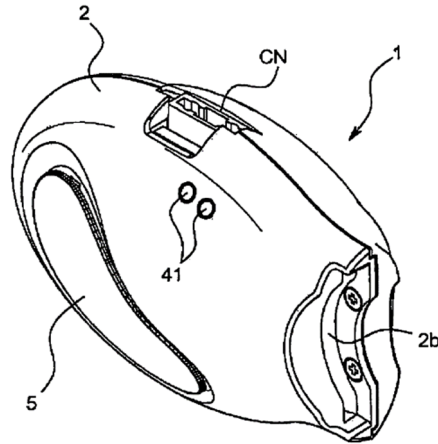


Fig.2

USAA-1024 (Katayama), Fig. 2

113. Recorder 1 detects occurrence of accidents and/or risk incidents based on the “situation data,” which includes sensor data such as “acceleration data indicating acceleration applied to a vehicle, position data indicating a position of the vehicle, speed data indicating a speed of the vehicle, brake data indicating whether or not a brake of the vehicle is activated, [and] door open/close data indicating whether a door is open or closed,” and “moving image data indicating an outside picture of the vehicle.” USAA-1024 (Katayama), [0013], [0019].

114. Figure 4 (below) depicts components of an exemplary recorder 1, including both internal sensors “CCD camera 31,” “acceleration sensor 32,” and “GPS receiver 33”, and an “internal memory 82” that is configured to store sensor data and related derived information, in addition to programs executed by “CPU

81.” USAA-1024, [0034], [0044]. As shown, components of an exemplary recorder 1 includes both internal sensors “CCD camera 31,” “acceleration sensor 32,” and “GPS receiver 33”, and an “internal memory 82” that is configured to store both data received from these and other sensors, and programs executed by “CPU 81.” USAA-1024 (Katayama), [0021], [0034], [0044]. Detection device 3 “senses the behavior, the surrounding situation, the operating condition or the like of [a] motor vehicle V and outputs situation data...” *Id.*

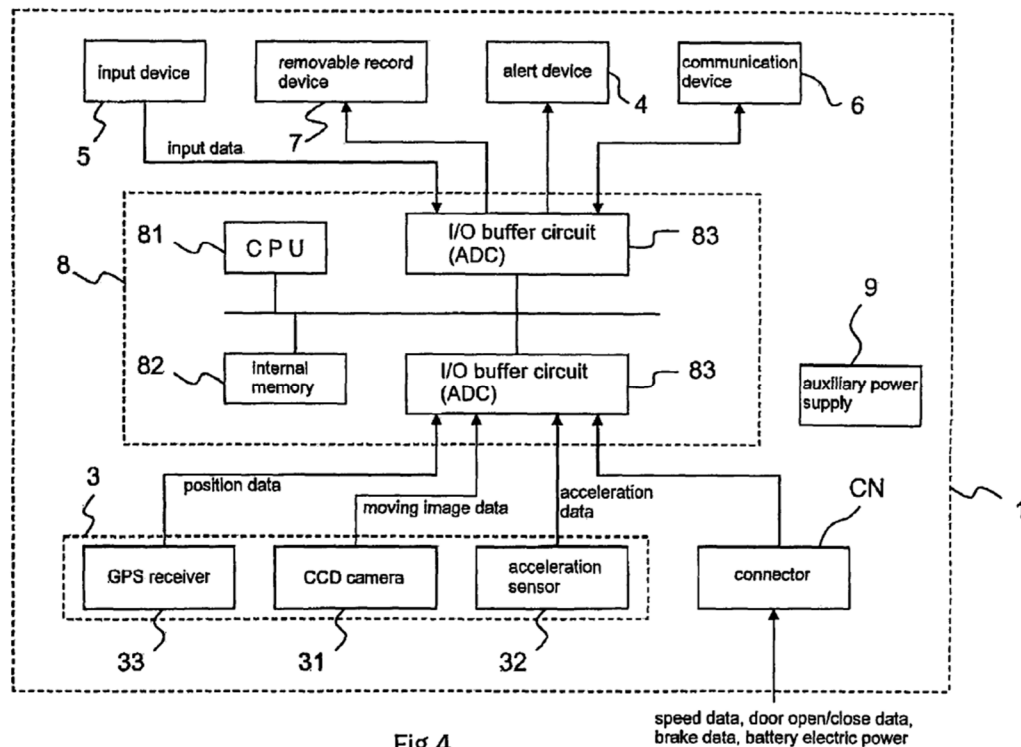


Fig.4

USAA-1024 (Katayama), Fig. 4

115. Katayama further discloses detecting whether “a hiyari hatto (risk incident) or an accident occurs,” then actions can be taken in response to the detected risk incident or accident. For example, Katayama describes that the

response can include “report[ing to] the driver about this event by means of light or sound by the alert device 4,” “verif[ying] the judgment [of a predetermined condition is satisfied] by means of, for example, input data (this is also one of the situation data) from the driver with an operation of ON/OFF of the button switch 5,” storing “situation data during a certain period before and after the situation data whose content meets the predetermined condition,” and “transmit[ing] the situation data stored in the situation data storage section 803 to the outside, the detachable record device 7.” USAA-1024 (Katayama), [0046], [0050], [0063].

116. Figure 5 (below) is a “functional block diagram” of the same “information processing device” depicted in Figure 4. USAA-1024 (Katayama), [0028], [0044]-[0045]. “As shown...each device is controlled...by operating the CPU 81 in accordance with programs stored in a predetermined area of the internal memory 82.” *Id.* As shown, Katayama’s data storage and management techniques use an information processing device 8 that includes a data receiving section 801, a temporary storage section 802, a situation data storage selection 803, a data administration section 804, a judgement criterion parameter storage section 805, and an internal memory 82 for storing programs (executed by CPU 81) to manage and store situation data. USAA-1024 (Katayama), [0044]. Figure 5 shows subcomponents of information processing device 8.

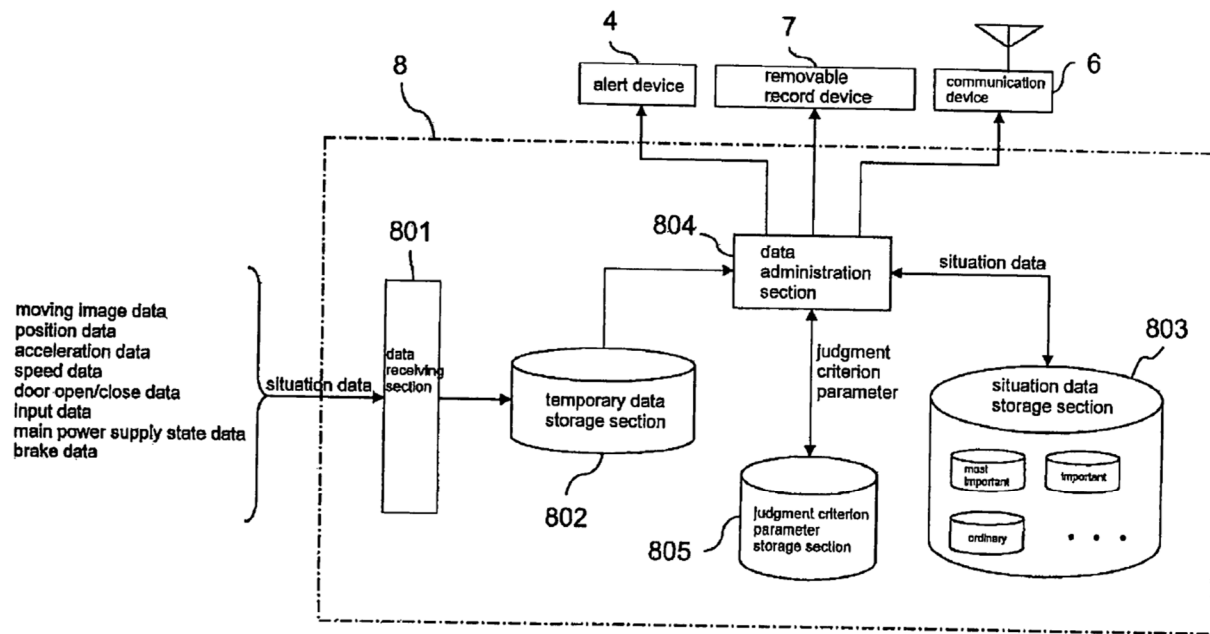


Fig.5

USAA-1024 (Katayama), Fig. 5

117. As described and shown, memory 82 features an architecture divided into multiple sections, including “data receiving section 801,” “temporary data storage section 802,” “situation data storage section 803,” “data administration section 804,” and “judgment criterion parameter storage section 805.” *Id.*, [0044]. In conjunction with this architecture, Katayama describes data handling techniques that enable “effective use” of the memory’s limited capacity such that “important data will not be erased,” and will instead remain available for easy and accurate “after-the-fact analysis” of accidents and/or risk incidents. *Id.*, [0016].

118. In more detail, data receiving section 801 receives “situation data” including sensor data “at a constant sampling time one after another in a

chronological order and writes the situation data” in temporary data storage section 802, which is set in another “predetermined area of the internal memory 82.”

USAA-1024 (Katayama), [0028], [0044]-[0045]. Due to that area’s limited capacity, “old data is sequentially erased” and replaced with “new situation data.”

USAA-1024 (Katayama), [0045].

119. To avoid erasure of situation data that might, for example, be useful in determining the cause of an accident or risk incident, a data administration section 804 “determines whether or not” temporarily stored situation data meets one or more predetermined criteria for long term recording and, if so, transfers that situation data from “temporary data storage section 802” to internal memory 82’s “situation data recording section 803.” *Id.*, [0001]-[0002], [0016], [0046]-[0050]. If so, the recorded situation data is for example classified with an identifier marking it as “important,”⁵ and then transferred with the identifier from “temporary data storage section 802” to long term “situation data recording section

⁵ Katayama describes a variety of potential categories of classification, with corresponding identifiers for each category; for example, “categories may be specified according to an event that is estimated to have occurred such as...an accident,” according to an “order of importance,” or “in accordance with a combination of the above or other category system.” USAA-1024, [0012]-[0016].

803.” *See* USAA-1024, [0001]-[0002], [0011]-[0016], [0027], [0046]-[0050], [0054], [0083]. In contrast, situation data that is classified with an identifier marking it as less than important remains in “temporary data storage section 802” until eventually overwritten with new data. *See* USAA-1024, [0011]-[0016], [0054].

120. Criteria used in determining whether to mark and/or transfer a given set of recorded accelerometer data may include, for example, “whether or not the acceleration” indicated by that data exceeds a “predetermined” threshold, and “whether or not the acceleration continues for more than or equal to a certain period [of time].” USAA-1024, [0047]-[0048]. Accelerometer data meeting either of these criteria may, for example, be marked with a corresponding identifier and transferred to long term storage in “situation data recording section 803.” *See* USAA-1024, [0011]-[0016], [0027], [0046]-[0050], [0054], [0083].

121. To enable these and other determinations to take place, “the value (the content) of each situation data is, for example, digitalized in accordance with the judgment criterion parameter” or parameters against which it will be compared, and the resulting “digitalized” values are temporarily stored. *See* USAA-1024, [0047]-[0049]. “[W]hether or not the content of each situation data meets” a “predetermined condition” for marking and/or transfer may then be judged based on logical comparisons between the stored values and the corresponding

parameter(s). USAA-1024, [0049]. For example, “concerning the acceleration,” the predetermined condition may be “satisfied at a time when...both the acceleration data exceeds the predetermined judgment criterion and the acceleration data continues over a certain period [of time].” USAA-1024, [0049].

5. *Overview of Balachandran*

122. Balachandran is a U.S. patent that describes an emergency response technique focused on “enabling emergency call initiations in response to the detection of a vehicle accident.” USAA-1007 (Balachandran), Abstract. Balachandran offers the driver an option to delay or abort an emergency call, such as 911, by “activat[ing] a timer 35 located within the cellular telephone 15. The timer 35 provides a preselected time delay before initiating an outgoing emergency call in response to detection of a vehicle accident.” *Id.*, 1:34-47, 2:53-56. Further, the cellphone can provide “[a]n audio or visual indication [that] notifies the passengers of activation [a] timer 35 and ceases with expiration or cutoff of the timer.” *Id.*, 2:46-63.

6. *Overview of Riemer*

123. Riemer describes “[a] portable device includes a safety feature that prevents some forms of use when the device is moving.” USAA-1028, Abstract. “The device may be a cell phone configured to disable transmission and reception of voice/text,” “if the cell phone is moving faster than walking speed,” such as

driving. USAA-1028, Abstract, [0002]. Riemer allows “overrid[ing] a blocking function and enable other functions” if there “a hands-free device” such as “a hands-free earpiece and microphone attachment” is used. USAA-1028, Abstract, [0074]. In this case, “the cell phone may further permit voice activated dialing and/or voice activated answering.” USAA-1028, [0066].

124. Riemer’s techniques can “add[] to or extend[] the functionality of a portable electronic device, its applications and the communications network it utilizes while a user with the device is driving,” “improve[] the safety of a driver while using a mobile device, its applications and services by allowing the driver of a motor vehicle to keep focused on the road and hands on the steering wheel instead of on the mobile device,” “while at the same time remaining connected automatically and transparently to other cell phone users via social networks, text messaging and emails USAA-1028, [0031], [0002].

7. Overview of Berkobin

125. Berkobin discloses “methods, systems, and apparatuses for determining driver behavior based on vehicle operating parameters and adjusting insurance premiums accordingly.” USAA-1010 (Berkobin), Abstract. Berkobin notes that the “methods and systems can employ Artificial Intelligence techniques such as machine learning and iterative learning[,]” such as “Bayesian networks,

behavior based AI, neural networks, fuzzy systems, evolutionary computation...”

Id., [0031].

XI. [GROUND 1A]- PENG AND CHATTERJEE RENDER CLAIMS 1-3, 5, 8, 16-23, 25, 28, 34, 37-54 OBVIOUS

126. For the reasons articulated in detail below, and based on my review of the '879 patent, the file history, and the prior art references cited here, it is clear that a POSITA would have readily understood that the teachings of Peng and Chatterjee makes the elements of claims 1-4, 6, 7, 9, and 13-26 obvious.

A. Proposed Combination

(a) *The Peng-Chatterjee Combination*

127. Peng describes a handheld mobile device 10 that is configured to “collect[] and evaluat[e] driving behavior data and/or driving environment data, and provid[e] feedback based on such evaluated data,” which can include calculating and providing “driving behavior metrics and/or scores based on [the] collected driving data.” USAA-1005 (Peng), [0001], [0068], [0021]; *see also id.*, Abstract, [0019], [0022], [0044], [0165].

128. In more detail, and as shown in Peng’s Fig. 4 (reproduced below), handheld mobile device 10, via a driving analysis application 50, performs the below exemplary method steps of providing driver feedback. USAA-1005 (Peng), [0075]-[0077], [0152]-[0153], [0057]-[0065], Figs. 4, 6A. As an initial matter, mobile device 10 determines whether it is “properly oriented” at step 102 before it

“begin[s] collecting driving data, i.e., start a data collection session, at step 104.”

Id. In doing so, handheld mobile device 10, via data collection module 40, can

“interact with the user to adjust the handheld mobile device 10 such that the orientation of handheld mobile device 10 is suitable for collecting driving data.”

USAA-1005 (Peng), [0076], Fig. 4.

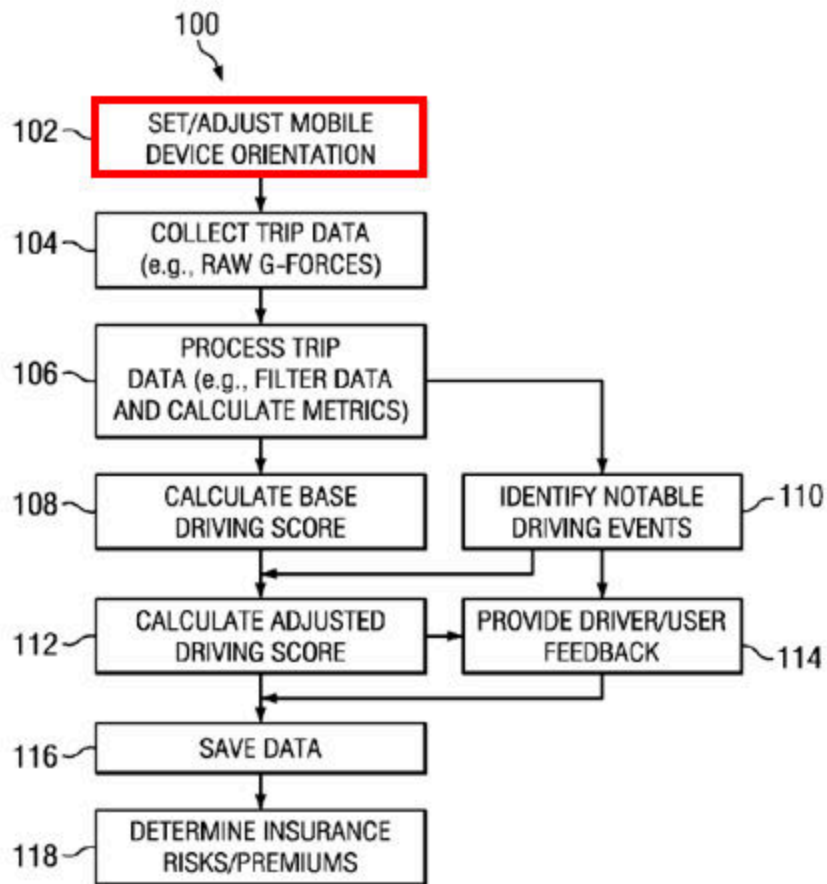


FIG. 4

USAA-1005 (Peng), Fig. 4 (annotated)

129. For example, as shown in Peng’s Fig. 6A (reproduced below), the user may be prompted by “a screen 200 of a device orientation feature” to “place [the]

device...in a cup holder” and to “[m]ake sure the top of [the] device is facing the front of [the] car and is facing up” to ensure proper orientation. USAA-1005 (Peng), [0151]. In this way, handheld mobile device 10 “assist[s] a user” with positioning the device 10 to obtain “the proper alignment or orientation of handheld mobile device 10 within the automobile or vehicle” so that “the physical orientation of handheld mobile device 10 is suitable for collecting driving data”. USAA-1005 (Peng), [0151], [0077], [0036], Fig. 6A. A POSITA would find implicit in this disclosure and thus would otherwise understand from this description that the device senses the need for repositioning/adjusting orientation, using its sensor data, because. Indeed, as illustrated by the example below, Peng indicates that the device is calling for user input through the display, by virtue of the user adjusting the device orientation.

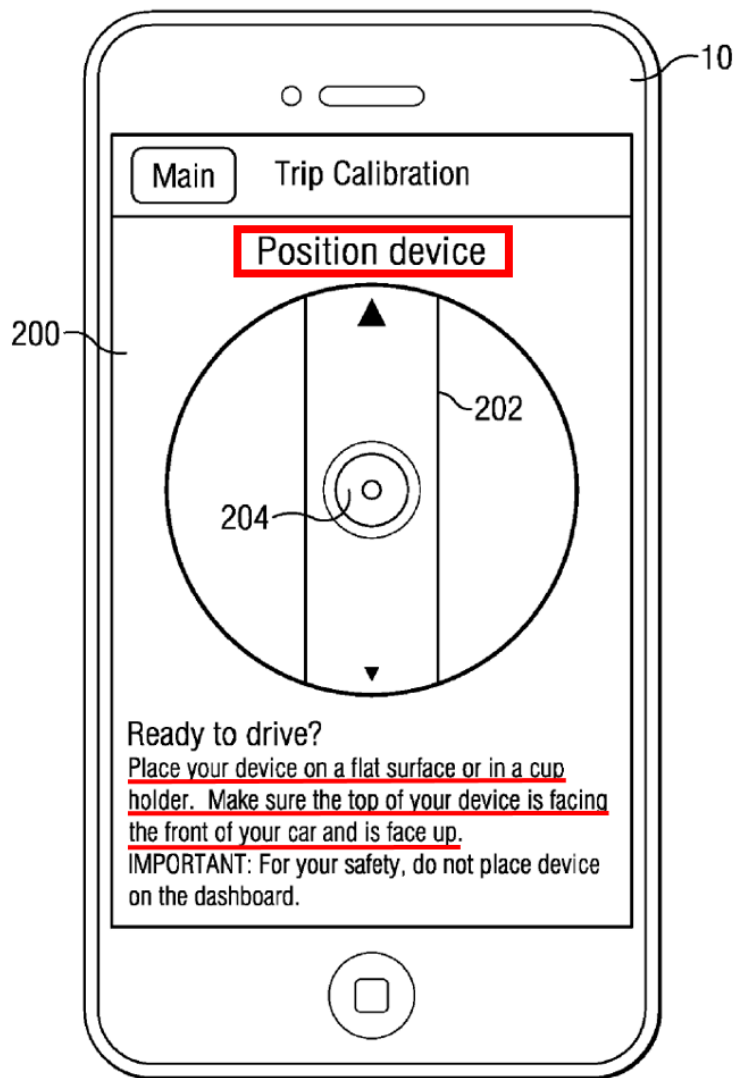


FIG. 6A

USAA-1005 (Peng), Fig. 6A (annotated)

130. As discussed above, Peng's handheld device 10 determines a start of a driving period, e.g., determines whether data collection can begin, during vehicle usage by determining whether the device 10 has been properly oriented by, e.g., using sensor data (GPS and position information). USAA-1005 (Peng), [0075]-[0077], [0152]-[0153], [0057]-[0065], Figs. 4, 6A. Once properly oriented, Peng's

handheld mobile device 10 includes one or more sensors such as a “built-in accelerometer 54” and “a location tracking system 56” (e.g., “GPS tracking system”) to collect one or more types of data regarding driving behavior and/or the driving environment. USAA-1005 (Peng), [0029], [0077]. And by using these one or more sensors, Peng’s handheld mobile device 10 can determine if it is “being properly oriented” based on the mobile device’s sensor data (e.g., “GPS and position information for the handheld mobile device 10”). USAA-1005 (Peng), [0037], [0152], [0040], [0067], [0036], Fig. 6A. Furthermore, handheld mobile device 10, via module 40, can “continue to monitor the orientation of handheld mobile device 10 relative to the vehicle during the driving data collection session.” USAA-1005 (Peng), [0037]. However, data collection can be interrupted if device 10 becomes improperly oriented during its collection process. USAA-1005 (Peng), [0036]-[0037], [0040]-[0041], [0152]-[0153]. Yet despite this, Peng describes positioning the device in a manner, e.g., on a flat surface of a console (*see* Fig. 1) or in a cup holder (Fig. 6A), that might leave the device vulnerable to orientation changes caused by vehicular movements.

131. Indeed, in certain circumstances, Peng acknowledges that interruptions may occur or that data compensation may be required if the device 10 is not properly oriented while data is being collected. USAA-1005 (Peng), [0036]-[0037]. For example, “data collection module 40 may allow or trigger the start and

stop (including interrupting and re-starting) of driving data collection based on the orientation of handheld mobile device 10 (relative to automobile 12).” USAA-1005 (Peng), [0036], [0040]-[0041] (“data collection or may include one or more interruptions []e.g., in some embodiments, if handheld mobile device 10 is moved out of proper orientation for data collection”), [0152]-[0153]. An interruption of data collection can initiate a new data collection session, e.g., a new driving session. USAA-1005 (Peng), [0040].

132. Considering that Peng already describes “interacting with the user...to manage the physical orientation of handheld mobile device 10” to “allow the driving data collection to...re-start after an interruption” has occurred and that the handheld mobile device 10 can determine if it is “properly oriented based on the mobile device’s sensor data”, it would have been obvious to a POSITA to have improved Peng’s system and to also include interactions with the user via user interface inputs and use sensor detection in the handheld mobile device of the combination to *prevent* interruptions caused by improper orientation from occurring in the first place. USAA-1005 (Peng), [0036]-[0037], [0067], [0152]-[0153]. A POSITA would have readily understood that a unsecured phone , e.g., one placed on an open flat surface as shown in Peng’s Fig. 1, or even in a cupholder as suggested by Peng’s Fig. 6A, is unstably positioned and therefore vulnerable to changes in orientation, such as sliding, tipping and/or falling, caused

by vehicle motion. A POSITA would have understood that a phone in an unsecured location, such as a cup holder, could be subject to sliding, tipping, etc.

133. Moreover, another readily known source of interruption would have been issues related to power consumption of the mobile device. USAA-1507 (Balasubramanian), 291 (“Energy on mobile phones is a precious resource.”); USAA-1508 (Carroll), 1 (“Mobile consumer-electronics devices, especially phones, are powered from batteries which are limited in size and therefore capacity. This implies that managing energy well is paramount in such devices.”), *id.* (“battery capacity is severely restricted due to constraints on size and weight of the device. This implies that energy efficiency of these devices is very important to their usability. Hence, optimal management of power consumption of these devices is critical.”). Because a mobile phone typically relies on a limited battery supply, a POSITA would have understood the potential risk that the phone’s power would quickly deplete from its active use for collecting and evaluating driving behavior, as described in Peng. *Id.* Thus, a POSITA would have appreciated the existence of an opportunity to improve Peng’s system, by, for example, ensuring reliable charging of handheld mobile device 10, and would have therefore sought related practical solutions. *Id.*

134. A POSITA would have readily found the solutions described in Chatterjee, and would have been motivated to pursue Chatterjee’s solutions in an

improved system; more specifically, the POSITA would have understood and found obvious that Peng's system would be improved by leveraging a dock, as taught by Chatterjee, to securely hold a portable device of the kind described by Peng, e.g., mobile device 10, when placed in a vehicle and subjected to vehicle motion and a POSITA would be naturally inclined toward a dock configured as suggested by Chaterjee to modify and/or detect orientation and the docked/undocked status based on Peng's disclosure of orientation detection.

USAA-1006 (Chatterjee), Abstract ("docking station includes a housing comprising a receiving surface top receive and retain the mobile computing device"), [0066] ("the dock 120 utilizes physical support structures (not shown), such as shelves, platforms, hooks or mechanical retention features, to retain the MCD 110 in a docked or mated position. In another embodiment, magnetic clasps may be included or provided the dock 120 and/or the MCD 110 to secure retention of the MCD against the dock"), [0003] ("[t]he use of docking stations and other accessory devices in connection with mobile computing devices (e.g. smart phones, media players etc.) is well known"). In the combination, Chatterjee's dock would be positioned within a vehicle in any suitable location to releasably attach the mobile device to the vehicle while it is being driven. Since mobile phones were used in a variety of circumstances, including in moving vehicles, it would have been obvious to a POSITA that the dock could advantageously secure the

device to a convenient location in a vehicle, such as the vehicle's console or windshield. USAA-1502 (Shawver), [0003], [0016], [0006], [0014]; USAA-1006 (Chatterjee), [0270]; USAA-1516 (Amigo), [0036].

135. As previously discussed, Chatterjee's system includes a dock that includes "a housing comprising a receiving surface top receive and retain the mobile computing device" in various ways, including mechanically, electrically, and logically. USAA-1006 (Chatterjee), Abstract, [0066], [0003], [0056]-[0057], [0060], [0064], [0069]-[0070]. For example, the dock can mechanically couple, for example, "utilize[] physical support structures," e.g., "magnetic clasps," "to retain the MCD 110 in a docked or mated position." USAA-1006 (Chatterjee), [0066], [0074]. Furthermore, Chatterjee explains that the dock can electrically couple to the mobile device by advantageously being "used to...recharge or supply power to the mobile computing device" as well as communicate data by means of a logical coupling. USAA-1006 (Chatterjee), [0003]; *see also* [0106] ("One primary purpose that the dock 600 may serve is to recharge or power the MCD using power communicated through the signal handler"). Consistent with Peng's focus on the use of one or more sensors within a handheld mobile device to gather data in a moving vehicle for the purpose of analyzing driving behaviors, Chatterjee describes its systems include a MCD that can "include audio and/or video playback or Global Positioning Services (GPS) as primary or enabled functions" and that the

docking station can be used in a vehicle, e.g., as a “vehicle's docking station.”

USAA-1006 (Chatterjee), [0270]. Also further consistent with Peng’s disclosure that a mobile device’s driving data collection is based on the orientation of handheld mobile device, Chatterjee describes that “orientation of the MCD on the dock may be changed by the user for purpose of configuring operations or behavior of one or both devices.” USAA-1005 (Peng), [0036]-[0037], [0067], [0076], [0151]; USAA-1006 (Chatterjee), [0065], [0092], [0097]-[0098], [0104], [0106], [0174]-[0177], [0182]-[0200], [0206].

136. Indeed, the combined disclosures of Peng and Chatterjee would have motivated a POSITA to supplement Peng’s teachings on obtaining “proper alignment or orientation of handheld mobile device 10 within the automobile or vehicle” by ensuring that the mobile device of the improved system could be removably attached to the vehicle via Chatterjee’s dock, as opposed to being placed on a flat surface or a cup holder where it might be subject to changes in orientations, such as sliding, tipping, and/or falling, and with related disruptions to data collection. USAA-1005 (Peng), [0036]-[0037], [0151], FIG. 6A; USAA-1006 (Chatterjee), [0002]-[0003], [0006], FIGS. 1-7. It would have been obvious to a POSITA to have removably attached the mobile device to the vehicle because a person typically takes the device along when leaving a vehicle. *Id.* Furthermore, a POSITA would have leveraged the teachings found in Chatterjee of using an

improved system in which the mobile device and/or the dock can inductively couple with each other and allow them to communicate with each other and to detect when the mobile device has been docked and in its proper orientation or position when docked. USAA-1006 (Chatterjee), [0092] (“MCD includes one or more detectors 560 (or sensors) for detecting orientation or position of the MCD 500 when the device is docked to the accessory device”), [0097]-[0098], [0104] (“dock 600 includes an orientation detection mechanism 612 that may detect the orientation of the MCD in the docked position”); [0200]-[0232]. In doing so, a POSITA would have found obvious that, in the combination, the handheld mobile device would have been able to detect its docking status as well as verify its proper positioning when docked prior to driving data being collected. *Id.* And by detecting its own docking status and assessment of whether it was properly oriented (e.g., landscape vs. portrait), the handheld mobile device would have prompted a user to dock the device or properly position the device (e.g., changing from landscape to portrait or vice versa), e.g., by aligning the arrow as shown in Peng’s Fig. 6A. *Id.*

137. In more detail, based on Peng’s explicit disclosure describing how handheld mobile phone 10’s user interface prompts user input and its one or more sensors determine proper orientation of the mobile device 10 within a vehicle, it would have been obvious to a POSITA to have extended Peng’s teachings to

incorporate the determination of the a start of a driving period during vehicle usage based on whether the mobile device was properly docked within a moving vehicle. Based on Peng's teaching of determining a start of driving activity (e.g., starting data collection) based on both user input and sensor data and by further leveraging orientation data to define periods of driving activity, the proposed combination would "trigger[s] the start and stop...of driving data collection" based on whether the mobile device is removably attached (e.g., docked) to the dock and properly oriented. USAA-1005 (Peng), [0036].

138. As I have illustrated below, in the proposed combination, it would have been obvious to a POSITA to configure the mobile device to prompt user input by requesting that the user place the mobile device in a dock attached with the proper orientation (e.g., using arrow on device's screen) to the vehicle to securely affix the handheld mobile device to the vehicle and maintain a suitable orientation to the device when the vehicle is moving. USAA-1005 (Peng), Fig. 6A; USAA-1006 (Chatterjee), [0066] ("magnetic clasps may be included or provided the dock 120 and/or the MCD 110 to secure retention of the MCD against the dock..., to physically retain the MCD 110 in a docked position with the dock 120"), [0205] ("magnetic clasping may be used to firmly grip two devices together in anyone of multiple possible or desired positions. Moreover, magnetic clasping enables the user to simply place the MCD onto the receiving surface of the dock").

Accordingly, it would have been obvious that the device in the combination determines a start of a driving period during vehicle usage based on user inputs (e.g., inputs to user interface prompts shown by the display) for properly orienting the device and/or adjusting the device's orientation when releasably attaching (e.g., docking) the mobile device to the dock. USAA-1006 (Chatterjee), [0174]-[0176], Fig. 15.

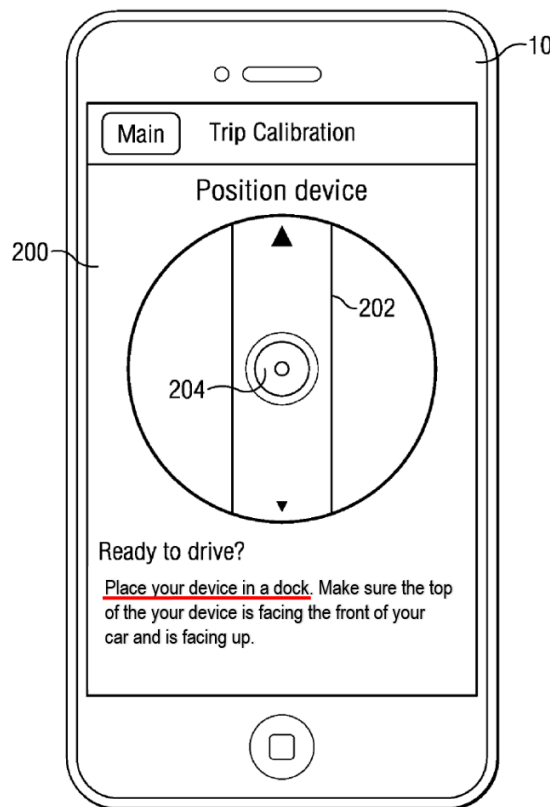


FIG. 6A

USAA-1005 (Peng), Fig. 6A (modified with Chatterjee's teaching)

139. Specifically, Chatterjee describes “magnetic claspings may offer several benefits, including the ability to enable the orientation, by which the MCD

is docked, to be altered.” USAA-1006 (Chatterjee), [0206]. Like Peng, Chatterjee recognizes that “the orientation of the MCD on the dock may be used to affect the state, mode or functionality of the MCD and/or dock.” USAA-1006 (Chatterjee), [0206]. Thus, it would have been obvious to a POSTIA to configure the mobile device in a dock attached to the vehicle using “magnetic clasping” to allow the user to alter the orientation, as taught by Chatterjee, to “affect the state, mode or functionality of the MCD and/or dock” such as “allow the user to adjust the handheld mobile device 10 such that the orientation of handheld mobile device 10 is suitable for collecting driving data” and “allow data collection to begin or continue.” USAA-1005 (Peng), [0037].

140. Since Chatterjee describes that “the orientation of the device when docked may be selected by the user in order for the user to enter a form of input or command as to how one or both devices (either combined or independently) operates,” a POSITA would have found it obvious that the combination device would have relied on user input for starting a driving activity (e.g., a start of a driving period) during vehicle usage based on its detection of the user having releasably attached (e.g., docked) the mobile device with a proper orientation for collecting driving data. USAA-1006 (Chatterjee), [0175]-[0176] (“the orientation in which the MCD is placed on the dock is selectable by the user, and that the orientation may determine or configure functionality of either device”), Fig. 15.

Thus, in the combination, the handheld mobile device would have relied on user inputs for determining a driving period by, for example, prompting the user to provide a proper orientation of the device and/or adjust the device's orientation based on the user interface prompts and the device display (e.g., arrow shown in Fig. 6A) when releasably attaching (e.g., docking) the mobile device to the dock. USAA-1006 (Chatterjee), [0175]-[0176], Fig. 15.

141. Peng also describes that handheld mobile device 10 includes one or more sensors, such as an accelerometer and GPS sensors, which may be used to determine the orientation angle and relative position status of the mobile device with respect to the vehicle, respectively; thus, it would have been obvious to a POSITA to have leveraged those same one or more sensors to determine whether the *Peng-Chatterjee* device is releasably attached (e.g., docked) within a moving vehicle in a couple of different ways. USAA-1005 (Peng), [0021], [0037], [0151]-[0152], [0040], [0067], [0036], Fig. 6A; USAA-1006 (Chatterjee), [0092].

142. As a first example, it would have obvious for a POSITA to have applied Peng's teachings to use the handheld mobile device's positional data to include the dock when determining a start of a driving period in which the mobile device was properly docked during vehicle usage. USAA-1005 (Peng), [0037]. Indeed, both Peng and Chatterjee disclose that mobile devices can include one or more sensors to determine position of the phone within the vehicle. USAA-1005

(Peng), [0037] (“determine the orientation of handheld mobile device 10 within the vehicle by comparing GPS and position information for the handheld mobile device 10 with GPS and position information for the vehicle 12.”); USAA-1006 (Chatterjee), [0092] (“MCD 500 includes one or more detectors 560 (or sensors) for detecting...position of the MCD 500 when the device is docked to the accessory device”), [0097]-[0098]. The use of GPS and positional sensor data technology was well-known by the Critical Date and would have provided a readily viable means for determining that a mobile device has been properly docked within a vehicle based on its location. USAA-1032 (Mohan), 1-7.

143. Accordingly, a POSITA would have found it obvious to determine a start of a driving period in which the *Peng-Chatterjee* handheld mobile device was releasably attached (e.g., docked) to the dock during vehicle usage by using data collected by device 10’s built-in sensors.

144. As a second example, it would have obvious for a POSITA to have applied the teachings in Peng, in addition to those found in Chatterjee, of using the handheld mobile device’s accelerometer (e.g., measuring “angular orientation” data) to include the dock in its determination of a start of a driving period in which the mobile device was releasably attached (e.g., properly docked) during vehicle usage based on the device’s angular orientation . For example, Peng discloses that handheld mobile device 10 can “indicate the physical orientation (e.g., angular

orientation) of handheld mobile device 10 relative to the automobile” to assess “proper alignment or orientation.” USAA-1005 (Peng), [0151]; Fig. 6A. Also, it was well-known in the prior art that a processor of a mobile device may leverage an accelerometer, such as that found in Peng’s device 10, to determine both an orientation angle and motion status of the device, and that such sensor data can in turn be leveraged to determine whether the device is docked with the desired orientation within a moving vehicle. USAA-1006 (Chatterjee), [0070]; USAA-1013 (Rabu), 3:1-10, 4:21-33, Figs. 1, 4. Indeed, Chatterjee also describes that a mobile device can “be equipped with orientation sensors such as accelerometers in order for the device to detect its own orientation” and “include functionality that enables or automatically performs based on its orientation on the dock 120” such that the mobile device can “communicates its orientation to the dock.” USAA-1006 (Chatterjee), [0070]; *see also* [0092] (“MCD 500 includes one or more detectors 560 (or sensors) for detecting orientation...of the MCD 500 when the device is docked to the accessory device.”), [0106] (“dock 600 detects an orientation of the MCD and then communicates the orientation information to the MCD.”); [0182]-[0191], [0198], [0097]-[0098], [0104]. Thus, a POSITA would have found it obvious to determine the driving period in which the handheld mobile device in the combination was releasably attached (e.g., properly docked)

in the dock within the moving vehicle using sensor data measured by the mobile device's built-in accelerometer.

145. The POSITA would have found obvious that enhancing Peng's system to use a dock, as taught by Chatterjee, to determine a start of the driving period while the device is removably attached to a vehicle via the dock and while the vehicle is in use, would introduce multiple advantages, as explained below.

146. First, The POSITA would have understood and found obvious that enhancing Peng's system to use a dock, as taught by Chatterjee, to hold and connect with the mobile device while in a moving vehicle, would increase reliability of securely holding the handheld mobile device and maintaining its initially set orientation while the vehicle is in motion, with correspondingly fewer interruptions requiring the re-starting of driving data collection. USAA-1006 (Chatterjee), [0066] ("dock 120 utilizes physical support structures...to retain the MCD 110 in a docked or mated position"), [0070], [0003]-[0005]; USAA-1005 (Peng), [0036] ("data collection module 40 may allow driving data collection to be manually or automatically...re-started after an interruption...only if the physical orientation of handheld mobile device 10 is suitable for collecting driving data"), [0040].

147. Second, the POSITA would have understood and found obvious that enhancing Peng's system to use a dock, as taught by Chatterjee, to hold and

connect with the mobile device while in a moving vehicle, would enhance utility in “recharg[ing] or supply[ing] power to the mobile computing device.” USAA-1006 (Chatterjee), [0003] (“docking stations are used to (i) recharge or supply power to the mobile computing device”), [0060] (“a mobile computing device (‘MCD’) and docking station (‘dock’) are individually equipped with features and components that enable charging/power signals to be communicated from the dock to the MCD without use of connectors”), [0067] (“dock 120 may include resources 121 for generating or extending power and/or data signals to the MCD 110”), *id.* (“dock 120 may be mated with a power outlet 124”); USAA-1005 (Peng), Fig. 1 (showing a wired connection between the mobile device and vehicle); USAA-1502 (Shawver), [0003] (“Portable-device docking platforms also provide connections to external power sources and various accessories”).

148. Third, the POSITA would have understood and found obvious that enhancing Peng’s system to use a dock, as taught by Chatterjee, to hold and connect with the mobile device while in a moving vehicle, would enhance utility by logically (e.g., inductively) linking the mobile device to the dock so that the “dock and/or MCD may exchange or transmit data signals to the other device when the MCD is retained against the dock” “through one or more connector-less connection.” USAA-1006 (Chatterjee), [0060], [0064] (“devices are interconnected through one or more connector-less connections”), [0003] (“enable

the computing device to communicate with other devices connected to the docking station”), [0047]; USAA-1005 (Peng), [0021] (“handheld mobile device 10 may collect certain driving data...from sensors and/or devices external to handheld mobile device 10”), [0014], Fig. 5; USAA-1502, [0003] (“Portable-device docking platforms also provide connections to external power sources and various accessories”).

149. Fourth, the POSITA would have understood and found obvious that enhancing Peng’s system to use a dock, as taught by Chatterjee, to hold and connect with the mobile device while in a moving vehicle, would increase safety because, in the combination, when the mobile device is being used by the driver of a moving vehicle, the dock can allow the device to be rigidly mounted on the vehicle’s dashboard or console, rather than in a location (e.g., flat surface, a cup holder) that may not secure the device to a particular orientation and location while the vehicle is in motion, and subsequently cause a distraction to the driver, e.g., one trying to reach a moved or dropped device. USAA-1005 (Peng), Figs. 1, 6A; USAA-1006 (Chatterjee), [0066] (“magnetic clasps may be included or provided the dock 120 and/or the MCD 110 to secure retention of the MCD against the dock”); USAA-1502 (Shawver), [0003]; USAA-1516 (Amigo), Abstract (“smartphone holder is configured to keep the smartphone in a stable, known position and orientation with respect to the vehicle”), [0004]-[0005].

150. Fifth, the POSITA would have understood and found obvious that enhancing Peng's system to use a dock, as taught by Chatterjee, to hold and connect with the mobile device while in a moving vehicle, would increase convenience for a user to operate by using a single hand the mobile device when the device is rigidly mounted to the vehicle's dashboard or console, as compared to when the device is not secured to its location and/or is positioned in an awkward location, e.g., placed in a cup holder. USAA-1005 (Peng), Figs. 1, 6A; USAA-1006 (Chatterjee), [0192] ("enable the call to be answered or handled easily without de-docking the device"), *id.* ("the user may be enabled to lightly tap a display of the MCD 1620 in order to direct the MCD 1620 to enter speaker-phone mode (without dislodging the device from the dock 1610)"); USAA-1502 (Shawver), [0007] ("mounting platform is used to hold the device, the PDA can be operated by a single hand....This is especially useful when the device is to be used in a moving vehicle"), [0013], [0003].

151. Sixth, the POSITA would have understood and found obvious that enhancing Peng's system to use a dock, as taught by Chatterjee, to hold and connect with the mobile device while in a moving vehicle would reduce noise and error in the collected data and reduce complexity in the processing of the collected data caused by reduced movement associated with the mobile device itself. USAA-1005 (Peng), [0037]-[0038]; USAA-1516 (Amigo), [0036] ("The stable

position and orientation of the smartphone 200 enables data from telematics sensors within the smartphone, such as accelerometers, to accurately reflect the behavior of the vehicle.”), [0038] (“If the smartphone is present in a vehicle, for example in the driver's pocket, then the smartphone acceleration information may somewhat reflect the acceleration behavior of the vehicle. However, **because the smartphone is free to move and jostle about within the driver's pocket, the acceleration data from the smartphone cannot be correlated directly to vehicle acceleration behavior. If the smartphone is instead placed in a holder that is directly, physically connected to the vehicle and prevents the smartphone from moving with respect to the vehicle, then the acceleration information provided by the smartphone is more closely correlated to vehicle acceleration.**”), *id.* (“Accelerometers are also useful because they can provide information that a vehicle computer may not be able to provide” and can “allow the vehicle behavior to be captured more accurately”). A POSITA would have readily understood that it is easier to process and interpret data (e.g., acceleration data from an accelerometer) if the mobile device is not moving around inside the vehicle because this would minimize deviations, error, and/or noise associated with distinguishing data attributed to mobile device movement from those attributed to vehicle movement.

152. These advantages would have motivated a POSITA to integrate Chatterjee's teachings such that the mobile device, in the combination, can determine a start of the driving period while mobile device is removably attached to a vehicle via a dock, as taught by Chatterjee and other related art, and while the vehicle is in use. USAA-1005 (Peng), [0014], [0021], [0036], Fig. 1, 5, 6A; USAA-1006 (Chatterjee), [0003], [0005], [0007], [0011], [0013]-[0014].

153. Configuring Peng's system to use Chatterjee's teachings and other related art in the proposed combination for using and applying a dock in a vehicle would have required only routine technical knowledge. This was well within the skill of a POSITA prior to the earliest effective filing date of the '879 patent. The proposed changes described above would have amounted to nothing more than the use of a known technique of attaching a dock to a vehicle and combining prior art elements according to known methods to yield the predictable results described above.

154. Furthermore, the elements of the resulting combination would each generally perform functions they had been known to perform prior to the combination—the handheld mobile device of the proposed combination would perform the same functions, as disclosed by Peng, to check for proper device orientation as well as collect and process driving information, but would leverage the techniques provided by Chatterjee's disclosure when mobile device performs

those functions while the mobile device is docked. Accordingly, a POSITA would have expected success when incorporating Chatterjee's teachings into Peng's systems, as described above.

B. Analysis of Claims 1-3, 5, 8, 16-23, 25, 28, 34, 37-54

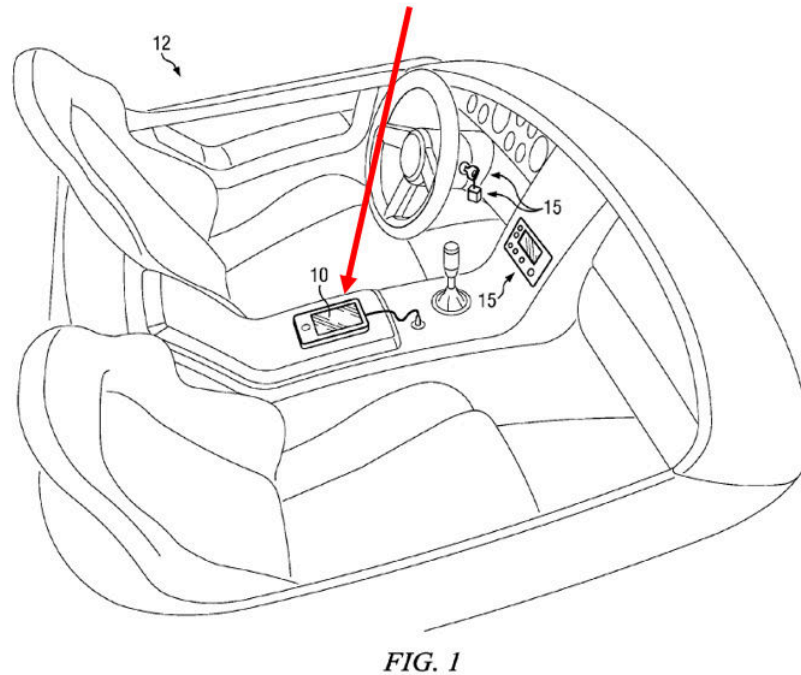
1. Claim 1

[1.1] A mobile telecommunications device configured to log driving information associated with a vehicle,

155. To the extent that the preamble is limiting, *Peng-Chatterjee* renders it obvious. As shown below, Peng includes a handheld mobile device 10 ("***mobile telecommunications device***"), which may be "any type of portable or **mobile electronics device**,"⁶ such as...a mobile telephone...or any other portable electronics device," for example, "a smart phone, such as an iPhone." USAA-1005 (Peng), [0019], Fig. 1. Furthermore, "data sources [are] accessible to handheld mobile device 100 [sic] by...**telecommunication** links." USAA-1005 (Peng), [0033].

⁶ Unless otherwise indicated, all emphasis has been added in this document.

Handheld mobile device 10
("Mobile telecommunications device")



USAA-1005 (Peng), Fig. 1 (annotated)

156. From this and related description, a POSITA would have understood and found it obvious that the proposed handheld mobile device is a mobile telecommunications device. USAA-1005 (Peng), [0019] ("handheld *mobile device* 10"), [0033], Figs. 1, 5. For example, the "iPhone 3G" smart phone described by Peng was a 3G wireless mobile telecommunications device additionally featuring Bluetooth and other wireless connectivity means; the iPhone 3G included GPS and accelerometer sensors, a processor, and flash memory for internal storage. USAA-1005 (Peng), [0033] ("device 10 may communicate with data source...external to handheld mobile device 10 via...*Bluetooth® or other*

wireless means, optical signal transmission, or any other known manner.”); USAA-1036, 1-4 (describing Bluetooth pairing of the iPhone 3G to a vehicle’s computer system); *id.*, 6-8, 10-12; *see also* USAA-1016, ¶¶[0046]-[0063], FIG. 3. As shown below, the iPhone 3G further included a user interface in the form of a touchscreen and various buttons enabling a user to interact with downloaded applications. USAA-1005 (Peng), 1:22-27; USAA-1034, 37-63; USAA-1036, 6-7, 32-51, 103-108. The included “Maps” application, for example, provided users with “detailed driving directions.” USAA-1036, 36, 103-108.



USAA-1036, 54 (left), 106 (right)

157. Consistent with the above discussions, a POSITA would have found obvious based on Peng’s disclosure that the *Peng-Chatterjee* combination is “configured to provide one or more features of a driving analysis system, such as

(a) **collection of driving data** (e.g., data regarding driving behavior and/or the respective driving environment)” (“*configured to log driving information associated with a vehicle*”). USAA-1005 (Peng), [0020]. More specifically, it would have been obvious from Peng’s teachings to have configured the combination to include a driving analysis application 50 that can, via a data collection module 40, “manage the collection of driving data, including driving behavior data and/or the driving environment data,” such as “collect[ing] such data from any number and types of data sources, including (a) data sources provided by handheld mobile device 10 (e.g., sensors 34, environmental data application 58), (b) data sources in vehicle 12 but external to handheld mobile device 10...and/or (c) data sources external to vehicle 12[.]” USAA-1005 (Peng), [0033], [0032], [0022], [0042] (“data...may be time stamped”); *see also* [0020]-[0021], Figs. 2, 6A-6G.

158. From this and related description, a POSITA would have understood and found it obvious based on Peng’s disclosure that, in the combination, the mobile telecommunications device is configured, among other things, to log driving information associated with a vehicle. USAA-1005 (Peng), [0019], [0020], [0022], [0032]-[0033]; *see also* [0020]-[0021], Figs. 1-2, 6A-6G. Thus, *Peng-Chatterjee* renders obvious [1.1].

[1.2] a sensor set comprising an image sensor, an audio sensor, an accelerometer or a positioning module, or a combination thereof;

159. Consistent with the figure shown below and with Peng's disclosure, it would have been obvious that the proposed combination would have been configured to feature one or more sensors 34 ("***a sensor set***"), which can include a built-in accelerometer 54 ("***accelerometer***"), a location tracking system 56, e.g., a GPS tracking system ("***positioning module***"), a camera ("***image sensor***"), and voice activated interfaces ("***audio sensor***"). USAA-1005 (Peng), [0021], ("handheld mobile device 10 may include a GPS (global **positioning system**) device or any other device for tracking the geographic location of the handheld mobile device"), *id.* ("handheld mobile device 10 may include a **built-in accelerometer** configured to detect acceleration in one or more directions"), [0023], [0029] ("handheld mobile device 10 may include a location tracking system 56, such as a GPS tracking system or any other system or device for tracking the geographic location of the handheld mobile device"), *id.* ("mobile device 10 may also...a camera"), [0031], Fig. 2; USAA-100F, 1-2; USAA-100G, 86-87, 107.

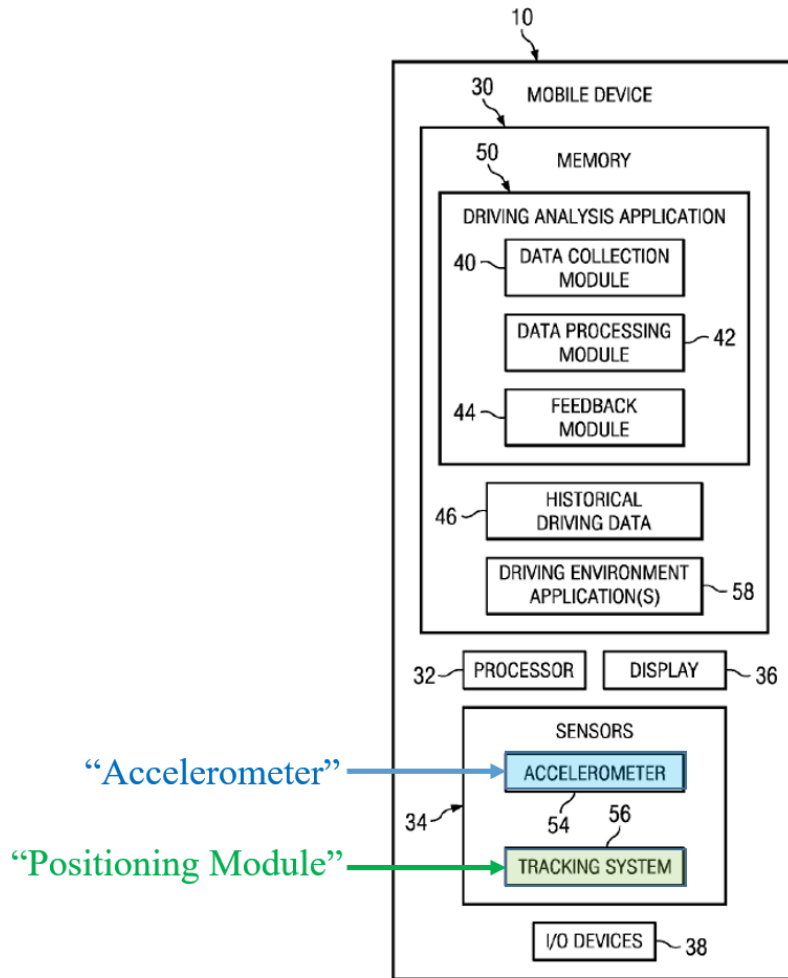


FIG. 2

Peng, Fig. 2 (annotated)

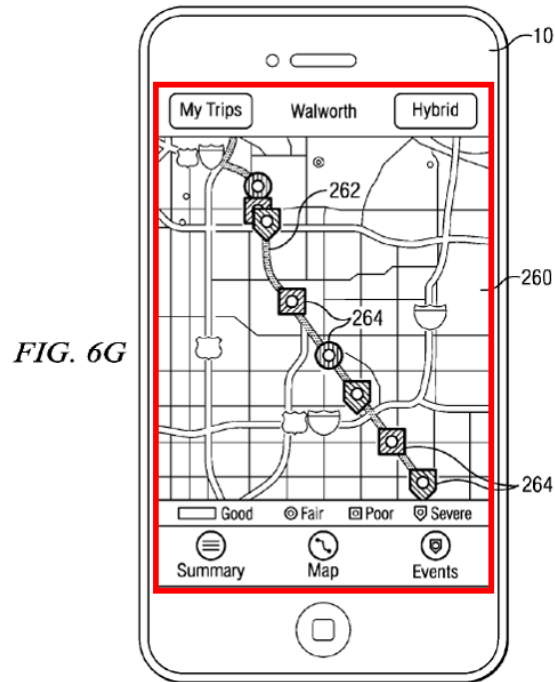
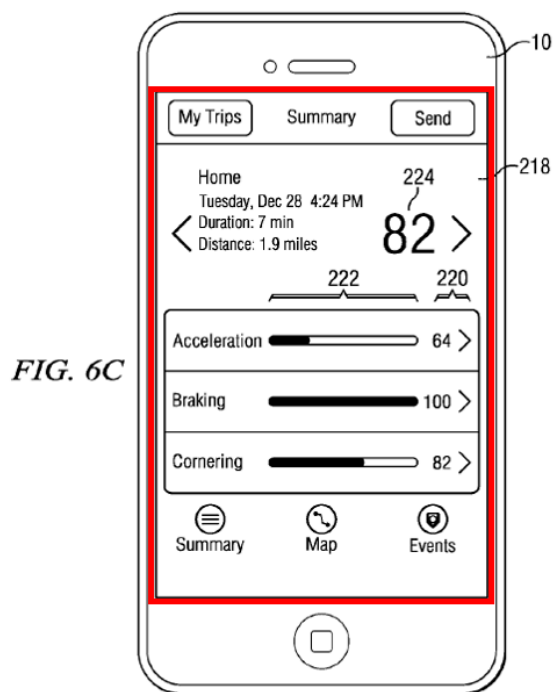
160. It would have been obvious to a POSITA that in the combination, data from the handheld mobile device's one or more sensors, e.g., "driving related data," and driving information derived from that data, e.g., "driving behavior metrics and/or scores based on such collected driving data," are used for various applications, such as "improv[ing] driving safety" by "monitor[ing] the driving behavior of a teen or student driver," and "determining the proper cost of an

insurance policy.” USAA-1005 (Peng), Abstract, [0022], [0002]-[0003], [0024].

Thus, *Peng-Chatterjee* renders obvious [1.2].

[1.3] a user interface;

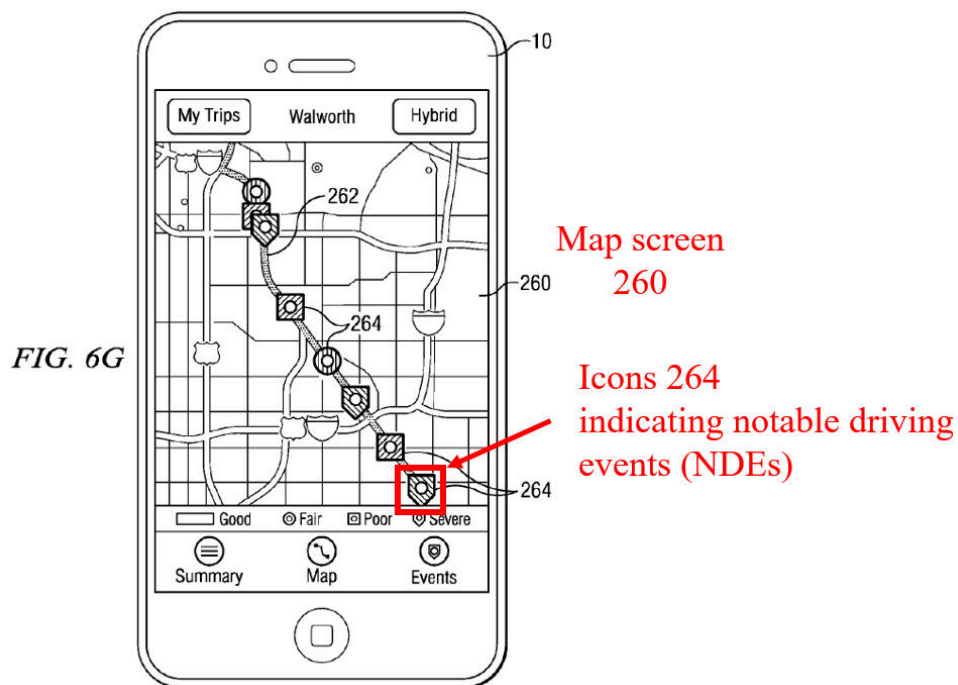
161. It would have been obvious to a POSITA that the proposed handheld mobile device would be configured to include a user interface as described by Peng. For example, Peng discloses “manag[ing] **user interactions** with application 50 via input/output devices 38 (e.g., **a touchscreen display 36, keys, buttons, and/or other user interfaces**).” USAA-1005 (Peng), [0062], [0063], FIGS. 6A-6G.



USAA-1005 (Peng), Fig. 6C (annotated, left), Fig. 6G (annotated, right)

162. Based on Peng’s disclosure, it would have been obvious to configure the combination to include “[i]nput/output devices 38 [that] may include **any suitable interfaces** allowing **a user to interact** with handheld mobile device 10, and in particular, with driving analysis application 50,” such as “a touchscreen, physical buttons, sliders, switches, data ports, keyboard, mouse, voice activated interfaces, or any other suitable devices.” USAA-1005 (Peng), [0031]. Moreover, smart phones featuring monitoring and navigation applications with graphical user interfaces were well-known by the ’879 Patent’s earliest effective filing date. *See, e.g.*, USAA-1008, USAA-1011, Figs. 4, 5; USAA-1016, ¶¶[0072]-[0073], Figs. 1-5, 7-9.

163. For example, and as shown below, Peng describes a user interface in the form of a touchscreen enabling a user to interact with a map application, e.g., “a map screen.” USAA-1005 (Peng), [0163] (showing “a map screen 260, indicating the path 262 of a recorded trip”), *id.* (“the **user may select a particular icon** 264 to display (e.g., via a pop-up window or new screen) additional details regarding [display icons 264 indicating the locations of notable driving events (NDEs)]”. FIGS. 6G (showing an exemplary map screen), [0019] (“iPhone”), [0023] (“application may also display a map”), [0059].



USAA-1005 (Peng), FIG. 6G (annotated)

164. From this and related disclosure, a POSITA would have understood and found obvious to configure the mobile device in the combination to use a touchscreen and various graphical user interfaces enabling the user of mobile device 10 to interact with applications (e.g., application 50 and/or related applications). USAA-1005 (Peng), [0030] (“display 36 may be an **interactive display** (e.g., a touch screen) that **allows a user to interact** with driving analysis application 50”), [0031] (“any **suitable interfaces** allowing a user to interact with handheld mobile device 10”), [0034], [0039], [0062], [0066], [0070]. Thus, *Peng-Chatterjee* renders obvious [1.3].

[1.4] a processor; and

165. As shown below, it would have been obvious to a POSITA to configure the handheld mobile device in the combination to include one or more processors (“*processor*”), e.g., a processor 32. USAA-1005 (Peng), [0006], Figs. 2-3. As Peng discloses, processor 32 “may be generally operable to execute driving analysis application 50” and can be used “to calculate, based at least on the collected driving data, one or more metrics related to the driver's driving behavior.” USAA-1005 (Peng), [0006], [0028], claims 1-14, 27.

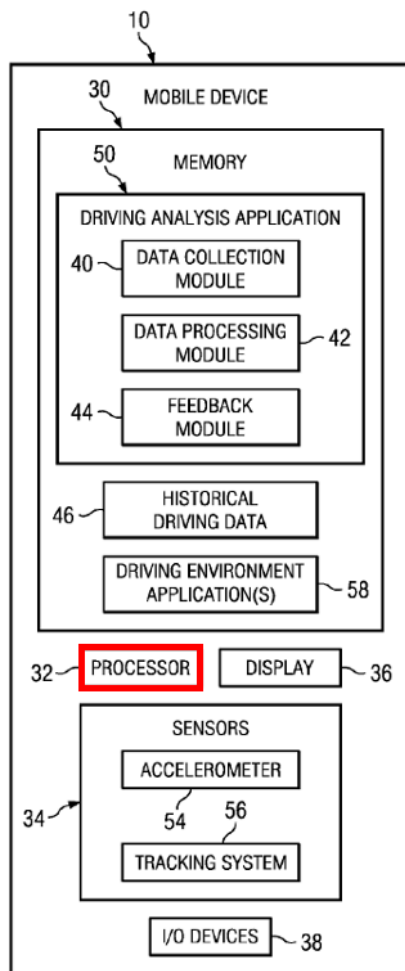


FIG. 2

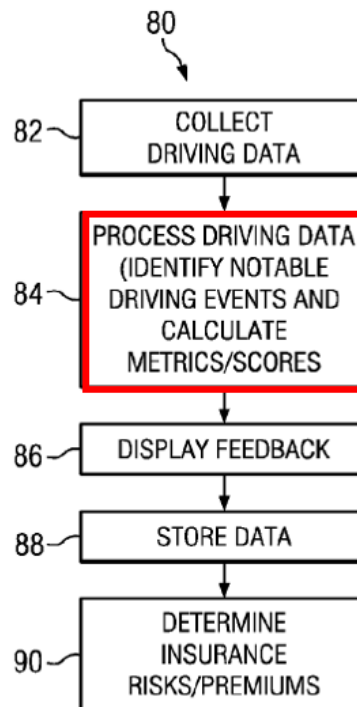


FIG. 3

USAA-1005 (Peng), Fig. 2 (annotated, left), Fig. 3 (annotated, right)

166. Based on this and related disclosure, *Peng-Chatterjee* discloses or renders obvious [1.4]. USAA-1005 (Peng), Abstract, [0006]-[0008], [0025], [0028]-[0029].

[1.5] a memory;

167. Based on Peng's disclosure, it would have been obvious to a POSITA to configure the handheld mobile device in the combination to include a memory 30 ("***memory***") for storing computer readable instructions and data associated with its driving analysis application 50, including various modules 40, 42, 44, historical driving data 46, and driving environment applications 58. USAA-1005 (Peng), [0025]-[0026], [0006], [0073], Abstract, [0028], [0032], [0058], [0071], [0142], Claims 1-13, Figs. 2-4. In the combination, the handheld mobile device would have been obviously configured to "manage short-term storage...[and]...long-term storage of certain data," based on Peng's teachings. USAA-1005, [0058], [0042], [0073].

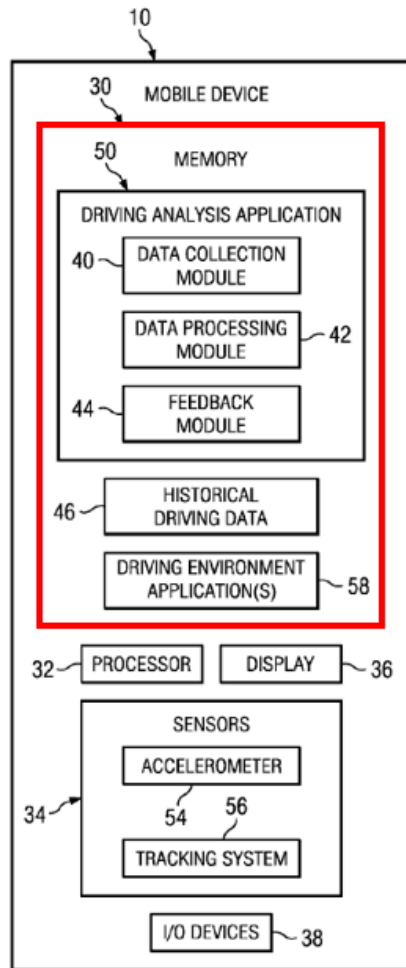


FIG. 2

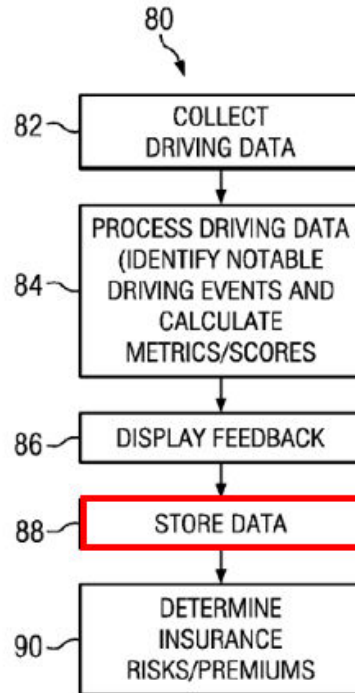


FIG. 3

USAA-1005 (Peng), Fig. 2 (annotated, left), Fig. 3 (annotated, right)

168. Based on the above and related disclosure from Peng, *Peng-Chatterjee* discloses or renders obvious [1.5]. USAA-1005 (Peng), Abstract, [0006]-[0008], [0025], [0028]-[0029].

[1.6] the mobile telecommunications device being configured to: determine, based on at least one of the inputs received by the user interface and sensor data from the device's sensor set, a start of a driving period during which

the mobile device is removably attached to the vehicle and the vehicle is in use;

169. Based on previous discussion and for reasons further discussed below, *Peng-Chatterjee* renders obvious determining, based on at least the inputs received by the user interface and sensor data from the device's sensor set, a start of a driving period during which the mobile device is removably attached to the vehicle and the vehicle is in use. USAA-1005 (Peng), [0001], [0014], [0019], [0021]-[0022], [0029], [0036]-[0037], [0040], [0067], [0076]-[0077], [0151]-[0153], [0165], Fig. 1, 4-6A; USAA-1006 (Chatterjee), Abstract, [0002]-[0003], [0005]-[0007], [0011], [0013]-[0014], [0016], [0047], [0060], [0064]-[0067], [0070], [0092], [0097]-[0098], [0104], [0175]-[0176], [0192], [0200]-[0232], Figs. 1-7, 15. Based on the disclosure of Peng and Chatterjee, as discussed above, in the combination, it would have been obvious to configure the mobile device and the dock to communicate with one another and to use at least the inputs received by the user interface and sensors (e.g., mobile device's accelerometer) to detect when the mobile device has been docked so that the determining a start of a driving period is based on whether the combination mobile device was properly docked during vehicle usage. USAA-1005 (Peng), [0036]-[0037], [0067], [0076], [0151]; USAA-1006 (Chatterjee), [0065], USAA-1006 (Chatterjee), [0092], [0097]-[0098], [0104], [0200]-[0232].

170. Based on Peng's descriptions of multiple embodiments, it would have been obvious to configure the combination's user inputs and motion sensor data from its sensor set determine a start of a driving period during which the phone is removably attached or affixed during vehicle usage. For example, as discussed previously, Peng describes "determin[ing] the orientation of handheld mobile device 10" before the mobile device 10 starts data recording (i.e., starting a data collection session) ("*a start of a driving period*"). USAA-1005 (Peng), [0153] ("data collection module 40 may start (or re-start) driving data collection automatically upon the proper orientation of handheld mobile device 10.').

171. Based on Peng's disclosure, it would have been obvious to configure the handheld mobile device, via data collection module 40, to "**interact** with the user" ("*at least one of the inputs received by the user interface*") to "adjust the handheld mobile device 10 such that the orientation of handheld mobile device 10 is suitable for collecting driving data" before the driving data is collected, based on Peng's teachings. USAA-1005 (Peng), [0076], Fig. 4.

172. As shown in the example provided in Peng's Fig. 6A (reproduced below) and explained by Peng's disclosure, it would have been obvious to a POSITA to configure *Peng-Chatterjee* to prompt a user to provide "proper alignment or orientation of handheld mobile device within the automobile or vehicle" when the device "instruct[s] or notif[ies] the user to adjust the orientation

of handheld mobile device” via graphical representations provided on mobile device’s screen. USAA-1005 (Peng), [0037], Fig. 6A. Further, it would have been obvious from Fig. 6A’s depiction that a user would confirm a readiness to drive (since the device display asks the question “Ready to Drive?”) via the device’s user interface following the user’s adjustment of the device orientation to prevent the premature/unintended collection of driving data that might otherwise occur, for example, if the user was still in the process of adjusting the orientation of the device. The mobile device in the combination, via module 40, can “determine the orientation of handheld mobile device [] within the vehicle,” using device’s sensor data (e.g., angular orientation, GPS and position information) (“***sensor data from the device's sensor set***”) since, as discussed above, the combination device’s sensor set integrates sensor functionality, as taught by Chatterjee, to enable detection of docking and orientation on the dock. USAA-1005 (Peng), [0037] [0151]; USAA-1006 (Chatterjee), [0092]. Suitable “physical orientation (e.g., angular orientation) of handheld mobile device [] relative to the automobile orientation” can be graphically show to the user by the use of indicators, e.g., “alignment image 202.” USAA-1005 (Peng), [0151], [0037].

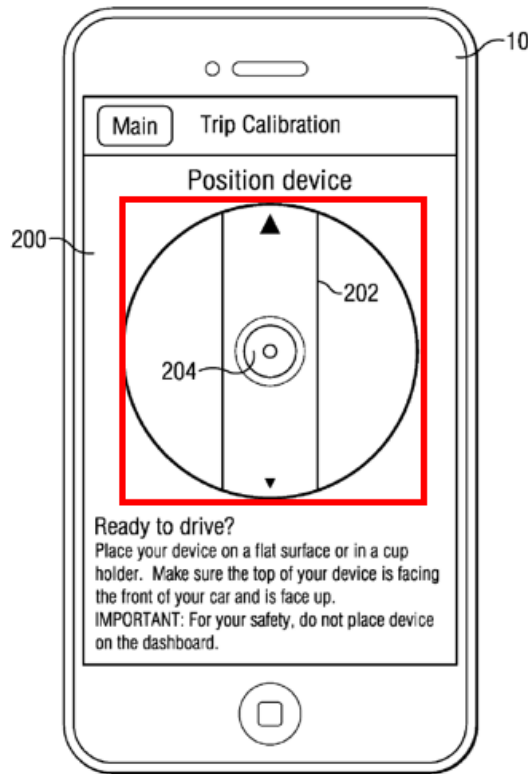


FIG. 6A

USAA-1005 (Peng), Fig. 6A (annotated)

173. Peng describes “[i]n embodiments requiring manual starting of data recording (i.e., starting a data collection session), a screen or image for starting data recording may appear upon the handheld mobile device 10 being properly oriented.” USAA-1005 (Peng), [0152]. User inputs in the form of “manual instruction” (“*at least one of the inputs received by the user interface*”), e.g., “a user pressing a ‘Start Recording’ button that is displayed on display 36” of handheld mobile device 10, may be used to “start (or re-start) collection of driving data” (“*a start of a driving period*”). USAA-1005 (Peng), [0152], [0066] (“data

collection module 40 may collect driving data during a data collection session (which may correspond to a driving trip, a portion of a driving trip, or multiple driving trips).”). Furthermore, since the display of the handheld mobile device can “provide a selectable image 214 for stopping the recording of driving data (i.e., ending the data collection session),” it would have been understood by or found obvious by a POSITA that a new driving period could be started manually at any time by the user, for example, when the handheld mobile device of the combination was properly oriented. USAA-1005 (Peng), [0154]. Also, it would have been obvious to a POSITA to configure the combination to apply the manual instruction to start data recording, as disclosed by Peng, to obtain efficient recordings (for example, to avoid data collection when the handheld mobile device is properly oriented but when the vehicle is idle, e.g., parked) which, in turn, would conserve the battery life of the mobile device in the combination and help to obtain more useful driving data. *Id.* Additionally, it would have been obvious to a POSITA to have configured the combination, based on Peng’s teaching, to interact with and receive user input via a user interface to confirm a readiness to collect driving data when determining proper orientation to prevent the premature/unintended collection of driving data. USAA-1005 (Peng), [0037], [0030], [0076], Fig. 4.

174. In another example, the handheld mobile device in the combination, via data collection module 40, can “automatically start and/or stop collection of driving data in response to determining that the handheld mobile device 10 is likely travelling in an automobile, e.g., **based on a real time analysis of data received from accelerometer 54, location tracking system 56, or other sensors 34** provided by handheld mobile device” (“*sensor data from the device's sensor set*”). USAA-1005 (Peng), [0035], [0077], [0029]. For example, Peng explains that algorithms may be used for “determining whether handheld mobile device 10 is likely travelling in an automobile” “by analyzing one or more of (a) the current **acceleration** of handheld mobile device 10 from accelerometer 54, (b) the current **location** of handheld mobile device 10 from location tracking system 56 (e.g., whether handheld mobile device 10 is located on/near a roadway), (c) the **velocity** of handheld mobile device 10 from location tracking system 56, (d) any other suitable data, or (e) any combination of the preceding.” USAA-1005 (Peng), [0035], [0077], [0029].

175. Thus, from these disclosures, a POSITA would have understood and/or found obvious that Peng contemplates examples in which a start of a driving period, e.g., starting a data collection session on the handheld mobile device in the combination, during vehicle usage is determined based on at least one of the inputs received by the user interface (e.g., user’s manual instruction, orientation

manipulation) and sensor data from the device's sensor set (e.g., acceleration, angular orientation, and GPS sensor data). USAA-1005 (Peng), [0035], [0037], [0076]-[0077], [0029], [0151]-[0153], [0066], [0154], Fig. 6A.

176. Also, as discussed previously, it would have been obvious to a POSITA to configure the combination device to determine the start of the driving period during which the device was removably attached to the vehicle and the vehicle was being used (e.g., being driven) based on both Peng's explicit disclosure and Chatterjee's supplemental teachings. For example, to the extent that removably attached means any form of connection between the vehicle and the mobile device, Peng discloses that the handheld mobile device may be releasably coupled to a vehicle "via a hardwire connection" while the vehicle is in use. USAA-1005 (Peng), [0001], [0014], [0019], [0021]-[0022], [0029], [0036]-[0037], [0040], [0067], [0076]-[0077], [0151]-[0153], [0165], Fig. 1 (showing hardwire connection between phone and vehicle), 4-6A; USAA-1006 (Chatterjee), Abstract, [0002]-[0003], [0005]-[0007], [0011], [0013]-[0014], [0016], [0047], [0060], [0064]-[0067], [0070], [0092], [0097]-[0098], [0104], [0175]-[0176], [0192], [0200]-[0232], Figs. 1-7, 15; USAA-1013, 3:1-10, 4:21-33, Figs. 1; USAA-1032, 323-330; USAA-1502, [0003], [0005]-[0007], [0011], [0013]-[0014], [0016]. Also, the mobile device and the dock can communicate with one another when coupled together to detect docking status as well as use device sensors (e.g.,

mobile device's accelerometer) to detect when the mobile device has been docked so that the determining a start of a driving period is based on the combination mobile device being properly docked during vehicle usage. Moreover, as explained above, *Peng-Chatterjee* would have rendered obvious configuring the combination to determine a driving period during which the handheld mobile device is removably attached to the vehicle via a dock and the vehicle is in use (e.g., moving) for its numerous associated advantages, e.g., minimizing driving data collection interruptions and securely attaching the device within the vehicle in a safe and convenient manner. *Id.* For at least these reasons, *Peng-Chatterjee* renders obvious [1.6].

[1.7] process the sensor data from the sensor set during the driving period to derive driving information associated with how the vehicle is driven; and

177. Based on Peng's disclosure, the combination renders obvious including a driving analysis application 50, which can be "downloaded via the Internet or installed on handheld mobile device 10 in any other known manner," to enable the handheld mobile device to obtain, based on "acceleration," "geographic location," and "driving environment" data from "a built-in accelerometer," "a GPS (global positioning system) device," and other "sensors" ("sensor data"), "one or more types of data regarding driving behavior and/or the driving environment," and to "process any or all of this driving data collected by handheld mobile device" during the driving period ("***process the sensor data from the sensor set during the***

driving period”) to derive and store “any of the metrics, scores, or other data calculated or proceed [sic] by data processing module,” where the “calculate[d] filtered or averaged driving behavior metrics,” such as “acceleration, braking, cornering, etc” are associated with the “collected driving data” (“*derive driving information associated with how the vehicle is driven*”) . USAA-1005 (Peng), [0021]-[0022], [0029], [0069]-[0071], FIG. 4 (“PROCESS TRIP DATA (e.g., FILTER DATA AND CALCULATE METRICS)”); [0039] (“As used herein, the term ‘user’ refers to **the driver** or other person interacting with driving analysis application 50 on handheld mobile device 10.”). Such processed information can be useful for various applications, such as “help[ing] drivers improve their driving behavior,” “analyz[ing] how driving has impacted fuel efficiency,” and “quantify[ing] and differentiat[ing] an individual's insurance risk base [sic] on actual driving behaviors and/or driving environment.” USAA-1005 (Peng), [0042] (“Any or all data collected by data collection module 40 may be time stamped,” i.e., processed), [0064], [0165].

178. As shown in Peng’s Fig. 4 (reproduced below), it would have been obvious to have configured the combination to use an application, e.g., application 50, to enable the mobile device to “Process Trip Data” by, “e.g., Filter[ing] Data and Calculat[ing] Metrics” and “calculate[] driving behavior metrics” (“*derive driving information*”), which is then used to generate “driving scores,” which can

be communicated to third parties such as auto insurance providers. USAA-1005 (Peng), [0074], [0044] (“calculate one or more driving scores based on the calculated driving behavior metrics (e.g., acceleration, braking, cornering, etc.) and/or based on additional collected data.”), FIG. 4.

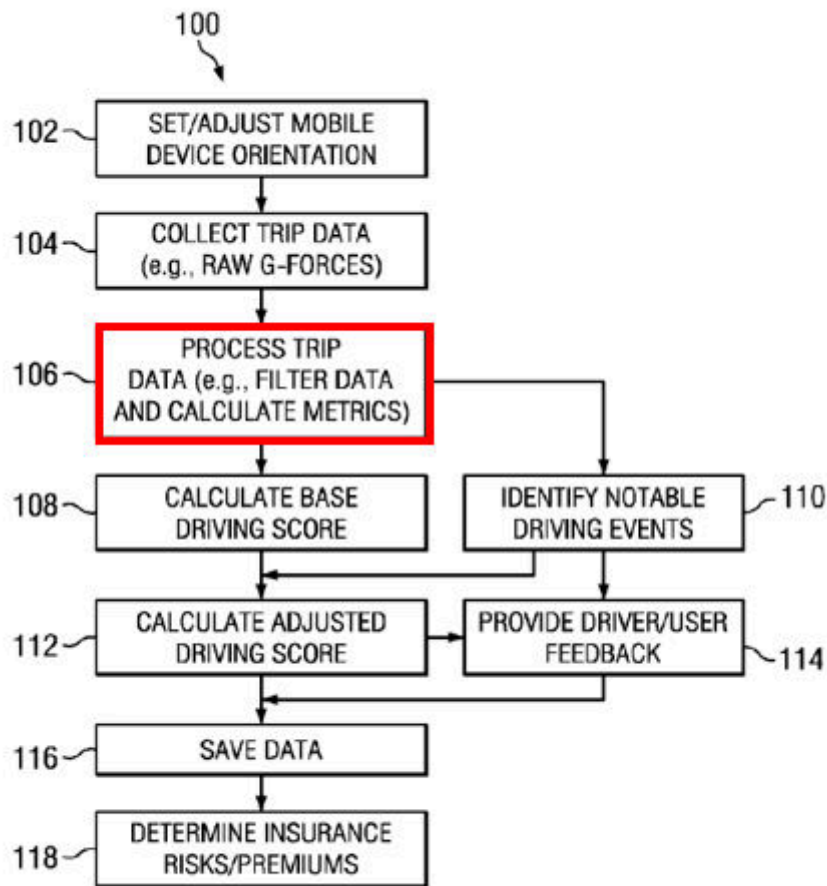


FIG. 4

USAA-1005 (Peng), Fig. 4 (annotated)

179. Based on the Peng’s disclosure, in the combination, the mobile device would have been obviously modified, via the driving analysis application, to “identify ‘notable driving events,’ such as instances of notable acceleration,

braking, and/or cornering, as well as the severity of such events” by, for example “collecting raw G-force data (i.e., acceleration data) from built-in accelerometer 54,” and “display a map showing the route of a trip, and indicating the location of each notable driving event.” USAA-1005 (Peng), [0022]-[0023].

180. From this and related description, a POSITA would have understood and found obvious to configure the mobile handheld device, via the driving analysis application 50, to cause the handheld mobile device to process sensor data from the sensor set during the determined driving period to derive, e.g., “calculated driving behavior metrics (e.g., acceleration, braking, cornering, etc.)” and scores (“*driving information associated with how the vehicle is driven*”), and to store a selection of that driving information to memory (e.g., “local volatile memory for display, in local non-volatile memory as historical driving data 46, and/or in remote memory as historical driving data 152”). USAA-1005 (Peng), [0044], [0071]. Thus, *Peng-Chatterjee* renders obvious [1.7].

[1.8] store a selection of the driving information to the memory;

181. It would have been obvious to a POSITA to configure the handheld mobile device, e.g., via the driving analysis application 50, based on Peng’s disclosure, to cause the handheld mobile device to store a selection of the driving information (e.g., data...for display” and “calculated driving behavior metrics (e.g., acceleration, braking, cornering, etc.)”) (“*the driving information*”) to the memory

(e.g., “local volatile memory for display, in local non-volatile memory as historical driving data 46, and/or in remote memory as historical driving data 152”). USAA-1005 (Peng), [0044], [0071].

182. The *Peng-Chatterjee* combination, via data processing modules 44, 42, may “manage the storage of **any** of the data collected by data collection module 40 at step 104 (e.g., raw data or filtered raw data) **and/or any** of the **metrics, scores, or other data calculated or processed** by data processing module 42...such that the stored data may be subsequently accessed, e.g., for display or further processing.” USAA-1005 (Peng), [0071], [0042] (“**Any or all data collected** by data collection module 40 may be time stamped...before sending the data to data collection module 40.”). Also, in the combination, the device “may manage short-term storage of **certain** data... and may further manage long-term storage of **certain** data[.]” USAA-1005 (Peng), [0058]. Data can be stored in a “local volatile memory for display, in local non-volatile memory as historical driving data 46, and/or in remote memory as historical driving data 152.” USAA-1005 (Peng), [0071], [0073] (“the collected data may be processed, displayed, stored in second memory (e.g., stored in non-volatile memory as historical driving data 46).”).

183. As shown in FIGS. 6C-6G, “various information collected or processed by application 50” such as “driving behavior metrics (Acceleration,

Braking, and Cornering) and a driving score ('224') calculated by data processing module 42" ("*driving information associated with how the vehicle is driven*") are displayed. USAA-1005, [0155]-[0164], FIGS. 6C-6G. A POSITA would have understood and/or found it obvious that at least a selection of such displayed driving information would be included in Peng's data stored in a "local volatile memory for display." *Id.*; USAA-1005, [0071], [0073]. Similarly, at least a selection of such displayed driving information would also be included in "in local non-volatile memory as historical driving data 46, and/or in remote memory as historical driving data 152" because Peng discloses "the collected data may be processed, displayed, stored in second memory (e.g., stored in non-volatile memory as historical driving data 46), and/or communicated to remote entities for storage, processing, and/or display *Id.*; USAA-1005, [0071], [0073].

184. From this and related description, a POSITA would have understood that data stored in local memory (e.g., "local volatile memory for display [and] in local non-volatile memory as historical driving data") includes "a selection of the driving information." USAA-1005 (Peng), [0071], [0073]. Thus, *Peng-Chatterjee* renders obvious [1.8].

[1.9] wherein the driving information is derived without data from the vehicle sensors, and

185. As explained above, in the combination, the handheld mobile device, via the driving analysis application 50, processes sensor data from the device's

sensor set during a determined driving period to derive “driving behavior metrics and/or scores” for various applications, including “to help drivers improve their driving behavior,” “analyze how driving has impacted fuel efficiency,” and “quantify and differentiate an individual's insurance risk base [sic] on actual driving behaviors and/or driving environment.” USAA-1005 (Peng), [0022], [0064], [0165].

186. Based on Peng’s disclosure, Peng-Chatterjee’s mobile device would have also been obviously configured to “collect [driving behavior] data from sources, including (a) data sources provided by [HMD]...(b) data sources in vehicle 12 but external to [HMD]...and/or (c) data sources external to vehicle 12.” *Id.*, [0033], [0034], [0029]. In the combination, it would have been obvious to configure the proposed handheld mobile device to “include...one or more sensors 34” “for detecting information regarding a driver's driving behavior,” such as “an accelerometer 54,” “a location tracking system 56,” “ magnetic field sensors,” “proximity sensors, a camera or ambient light.” USAA-1005 (Peng), [0029]. This is based on Peng’s explanation that “[d]ata collection module 40 may collect such data from **any number and types of data sources**, including...data sources provided by handheld mobile device 10 (e.g., one or more sensors 34, environmental data application 58).” USAA-1005 (Peng), [0033], [0034].

187. For instance, Peng describes that its handheld mobile device 10, via the data collection module 40, “may automatically start...collection of driving data in response to determining that the handheld mobile device 10 is likely travelling in an automobile, e.g., based on a real time analysis of data received from accelerometer 54, location tracking system 56, or other sensors 34 provided by handheld mobile device 10.” USAA-1005 (Peng), [0035]. “For example, data collection module 40 may include algorithms for determining whether handheld mobile device 10 is likely travelling in an automobile based on data from accelerometer 54 and/or location tracking system 56, e.g., by analyzing one or more of (a) the current acceleration of handheld mobile device 10 from accelerometer 54, (b) the current location of handheld mobile device 10 from location tracking system 56 (e.g., whether handheld mobile device 10 is located on/near a roadway), (c) the velocity of handheld mobile device 10 from location tracking system 56, (d) any other suitable data, or (e) any combination of the preceding.” USAA-1005 (Peng), [0035], claim 27 (“receive driving data collected by one or more sensors associated with a handheld mobile device during a data collection session”), *see also* claims 1, 5, 14, 18), Fig. 2 (“sensors 34” may include “accelerometer 54” and “tracking system 56”). Furthermore, the handheld mobile device, via the data processing module 42, “may be operable to process or analyze any of the driving data (e.g., driving behavior data and/or the driving environment

data) collected by handheld mobile device 10 itself and/or collected by external devices and communicated to handheld mobile device 10, and based on such collected driving data, calculate one or more driving behavior metrics and/or scores.” USAA-1005 (Peng), [0044].

188. From at least some of the above examples, a POSITA would have understood and found obvious that the mobile phone derives driving information without data from the vehicle sensors, because some of Peng’s examples focus only on leveraging motion data obtained from one or more sensors provided by the mobile device (e.g., sensors 34) to derive filtered data and/or driving behavior metrics (“*driving information*”). USAA-1005 (Peng), [0044], [0035].

189. Further, from the above disclosures of Peng and the known prior art, a POSITA would have understood there to be no need to use data from vehicle sensors to derive Peng’s driving information, and would have found obvious that derivation of that driving information without data from the vehicle’s sensors provides an elegant and cost-effective means of obtaining driving information, without the complexities and costs that might potentially be involved in obtaining and integrating data from a vehicle’s sensor set. USAA-1005 (Peng), [0044], [0035]. If a phone contains an accelerometer, then an accelerometer is sufficient to allow detecting driving conditions. As such, there is no need for any sensors other than those contained in the phone. Thus, *Peng-Chatterjee* renders obvious [1.9].

[1.10] the mobile telecommunications device is controlled by a downloaded application to control the mobile device to process the driving information to generate a driving score associated with a particular driver.

190. Peng-Chatterjee's "[HMD] [] may include...a driving analysis application," which "may be **downloaded** via the Internet...on handheld mobile device 10" ("***a downloaded application***"). USAA-1005 (Peng). USAA-100, [0020], [0027], [0145].

191. The application can "process...driving data collected by [HMD]...**to calculate one or more driving behavior metrics and/or scores....**" ("***generate a driving score***"). USAA-1005, [0022], [0074], [0143]. It would have been readily understood by a POSITA that HMD 10 is controlled by driving analysis application 50 because Peng explains that the application is embodied in the software, firmware, and/or computer-readable instructions and controls the mobile device via multiple modules (e.g., data collection modules 40, data processing 42, and feedback module 44). USAA-1005 (Peng), [0026], [0032] ("driving analysis application 50 may include a data collection module 40, a data processing module 42, and a feedback module 44."), Fig. 2. For example, the application includes a "data processing module 42...operable to process or analyze any of the driving data..., **calculate one or more driving behavior metrics and/or scores.**" USAA-1005 (Peng), [0032], [0044].

192. The “**driving behavior metric and/or score**” is *associated with a particular driver* because they are “metrics related to **the driver's** driving behavior” and “data for risk analysis of **a driver.**” USAA-1005, Abstract [0024], [0027], [0032], [0044], [0074], Fig. 2. Based on the above, a POSITA would have found that the *Peng-Chatterjee* combination renders this limitation obvious.

2. Elements of Claim 21, 46, 51, 54

193. *Peng-Chatterjee* renders obvious these claims in the same manner as explained above for the corresponding claim 1 limitations listed in the table below.

Claim 1 Limitation	Corresponding Limitations
[1.1]	[21.1], [46.1], [51.1], [54.1]
[1.2]	[21.3], [46.2], [51.3], [54.2]
[1.3]	[46.3], [54.3]
[1.4]	[21.4], [46.4], [51.4], [54.4]
[1.5]	[21.5], [46.5], [51.5], [54.5]
[1.6]	[21.6], [46.6], [51.6], [54.6]*
[1.7]	[21.7], [46.7], [51.7], [54.7]
[1.8]	[21.8], [46.8], [51.8], [54.8]
[1.9]	[21.10], [46.9], [51.10], [54.9]
[1.10]	[21.9], [46.12], [51.9], [54.10]

* See also analysis provided below.

[21.1], [51.1], [54.1] *A non-transitory computer readable medium having instructions comprising a software application stored thereon, wherein the*

instructions are configured to be executed on a processor of a mobile telecommunications device to enable ...,

194. See [1.1], [1.4], *supra*. The combination renders obvious “***non-transitory computer readable medium having instructions comprising a software application stored thereon, wherein the instructions are configured to be executed on a processor of a mobile telecommunications device to...***” based on Peng’s disclosure of “[a] further aspect of the invention provides a **non-transitory computer readable medium containing a set of computer readable instructions executable by a processor** to receive driving data collected by one or more sensors associated with a handheld mobile device...” USAA-1005, [0008], claim 27 (“A non-transitory computer readable medium containing a set of computer readable instructions executable by a processor to...”).

[21.2a], [51.2a] the mobile telecommunications device including a display;

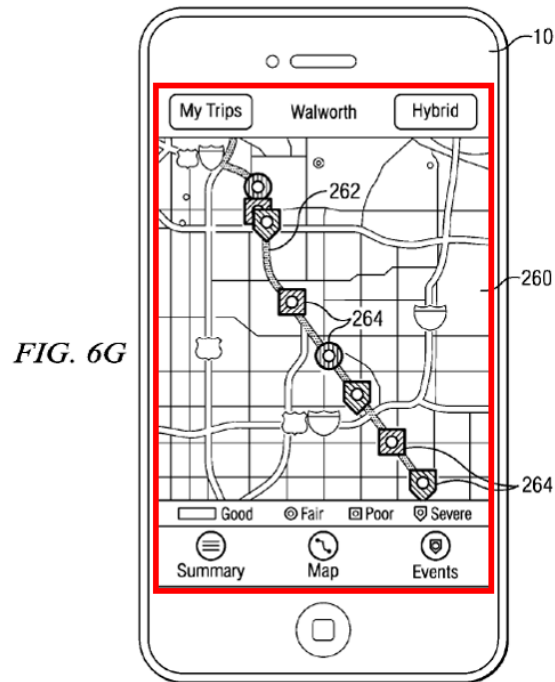
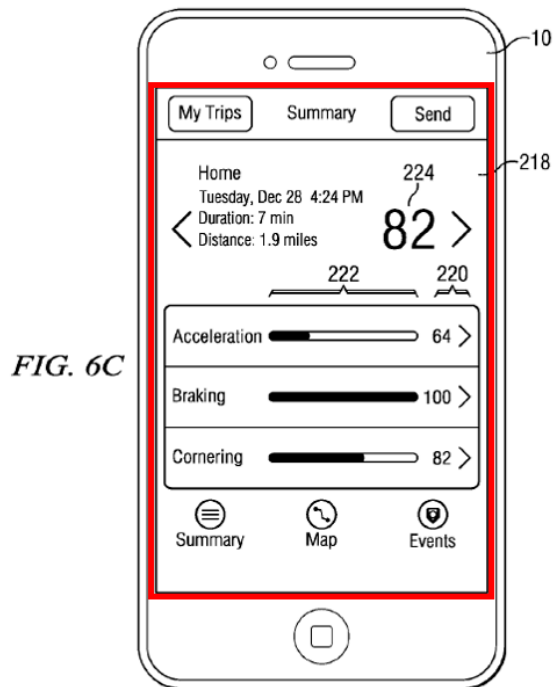
195. See [1.3], *supra*. Peng-Chatterjee renders obvious this element because “[HMD] 10 may include ... a display” (“***display***”). USAA-1005, [0020], [0025]. For example, “**Display 36** may comprise any type of display device for displaying information related to driving analysis application 50.” USAA-1005, [0030], claim 1 (reciting “a handheld mobile device, including;... a display device”).

[21.2b], [51.2b] present a user interface on the display;

196. See [1.3], [21.2a], *supra*. Peng-Chatterjee renders obvious this element because Peng discloses **displaying** “displayable objects (e.g., screens, windows, menus, images etc.)” that “**facilitate[s] user navigation** among the various objects” (“***a user interface***”), e.g., on “**a touchscreen display 36**,” as “shown and discussed below with reference to FIGS. 6A-6G.” USAA-1005 (Peng), [0062], FIGS. 6A-6G. The “**touchscreen display 36**” is an example of an “[i]nput/output devices 38 may include any suitable **interfaces allowing a user to interact with handheld mobile device 10**, and in particular, with driving analysis application 50. For example, **input/output devices 38 may include a touchscreen**, physical buttons, sliders, switches, data ports, keyboard, mouse, voice activated interfaces, or any other suitable devices.” USAA-1005 (Peng), [0031]; *see also id.* [0163], [0019] (“iPhone”), [0023], [0059].

197. In view of Peng’s disclosure, a POSITA would have readily understood that the *Peng-Chatterjee*’s HMD is configured to present ***a user interface***, such as the variable “displayable objects,” which are graphic user interfaces, to “**facilitate user interaction** with application 50 (e.g., via a touchscreen display 36 or other input devices 38)[.] allowing the user to view any of the data discussed above, e.g., **by user selection or navigation of displayed objects**” ***on the display*** (e.g., on the “touchscreen display 36”). Based on the

above, a POSITA would have found that the *Peng-Chatterjee* combination renders this limitation obvious.



USAA-1005, Fig. 6C (annotated, left), Fig. 6G (annotated, right)

[46.10] the mobile telecommunications device is configured to process the sensor data by determination of at least one of: vehicle acceleration events; and vehicle braking events;

198. As discussed (§III.A.1, [1.7] *supra*), a POSITA would have found obvious that *Peng-Chatterjee*’s mobile device is configured to “**process any or all of this driving data** collected by handheld mobile device 10” (perform “the *process step*”), “**to calculate one or more driving behavior metrics and/or scores** based on such collected driving data” such as “**acceleration, braking.**” USAA-

1005 (Peng), [0022]. The mobile device includes a “driving analysis application [that can] **identify “notable driving events,” such as** instances of **notable acceleration, braking, and/or** cornering, as well as the severity of such events” (*“determination of at least one of: vehicle acceleration events and vehicle braking events”*). USAA-1005 (Peng), [0022]. *See also* USAA-1005 (Peng), [0044] (“Data processing module 42 may be operable to **process or analyze any of the driving data** (e.g., driving behavior data and/or the driving environment data),” “and based on such collected driving data, calculate one or more driving behavior metrics and/or scores” such as “the driving behavior metrics of **acceleration, braking,** and/or cornering metrics based on driving behavior data collected by an accelerometer 54, location tracking system 56, and/or other collected data.”). Based on the above, a POSITA would have found that the *Peng-Chatterjee* combination renders this limitation obvious.

[46.11], [51.11] wherein the determining of such events occurs when data from the sensor set accords with predefined threshold values; and

199. The combination render obvious this limitation based on Peng’s disclosure that “[d]ata processing module 42 may identify notable driving events using any suitable algorithms. For example, **an algorithm may compare acceleration data from accelerometer 54 (raw or filtered) to one or more predefined thresholds for notable acceleration, braking,** or cornering.” USAA-1005 (Peng), [0053]. “For example, module 42 may execute the following example

algorithms to **identify the occurrence and type of a notable driving event (NDE)** for a Chevrolet Impala” by “compar[ing] the lateral and longitudinal G-force data to corresponding threshold values” and determining NDEs such as “NDE_type ‘A’=**Acceleration**” and “NDE_type ‘D’=**Deceleration**” when the **lateral G-force data** (“LatG”) “detected by the accelerometer” satisfies “corresponding threshold values” (“*determination of such events occurs when data from the sensor set accords with preset parameters*”). USAA-1005 (Peng), [0099]-[0115]. Based on the above, a POSITA would have found that the *Peng-Chatterjee* combination renders this limitation obvious.

[0099] At step 110, data processing module 42 may identify and analyze any notable driving events during the data collection session, based on the collected/processed G-force data and jerk data. For example, module 42 may compare the lateral and longitudinal G-force data to corresponding threshold values to identify the occurrence of notable driving events. For example, module 42 may execute the following example algorithms to identify the occurrence and type of a notable driving event (NDE) for a Chevrolet Impala:

```
[0100] lat_magnitude_gf=max(0, abs(LatG)-0.40);
[0101] lon_magnitude_gf=max(0, abs(LonG)-0.30);
[0102] magnitude_gf=max(lat_magnitude_gf, lon_magnitude_gf);
[0103] if magnitude_gf=lat_magnitude_gf and latG.>0
then NDE_type="L";
[0104] else if magnitude_gf=lat_magnitude_gf and
latG.<=0 then NDE_type="R";
[0105] else if magnitude_gf=lon_magnitude_gf and
lonG<0 then NDE_type="A";—
[0106] else if magnitude_gf=lon_magnitude_gf and
lonG>=0 then NDE_type="D";
[0107] else no NDE identified.
[0108] wherein:
[0109] LatG=lateral G-forces detected by the accelerometer;
[0110] LonG=longitudinal G-forces detected by the accelerometer;
[0111] NDE_type "L"=Left Cornering
[0112] NDE_type "R"=Right Cornering
[0113] NDE_type "A"=Acceleration
[0114] NDE_type "D"=Deceleration
```

USAA-1005 (Peng), [0099]-[0114].

[54.6] the mobile telecommunications device being configured to: determine, based on at least one of the inputs received by the user interface and sensor data from the device's sensor set, a start of a driving period during which the mobile device is removably affixed to the vehicle and the vehicle is in use;

200. See [1.6], *supra*. Claim element [54.6] differs from claim element [1.6] by a single word, “affixed” recited in element [54.6] compared to “attached”

recited in [1.6]. The '879 patent specification does not distinguish the two terms “affix” versus “attach.”

201. The '879 patent specification does not distinguish the two terms “affix” versus “attach.” In fact, the '879 patent specification uses both “affix” and “attach” in similar manner. *See* USAA-1001, 3:8-11 (“For example, if the sensor set comprises an accelerometer, the acceleration of the vehicle can be more accurately measured due to the mobile device being firmly attached to the vehicle.”); 15:9-11 (“For example, the device 17 may be attached to the windshield 19 of the automobile 3 in an adapter 21”), *cf.* USAA-1001, 18:49-52 (“The mobile telecommunications device is configured within the vehicle, at step 38. This may comprise affixing the mobile telecommunications device 17 to the vehicle via an adapter, as described previously.”), 15:19-25 (“The details of the adapter 21 are irrelevant for present purposes, with the exception that it must enable a clear line of sight in the principle direction of travel of the vehicle to be obtained, and it must firmly affix the mobile to the vehicle. **Affixing** the mobile telecommunications device 17 to the automobile 3, ensures that the mobile device 17 is able to accurately capture the automobile's state of motion.”); 19:7-10 (“Alternatively, the start of the driving period may be initiated once the application determines that the mobile telecommunications device 17 has been **affixed** to the vehicle.”).

202. A POSITA would have understood that, as explained at length above (e.g, [1.6], *supra*), *Peng-Chatterjee* also renders obvious removably affixing handheld mobile device 10 to the vehicle via a dock during a driving period for its numerous associated advantages, e.g., minimizing driving data collection interruptions and securely attaching the device 10 within the vehicle in a safe and convenient manner.

3. Claims 2, 3, 5, 8, 16-20, 41-43, 45

[2] *A mobile telecommunications device according to claim 1, wherein the mobile telecommunications device is controlled by the downloaded application to control the mobile device to detect occurrence of a predetermined event and in response take at least one predetermined action.*

203. As discussed ([1.7], [1.10], *supra*), *Peng-Chatterjee*’s “handheld mobile device [] may include...a driving analysis application,” (“***the downloaded application***”) that can “process...driving data collected by handheld mobile device...to calculate one or more driving behavior metrics and/or scores[.]” USAA-1005 (*Peng*), [0020], [0022], [0027], [0074], [0143]. It would have been readily understood by a POSITA reading *Peng*’s disclosure that the mobile device 10 is controlled by the driving analysis application 50 because *Peng* explains that the application is embodied in the software, firmware, and/or computer-readable instructions and controls the mobile device via multiple modules. USAA-1005 (*Peng*), [0026], [0032], Fig. 2. For example, the application 50 can “**control the**

start and stop of driving data collection” and “identify ‘notable driving events’ (NDEs), such as instances of notable acceleration, braking, and cornering” (“*detect occurrence of a predetermined event*”). USAA-1005 (Peng), [0034], [0022], [0045]-[0053].

204. Furthermore, in response to identifying the NDEs, the application 50 takes at least one predetermined action, such as: (1) determining the severity of, (2) storing (either locally and/or remotely), (3) displaying, and/or (4) reporting the NDEs to the driver and/or third parties” (“*in response take at least one predetermined action*”). USAA-1005 (Peng), [0034], [0055], [0064], [0074], [0142], [0163]; Figs. 2-4. It would have been obvious to a POSITA that the determining of the NDE severity and the storing, displaying, and/or reporting of NDEs would need to occur in response to the detection of the NDE in order to, e.g., “provide the driver real time feedback regarding notable driving events” that distinguishes “different types of notable driving events.” USAA-1005 (Peng), [0061], [0073], Fig. 4.

205. For at least the reasons above, Peng-Chatterjee renders obvious [2].
[3] A mobile telecommunication device according to claim 2, wherein predetermined action is storing driving information associated with that event to the memory.

206. As discussed above (e.g., [1.5], [1.10], [2], *supra*), Peng discloses that “**collected data may be processed, displayed, [and] stored...in non-volatile**

memory” (*“storing driving information associated with that event to the memory”*). ; USAA-1005 (Peng), [0073]. Peng also generally describes processing collected data to provide driving information (e.g., “driving behavior metrics) and using the driving information (e.g., processed sensor data) to identify NDEs. USAA-1005 (Peng), [0068].

207. As shown in Peng’s Fig. 4 (reproduced below), the methods performed by the driving analysis application 50 in the combination would have been obviously configured to include identifying notable driving events (step 110) (*“occurrence of a predetermined event”*) that is followed by predetermined actions, including a step to “save data” (step 116) (*“storing driving information associated with that event to the memory”*). USAA-1005 (Peng), [0013], [0075], [0136], [0071], [0146], Figs. 2, 4.

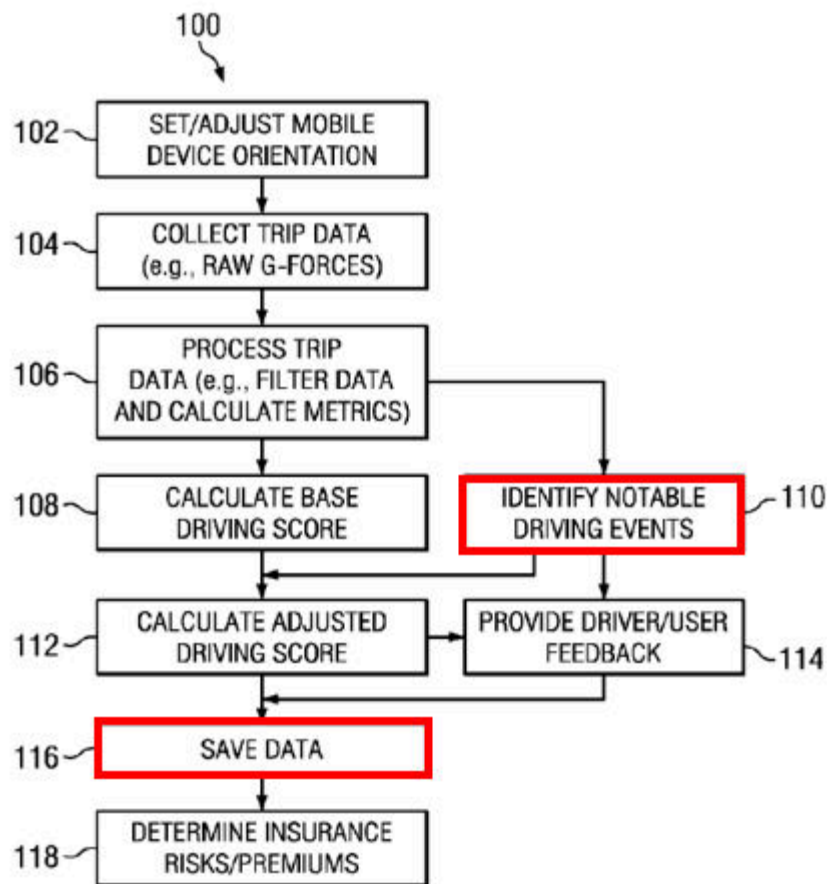


FIG. 4

USAA-1005 (Peng), Fig. 4 (annotated)

208. From this and related description, a POSITA would have understood and/or found obvious that examples of a predetermined action would have included storing and/or reporting the identified notable driving events (NDEs) to the memory (e.g., non-volatile memory) of the *Peng-Chatterjee* device. USAA-1005 (Peng), [0068], [0099]; *see also id.*, [0034], [0064], [0073], [0074], [0142]; Figs. 2, 4. It would have been obvious to a POSITA that the storing of NDEs would need

to occur in response to the detection of the NDE in order to, e.g., “provide the driver real time feedback” and “display...the locations of notable driving events (NDEs).” USAA-1005 (Peng), [0061], [0163], [0073]. Thus, *Peng-Chatterjee* renders obvious [3].

[5] A mobile telecommunication device according to claim 2, wherein predetermined action is transmitting driving information via a wireless telecommunication module of the mobile telecommunication device to a remote system.

209. As discussed previously (e.g., [2], *supra*), it would have been obvious to configure *Peng-Chatterjee*’s device to identify notable driving events (NDE) (“*an event has been detected*”) from the collected/processed sensor data (“*driving information*”) and, in response, store in memory and report the events to “remote entities” (“*predetermined action is transmitting driving information...to a remote system*”). USAA-1005 (Peng), [0068], [0099], [0034], [0064], [0073]-[0074], [0142], [0061], [0163], Figs. 2, 4. Additionally, based on Peng’s disclosure, *Peng-Chatterjee* would have been obviously configured to “communicate **data associated with application 50** via a network or other communication link(s) to one or more **other** computer devices,” in which communication of data can be transmitted “via any one or more...**wireless** communication links” (“*transmitting driving information via a wireless telecommunication module of the mobile telecommunication device to a remote system*”). USAA-1005 (Peng), [0058],

[0149]; *see also id.*, [0033], [0035], [0057], Fig. 5. Thus, *Peng-Chatterjee* renders obvious [5].

[8.1] A mobile telecommunications device according to claim 2, wherein the predetermined action comprises communicating to a remote system that an event has been detected,

210. As discussed previously (*e.g.*, [2], [5], *supra*), a POSITA would have understood and/or found obvious from Peng's disclosure that the *Peng-Chatterjee* mobile device identifies notable driving events (NDE) ("***an event has been detected***") from the driving information (*e.g.*, collected/processed sensor data) and, in response, the combination device can store in memory and report the events to "remote entities" ("***predetermined action comprises communicating to a remote system***"). USAA-1005 (Peng), [0068], [0099], [0034], [0064], [0073], [0074], [0142], Figs. 2, 4. Based on the above, a POSITA would have found that the *Peng-Chatterjee* combination renders this limitation obvious.

[8.2] the mobile telecommunications device being further configured to receive from the remote system a request to transmit to the remote system selected portions of the driving information associated with the detected event.

211. A POSITA would have found obvious based on Peng's disclosure that *Peng-Chatterjee*'s mobile device is configured to receive from a remote system a request to transmit to the remote system selected portions of the driving information associated with the detected event. For example, Peng describes that the mobile device 10, via the data processing module 42, can identify 'notable

driving events” (NDEs)” and “process the collected data” “**in response to a request**” (“*configured to receive from the remote system a request to transmit to*”) by remote entities, e.g., “a user of handheld mobile device 10, a user at remote computer 150, or other user.” USAA-1005 (Peng), [0068]. Furthermore, Peng’s device 10 may “communicate **some** or all data collected by data collection module 40” (“*selected portions of*”), including “**partially processed data**” (“*the driving information associated with the detected event*”), to “a remote processing computer 150” (“*remote system*”). USAA-1005 (Peng), [0146]. Thus, it would have been obvious to a POSITA that *Peng-Chatterjee*’s mobile device may be configured to receive a request from a remote system (e.g., a request from a user at a remote computer 150) to process select portions of the driving information (e.g., some of the partially processed collected driving data) associated with a detected event (e.g., NDE). Thus, *Peng-Chatterjee* renders obvious [8].

[16] A mobile telecommunications device according to claim 2, wherein the at least one predetermined action comprises providing the user with options to control the mobile device to take further actions.

212. As discussed (e.g., [2], *supra*), based Peng’s disclosure, the combination renders obvious that, in response to identifying NDEs in step 110, the mobile device is configured to “display[] data on display device 36 on handheld mobile device 10, providing visual, audible, or other sensory feedback to the driver via handheld mobile device 10” and “facilitate user interaction with application 50

(e.g., via a touchscreen display 36 or other input devices 38) allowing the user to view any of the data discussed above, e.g., by user selection or navigation of displayed objects) (“***providing the user with options to control the mobile device to take further actions*Peng-Chatterjee renders obvious [16].**

[17] A mobile telecommunications device according to claim 1, further configured to: interface with an external device, the external device having access to external driving information associated with a condition of the vehicle; and, to receive at least a portion of the external driving information from the external device.

213. Peng discloses “devices external to handheld mobile device 10 (e.g., speed sensors, blind spot information sensors, seat belt sensors, GPS device, etc.)”

and “data sources in vehicle 12 but external to handheld mobile device 10 (e.g., on-board vehicle computer, seat belt sensors, GPS system, etc.)” (“*external device*”). USAA-1005 (Peng), [0021], [0033]. The mobile device 10 interfaces with the external device, for example, “via a hardwire connection, Bluetooth® or other wireless means, optical signal transmission, or any other known manner.” USAA-1005 (Peng), [0021], [0033]. These external devices provide “driving behavior data and/or driving environment data” regarding the driving environment (“*external driving information associated with a condition of the vehicle*”). USAA-1005 (Peng), [0063], [0066]. “For example, such driving environment data may include any of (a) traffic environment characteristics, e.g., congestion, calmness, or excitability of traffic, quantity and type of pedestrian traffic, etc., (b) weather environment characteristics, e.g., ambient temperature, precipitation, sun glare, darkness, etc., (c) roadway environment characteristics, e.g., curvature, skid resistance, elevation, gradient and material components, etc., (d) infrastructure environment characteristics, e.g., lighting, signage, type of road, quantity and type of intersections, lane merges, lane markings, quantity and timing of traffic lights, etc., and/or (e) any other type of driving environment data.” USAA-1005 (Peng), [0063].

214. In fact, it had been known that a mobile device can interface with an external device by the Critical Data. For example, Katayama describes a set of

vehicle sensors (“*external device*”) configured to sense data related to “the behavior, surrounding situation, and operating condition or the like of [a] motor vehicle V” (“*external driving information associated with a condition of the vehicle*”). USAA-1024 (Katayama), [0034], [0064]. Examples of the vehicle sensors include “automobile speed meter 10 incorporated into the vehicle, the door 11, the emergency brake 12 and the ignition switch 13.” *Id.*, [0064].

215. Based on the above, a POSITA would have found that Peng-Chatterjee combination renders obvious that the mobile device is configured to interface with an external device, the external device having access to external driving information associated with a condition of the vehicle.

216. Based on Peng’s disclosure, a POSITA would have found obvious that Peng-Chatterjee’s mobile device can “collect driving data” that “include driving behavior data and/or driving environment data collected by external devices and communicated to handheld mobile device 10.” USAA-1005 (Peng), [0066]. *See also* USAA-1005 (Peng), [0021] (“handheld mobile device 10 may **collect certain driving data** (e.g., driving behavior data and/or driving environment data) **from** sensors and/or **devices external to handheld mobile device 10** (e.g., speed sensors, blind spot information sensors, seat belt sensors, GPS device, etc.).”).

217. In fact, it had been known that a mobile device can receive at least a portion of the external driving information from the external device by the Critical Data. For example, Katayama describes the data used for accident detection includes “position data indicating a position of the vehicle, speed data indicating a speed of the vehicle, brake data indicating whether or not a brake of the vehicle is activated, door open/close data indicating whether a door is open or closed” (“*at least a portion of the external driving information*”). USAA-1024 (Katayama), [0013]. Katayama teaches receiving at least a portion of the data collected by external vehicle sensors (“*external device*”). *Id.*.

218. Based on the above, a POSITA would have found that the Peng-Chatterjee combination renders obvious that the mobile device is configured to receive at least a portion of the external driving information from the external device.

[18] A mobile telecommunications device according to claim 17, further arranged to interface with the external device wirelessly.

219. Based on Peng’s disclosure, a POSITA would have found obvious that Peng-Chatterjee’s mobile device interfaces with the external device wirelessly, for example, via “Bluetooth® or other wireless means.” USAA-1005 (Peng), [0033]. Based on the above, a POSITA would have found that the Peng-Chatterjee combination renders this limitation obvious.

[19] A mobile telecommunications device according to claim 1, wherein the mobile telecommunications device utilizes its own power supply.

220. A POSITA would have understood and/or found obvious that *Peng-Chatterjee*'s mobile device includes its own device battery ("***power supply***") given *Peng*'s non-limiting disclosure of handheld mobile device 10 encompassing "any type of portable or mobile electronics device, such as for example a mobile telephone...." USAA-1005 (*Peng*), [0019]. Furthermore, since "handheld mobile device 10 may be a smart phone, such as an iPhone by Apple Inc.," a POSITA would have understood that a mobile phone has its own battery as a power supply. USAA-1005 (*Peng*), [0019]; USAA-1500, [0002]. Based on the above, a POSITA would have found that the *Peng-Chatterjee* combination renders this limitation obvious.

[20] A mobile telecommunications device according to claim 1, wherein the mobile telecommunications device is a smartphone.

221. A POSITA would have found obvious that *Peng-Chatterjee*'s mobile device ("***mobile telecommunications device***") "may be a smart phone, such as an iPhone." USAA-1005 (*Peng*), [0019], Figs. 1, 5, 6A-6E. Based on the above, a POSITA would have found that the *Peng-Chatterjee* combination renders this limitation obvious.

[41] A non-transitory computer readable medium according to claim 21, wherein the processing step comprises determination of at least one of: vehicle acceleration events and vehicle braking events.

222. See [46.10] *supra*.

[42.1] A mobile telecommunications device according to claim 21, wherein process step comprises determination of vehicle swerving events and

223. The term “swerving” appears once in the ’879 patent specification and is determined based on “lateral G-forces.” USAA-1001, 21:41-42 (“Harsh swerving—lateral G-forces greater than 0.7G for more than 400 msec.”)

224. As discussed above (e.g., [1.7], [41] *supra*), a POSITA would have found obvious that *Peng-Chatterjee*’s mobile device is configured to “**process any or all of this driving data** collected by handheld mobile device 10” (perform “the *process step*”), “to calculate “**cornering** metrics based on driving behavior data” and identify NDEs such as instances of **notable cornering** (“*determination of vehicle swerving events*”). USAA-1005 (Peng), [0022]. *See also* USAA-1005 (Peng), [0044]. Based on the above, a POSITA would have found that the *Peng-Chatterjee* combination renders this limitation obvious.

[42.2] the determination of such events occurs when data from the sensor set accords with preset parameters.

225. A POSITA would have understood, based on Peng’s similar disclosure to the ’879 patent specification, that in the combination, the determination of NDEs such as “Left Cornering” and “Right Cornering” occurs when the **lateral G-force data** (“LatG”) “detected by the accelerometer” satisfies “corresponding threshold values” (“*determination of such events occurs when data from the sensor set accords with preset parameters*”). USAA-1005 (Peng),

[0099]-[0115]. Based on the above, a POSITA would have found that the *Peng-Chatterjee* combination renders this limitation obvious.

[0099] At step 110, data processing module 42 may identify and analyze any notable driving events during the data collection session, based on the collected/processed G-force data and jerk data. For example, module 42 may compare the lateral and longitudinal G-force data to corresponding threshold values to identify the occurrence of notable driving events. For example, module 42 may execute the following example algorithms to identify the occurrence and type of a notable driving event (NDE) for a Chevrolet Impala:

```
[0100] lat_magnitude_gf=max(0, abs(LatG)-0.40);
[0101] lon_magnitude_gf=max(0, abs(LonG)-0.30);
[0102] magnitude_gf=max(lat_magnitude_gf, lon_
      magnitude_gf);
[0103] if magnitude_gf=lat_magnitude_gf and latG.>0
      then NDE_type="L";
[0104] else if magnitude_gf=lat_magnitude_gf and
      latG.<=0 then NDE_type="R";
[0105] else if magnitude_gf=lon_magnitude_gf and
      lonG<0 then NDE_type="A";—
[0106] else if magnitude_gf=lon_magnitude_gf and
      lonG>=0 then NDE_type="D";
[0107] else no NDE identified.
[0108] wherein:
[0109] LatG=lateral G-forces detected by the acceler-
      ometer;
[0110] LonG=longitudinal G-forces detected by the
      accelerometer;
[0111] NDE_type "L"=Left Cornering
[0112] NDE_type "R"=Right Cornering
[0113] NDE_type "A"=Acceleration
[0114] NDE_type "D"=Deceleration
```

USAA-1005 (Peng), [0099]-[0114].

[43] A mobile telecommunications device according to claim 21, wherein the process step comprises determination of both vehicle acceleration events and vehicle braking events.

226. As discussed above (e.g., [1.7], [41] *supra*), a POSITA would have found obvious that *Peng-Chatterjee*'s mobile device is configured to “**process any or all of this driving data** collected by handheld mobile device 10” (perform “the *process step*”), “to calculate one or more driving behavior metrics and/or scores based on such collected driving data” such as “**acceleration, braking, and cornering metrics.**” USAA-1005 (Peng), [0022]. The mobile device includes a “driving analysis application [that can] identify “**notable driving events,**” such as instances of **notable acceleration, braking, and/or cornering**” (“*both vehicle acceleration events and vehicle braking events*”). USAA-1005 (Peng), [0022]. See also USAA-1005 (Peng), [0044] (“Data processing module 42 may be operable to **process or analyze any of the driving data** (e.g., driving behavior data and/or the driving environment data),” “and based on such collected driving data, calculate one or more driving behavior metrics and/or scores” such as “the driving behavior metrics of **acceleration, braking, and/or cornering metrics** based on driving behavior data collected by an accelerometer 54, location tracking system 56, and/or other collected data.”).

227. Based on the above, a POSITA would have found that the *Peng-Chatterjee* combination renders this limitation obvious.

[45.1] A mobile telecommunications device according to claim 1, wherein the mobile telecommunications device further comprises a proximity sensor and

228. Based on Peng's disclosure, a POSITA would have found obvious that Peng-Chatterjee's mobile device "include[s] **proximity sensors**," USAA-1005 (Peng), [0029]. Based on the above, a POSITA would have found that the Peng-Chatterjee combination renders this limitation obvious.

[45.2] the instructions, upon execution by the processor, enable the mobile telecommunications device to detect the proximity of the mobile telecommunications device to the vehicle.

229. Based on Peng's disclosure, a POSITA would have found obvious that Peng-Chatterjee's mobile device "**include[s] algorithms for determining whether handheld mobile device 10 is likely travelling in an automobile based on data from** accelerometer 54 and/or location tracking system 56, e.g., by analyzing one or more of ... (b) the current location of handheld mobile device 10 from location tracking system 56 (e.g., whether handheld mobile device 10 is located on/near a roadway), ... **(d) any other suitable data.**" USAA-1005 (Peng), [0035]. Given that the HMD is already equipped with "**proximity sensors**," it would have been obvious to a POSITA that the mobile device would include "algorithms" ("***the instructions, upon execution by the processor***") "for determining whether handheld mobile device 10 is likely travelling in an automobile based on data from" the proximity sensors, e.g., by analyzing whether

the handheld mobile device 10 is in proximity of the vehicle (*“enable the mobile telecommunications device to detect the proximity of the mobile telecommunications device to the vehicle”*). USAA-1005 (Peng), [0029], [0035].

230. Additionally or alternatively, Peng describes “the handheld mobile device 10 may communicate with data source in vehicle 12 but external to handheld mobile device 10 via **“Bluetooth®.”** USAA-1005 (Peng), [0034]. A POSITA would have understood that the mobile device would include a Bluetooth sensor, which is a proximity sensor capable of proximity detection based on Bluetooth signal strengths. USAA-1005 (Peng), [0034], [0019]; USAA-1009, Abstract (“determining the proximity of radio frequency devices using the analysis of a series of receive signal strength indicator (RSSI) values.”), 14:25-15:3 (“an exemplary embodiment “applied to measurement of Bluetooth signal strength from a mobile phone inside a stationary vehicle.” *Id.*, 14:25-15:3. This embodiment “provide[s] a proximity detection of the phone coming within 2 meters of the vehicle in any manner from any direction.”). In fact, Peng references the Apple iPhone as an example of the mobile device, which includes a Bluetooth sensor. USAA-1005 (Peng), 1:22-27. Thus, a POSITA would have found it obvious that, in the combination, the mobile device would have included the Bluetooth sensor and corresponding instructions, upon execution by the processor, enable the mobile device to use the Bluetooth sensor to detect a proximity of the mobile device to the

vehicle 12 so as to “communicate with data source in vehicle 12...via “**Bluetooth®**,” as described in Peng. USAA-1005 (Peng), [0034]. Based on the above, a POSITA would have found that the *Peng-Chatterjee* combination renders this limitation obvious.

4. Elements of Claims 22, 23, 25, 28, 34, 37-40, 44, 47-50, 52, 53

231. *Peng-Chatterjee* renders these claims obvious in the same manner as explained above for the corresponding claims listed in the table below.

Claim Limitation	Corresponding Limitations
[2]	[22]
[3]	[23]
[5]	[25]
[8.1]-[8.2]	[28.1]-[28.2]
[16]	[34]
[17]	[37]
[18]	[38]
[19]	[39]
[20]	[40]
[42.1]-[42.2]	[47.1]-[47.2], [52.1]-[52.2]
[43]	[48]
[42.1]-[42.2] & [43]	[44.1]-[44.2], [49.1]-[49.2],
[45.1]-[45.2]	[50.1]-[50.2], [53.1]-[53.2]

XII. [GROUND 1B] - PENG, CHATTERJEE, AND TAMIR RENDER CLAIMS 4 AND 24 OBVIOUS

A. Proposed Combination

a) Peng-Chatterjee-Tamir Combination

232. Based on Peng's disclosure, it would have been obvious to have configured in the combination that "data collected by data collection module 40 [of handheld mobile phone 10] may be **time stamped (e.g., time and date)**" and that the device "may calculate the number of each type of notable driving events (and/or the number of each severity level of each type of notable driving event) for a **particular time period.**" USAA-1005 (Peng), [0042], [0077]. Peng also describes "process[ing] the collected data after some delay period, upon the end of the data collection session," for example, "at any...suitable time or in response to any...suitable event." USAA-1005 (Peng), [0042]. But while Peng contemplates designating time periods in its data collection and processing steps, it does not provide any details regarding the sampling rates that should be applied in these steps. Thus, a POSITA implementing Peng's data collection and processing method would have looked to well-known temporal sampling techniques applicable for data similar to those being collected by Peng's device 10 (e.g., accelerometer data, position data).

233. In doing so, a POSITA would have recognized that it was well-known by the Critical Date to employ data collection techniques in vehicle monitoring

systems with variable data sampling rates. As discussed previously, Tamir discloses one example in which a sampling rate is adjusted based on conditions associated with data collection (e.g., location of driving, driving behavior).

USAA-1012 (Tamir), 9:10-20, 20:52-21:11. A POSITA would have recognized that incorporating Tamir's data collection technique into the combination system would have improved Peng's data collection and processing steps by, for example, allowing "lower power consumption and less wear and tear of the" handheld mobile device, as taught in Tamir. USAA-1012 (Tamir), 20:52-21:2.

Furthermore, dynamic sampling rates were known to provide several advantages to data processing in vehicle monitoring systems, such as maintaining measurement precision, high adaptation to different driving conditions, and increased responsiveness. USAA-1017, 5:61-6:9, 9:3-7; USAA-1018, [0019]; USAA-1019, 5:1-3.

B. Analysis of Claims 4, 24

[4]/[24] A mobile telecommunication device according to claim 2, wherein predetermined action is storing driving information captured at a higher sampling rate than when an event is not detected.

234. As discussed ([2], [3], *supra*), the combination renders obvious that the predetermined action is storing driving information associated with that event to the memory since Peng can identify notable driving events (NDE) ("***an event has been detected***") from the collected/processed sensor data ("***driving***

information”) and, in response, store in memory. USAA-1005 (Peng), [0068], [0099], [0034], [0064], [0073]-[0074], [0142], [0061], [0163], Figs. 2, 4. As discussed above, a POSITA would have configured the combination to use Tamir’s data collection technique to improve Peng’s motion recording process by using variable sampling rates. USAA-1012 (Tamir), 9:10-20, 20:52-21:11. Tamir describes that “the sampling rate is adjusted according to the driving pattern of vehicle 15” and that “when it is determined that the driver is driving relatively daringly, a higher sampling rate is used.” *Id.*, 20:52-21:2. Tamir also contemplates adjusting data collection “at special occasions, such as when an accident is possible.” *Id.* A POSITA would have therefore understood and/or found it obvious that in scenarios in which the handheld mobile device, in the combination, detects a notable driving event (“*an event*”), a higher sampling rate is used for data collection relative to other scenarios (“*driving information captured at a higher sampling rate than when an event is not detected*”).

235. A POSITA would have also appreciated additional benefits of preserving more information related to an event of interest (e.g., Peng’s NDE or Tamir’s unsafe driving behavior) and derive better metrics and/scores to reflect the event of interest, compared to other collection period without any event of interest. *See e.g.*, USAA-1024 (Katayama), [0016] (“the important data will not be erased...which enables effective use of the memory without erasing important

situation data”), [0027], [0057]-[0058]. Moreover, with such an adapted sampling rate, storage resources of the Peng-Chatterjee-Tamir combination can be used more efficiently by spending more storage space for collected/processed data related to event of interest, “such that the stored data may be subsequently accessed, e.g., for display or further processing,” especially for NDEs, as taught by Peng. USAA-1005 (Peng), [0071].

XIII. [GROUND 1C] - PENG, CHATTERJEE, AND KATAYAMA RENDERS CLAIMS 6, 9, 10, 14, 15, 26, 32, 33, 35, 36 OBVIOUS

A. Proposed Combination

a) The Peng-Chatterjee-Katayama Combination

(i) Accident Detection/Verification

236. As previously discussed, Peng-Chatterjee’s handheld mobile device is obviously configured to execute a method of identifying notable driving events (NDEs),” such as “notable acceleration” and “severity level of each NDE,” e.g., “warning,” “extreme,” or “severe.” USAA-1005 (Peng), [0022], [0055] [0059], [0061], [0068], [0073], [0126], [0136], [0146], [0155], [0163]. Such identification of NDEs can be useful in various applications, for example, to “provide data...as a basis to provide a potential customer a quote for insurance” to an insurance provider, “proctor a driver's test for a candidate to obtain a driver's license,” and “educate drivers about safe driving behaviors.” USAA-1005 (Peng), [0074], [0165]. In one example, Peng explains that the cost of an insurance policy may be

based on “data useful for predicting the occurrence of accidents[.]” USAA-1005 (Peng), [0165]. It would have been obvious to a POSITA to have looked to the well-known accident detection techniques to supplement Peng’s method since a POSITA would have understood that accidents are typically associated with NDEs (e.g., notable acceleration, braking, and/or cornering) and that accident-occurrence information would be highly relevant to its exemplary applications, e.g., predicting future occurrence of accidents for insurance companies assessing policy cost. USAA-1515 (Flowers), 29 (“drivers with high accident...rates will be more likely to be involved in future accidents.”)). In this way, a POSITA looking to implement Peng’s system would have looked to supplement its disclosure using accident detection and verification techniques that were well-known by the Critical Date to advance Peng’s overall motivation to provide relevant notable driving events in its disclosed applications (e.g., assess insurance or monitor teen driver) as well as collect driving information that would be highly pertinent for an insurance provider, a parent, or a driving instructorUSAA-1005 (Peng), [0024], [0074], [0143], [0165]; USAA-1008.

237. Several vehicle monitoring systems by the Critical Date were similarly capable of detecting accidents. USAA-1007 (Balachandran), Abstract, 1:40-42, Fig. 3; USAA-1509; USAA-1510; USAA-1511; USAA-1512. For example, as discussed above, Katayama describes using a “vehicle-mounted

driving recorder” to detect an event, e.g., an accident or a risk incident (i.e., *hiyari hatto*) based on sensor data. USAA-1024 (Katayama), Abstract, [0012]. Like Peng, Katayama similarly detects notable driving events (e.g., *hiyari hatto* and driving abnormalities), but further includes the detection and verification of accidents in its detection methods. USAA-1024 (Katayama), [0002], [0004], [0013], [0020], [0035]-[0038]. Like Peng, Katayama similarly detects notable driving events, such as a *hiyari hatto* (risk incident) or an abnormality such as “when an acceleration (a deceleration) of the vehicle shows above a certain numerical value,” but further goes to also include the detection and verification of accidents. USAA-1024 (Katayama), [0004], [0002], [0013], [0020], [0035]-[0038]. Also similar to Peng’s techniques for using a device’s sensor data, Katayama also uses recorder’s sensor data, e.g., acceleration data and position data, to detect an accident. USAA-1024 (Katayama), [0013], [0035]-[0037]. For example, Katayama’s recorder can detect an event, such as an accident, by means of “acceleration detected by acceleration sensor 32 that exceeds a predetermined criterion.” USAA-1024 (Katayama), [0040], [0048]-[0049]. And once an accident has been detected, Katayama teaches alerting and enabling the driver to verify, via user inputted data, whether an accident actually occurred. USAA-1024 (Katayama), [0050], [0007], [0012]-[0013].

238. A POSITA would have been motivated to include vehicle-related event detection and verification techniques, as taught by Katayama, in the proposed combination to further leverage its data collection and processing methods towards helping “improve driving safety” and address Peng’s concerns regarding “motor vehicle crashes” and deaths. USAA-1005 (Peng), [0002]-[0004]. In addition, a POSITA would be motivated to include Katayama’s vehicle-related event detection and verification techniques in Peng’s system to accurately record, classify, and efficient store the vehicle driving information being collected by the device in the combination. A POSITA would have readily appreciated that the structural and functional similarities between Katayama’s “vehicle-mounted driving recorder” that includes sensors, processors, memories, controllers and Peng’s “handheld mobile device, e.g., a smart phone.” USAA-1024 (Katayama), Figs. 3-4; USAA-1005 (Peng), [0001], [0165]. Thus, it would have been obvious to a POSITA to implement in the handheld mobile device in the combination the functionalities of Katayama’s vehicle-mounted driving recorder given the already-available hardware components (e.g., sensors, processors, memories, controllers) found in Peng’s “handheld mobile device.” *Id.*

239. A POSITA would have also been motivated to incorporate Katayama’s functionalities, such as accident detection and response techniques (e.g., event-triggered storage technique), into the handheld mobile device in the

combination, for example, to “facilitate an after-the-fact analysis on not only situation data at a time of an accident but also situation data at a time of a hiyari hatto (risk incident)” which “can contribute accident prevention,” facilitating at least one of Peng’s objectives of “improve driving safety.” USAA-1005 (Peng), [0003]; USAA-1024 (Katayama), Abstract.

240. A POSITA would have had a reasonable expectation of success because the proposed combination merely involved implementing a known technique (e.g., Katayama’s detection and verification of an accident based on collected driving data) into a known system (Peng’s system). Furthermore, the elements of the resulting combination would each generally perform functions they had been known to perform prior to the combination—the device in the combination would perform the functions, as described in Peng, to collect driving data using sensor data, but would further leverage techniques to identify and verify accidents, as taught by Katayama, when processing the collected data already described by Peng. USAA-1005 (Peng), [0006], [0029], [0033]; USAA-1024 (Katayama), [0040], [0048]-[0050].

(ii) Data Storage Management

241. Peng describes that its memory 30 includes short-term storage (e.g., volatile memory) and long-term storage (e.g., non-volatile memory) of certain data. USAA-1005 (Peng), [0026], [0058], [0073]. Peng acknowledges that the use

of short-term storage is limited by, for example, indicating that data collection module 40 “filter[s] or truncate[s]” its short term data by “eras[ing] data collected during...the data collection session,” e.g., (e.g., “the first and last 60 seconds of the data collection session,” when data collection session exceeds a certain time threshold. USAA-1005 (Peng), [0077], [0058], [0073]. A POSITA would have recognized that Peng’s techniques of erasing data based on time-based factors alone does not take in account the data’s potential importance as it would have been understood that such erasing steps are generally used to address memory storage limitations and erasing data based on time-based factors alone does not take in account the potential importance of the data being erased. USAA-1024 (Katayama), [0004], [0085] (“provide a driving recorder that can accurately select and record the situation data [sic] relating to the accident.”), USAA-1039 (Kim), [0002]-[0006]. Furthermore, a POSITA would have known that the advantages of identifying and storing driving information based on its relative importance were well recognized and disclosed by the prior art (e.g., Katayama and Kim) before the Critical Date. *Id.* In fact, Katayama discloses that it was known that important driving information (e.g., “situation data whose importance is high”) “at a time of an accident and at a time of a hiyari hatto (risk incident)” may need special treatments, such as, being “recorded in a nonvolatile memory ... from a transient memory,” or more advantageously, being “accurately select[ed] and record[ed].”.

USAA-1024 (Katayama), [0004]-[0009], [0085]. Hence, a POSITA would have perceived a need to supplement the proposed combination's capabilities with well-known data handling and storing techniques to address the combinations's limited storage capacities while advantageously ensuring that data was being stored based on its potential importance. USAA-1513; USAA-1514; USAA-1024 (Katayama), [0004]-[0009].

242. In performing this search, a POSITA would have discovered Katayama also describes a storage device with multiple storage sections (sections 802, 803) and offers solutions to store data into the multiple storage sections using a judgement criterion parameter storage section 805. USAA-1024 (Katayama), [0044]-[0046]. In Katayama, “[i]f a capacity of the temporary data storage section 802 runs out, old data is sequentially erased and new situation data is written in the temporary data storage section 802, but Katayama further describes using “judgment criterion parameters” to determine whether situation data stored in temporary data storage section 802 should be transferred to situation data recording section 803. *Id.*, [0045]-[0046]. Additionally, Katayama discloses storing/transferring to the situation data recording section 803 or an outside, detachable record device 7 only in response to detecting hiyari hatto (risk incident) or the accident when the situation data meets a predetermined condition. USAA-1024 (Katayama), [0044]-[0051], [0063]. These event-triggered storage techniques

in response a detected event (e.g., accident) can further save the storage space, “thereby eliminating accumulation of useless data.” USAA-1024

(Katayama), [0053]. In this way, Katayama teaches uses different types of storage depending on the data’s potential usefulness, and transfers potentially useful driving data to advantageously save important data.

243. A POSITA would have understood that Katayama not only recognizes that storage constraints of mobile devices necessitate different types of storage depending on its potential usefulness, but further discloses a technique for transferring potentially useful driving data to permit data preservation despite the storage constraints and that Katayama’s teaching and the associated benefits of identifying and storing important data can be applied generally to data, i.e., including both raw and processed data. A POSITA would have been motivated to configure the combination device’s memory in a similar fashion to take advantage of Katayama’s storage techniques that “enables effective use of the memory without erasing important situation data.” *Id.*, [0016], [0044]-[0051], [0063], [0053].

244. In the combination, based on teachings of Peng and Katayama, it would have been obvious to a POSITA to configure its memory to include: (1) a short term memory configured to store raw and processed data (e.g., “time-stamped data,” “filtered data,” “metrics” and “scores”) in a similar manner that

Katayama's temporary data storage section 802 is used for data storage regardless of its contents and associated importance. USAA-1005 (Peng), [0026], [0058], [0073]; USAA-1024 (Katayama), [0016], [0051] ("the temporary data storage section 802 temporarily stores the situation data irrespective of the contents of the situation data"), [0044], [0046], [0057]. Furthermore, in the combination, memory 30 would have been obviously configured to include a long term memory configured to store at least select processed data (e.g., data indicating NDEs) based on its higher importance for long-term storage in a similar manner as Katayama's situation data recording section 803 is used to store "data whose importance is higher." *Id.* A POSITA would have understood from Peng's disclosure that "the data indicating NDEs" would include raw and processed data (e.g., "time-stamped data," "filtered data," "metrics" and "scores") that are associated with identified NDEs. USAA-1005 (Peng), [0042]. For example, when a NDE is identified, there may be "time-stamped data" such as time-stamped data from accelerometer 54, "filtered data" such as filtered acceleration data, "metrics" such as acceleration or braking occurrences, and "scores," such as a score calculated based on the Acceleration, Braking, and Cornering metrics, that are associated with the identified NDE. USAA-1005 (Peng), [0042]. In this way, the combination leverages Katayama's teaching of using its temporary data storage section 802 for data storage irrespective of its contents and its situation data recording section 803

to store “data whose importance is higher,” Such as data indicating NDEs of “seere” or “extreme” levels. *Id.* A POSITA would have been motivated to configure the combination’s memory to generally apply data storage techniques to “eliminat[e] accumulation of useless data” and “enable[] effective use of the memory without erasing important situation data” by ensuring storage of potentially important data (e.g., data indicating NDEs) in the combination’s long term memory, e.g., as “historical driving data 46.” USAA-1005 (Peng), [0071], [0142], [0163], [0026], [0058] (“feedback module 44 may...manage long-term storage of certain data as historical driving data 46”), [0073], [0126]-[0133]; USAA-1024 (Katayama), [0016], [0053], [0044], [0046]. A POSITA would have recognized that the the benefits of using Katayama’s effective memory storage would be applicable to raw data as well as processed data.

245. A POSITA would have found the proposed combination obvious because of structural and functional similarities between Katayama’s vehicle-mounted driving recorder and the handheld mobile device described by Peng, and would have therefore had a reasonable expectation of success in this combination. USAA-1024 (Katayama), Figs. 3-4; USAA-1005 (Peng), [0001], [0165]. A POSITA would have had a reasonable expectation of success in implementing this configuration since memory allocation configurations were employed and well-known in dynamic monitoring systems by the Critical Date. USAA-1042, 1

Furthermore, the elements of the resulting combination would each generally perform functions they performed prior to the combination—the device in the combination would, as described in Peng, store its driving information data (e.g., certain data for displaying) in short-term memory, but further leverage identifying and storing select data based on its relative importance, as taught by Katayama, when storing the select data in the long-term memory, e.g., based on Peng’s NDE identification/classification. USAA-1005 (Peng), [0058] (“feedback module 44 may manage short-term storage of certain data (e.g., in volatile memory of handheld mobile device 10), and may further manage long-term storage of certain data as historical driving data 46 (e.g., in non-volatile memory of handheld mobile device 10)”); USAA-1024 (Katayama), [0015]-[0016], [0027].

B. Analysis of Claims 6, 9, 10, 14, 15

[6.1] A mobile telecommunications device according to claim 2, wherein the predetermined action comprises providing feedback to a user to indicate that an event has been detected,

246. The combination device renders obvious to identifying notable driving events (“*detect occurrence of a predetermined event*”). USAA-1005 (Peng), [0022]. Upon detecting the notable driving event, the combination device would be obviously configured, based on Peng and Katayama’s disclosures, to “provide the driver real time feedback regarding notable driving events, via any suitable form of feedback,” e.g., “audible feedback...or visual feedback via display 36”

(“*providing feedback to a use to indicate that an event has occurred*”). USAA-1005 (Peng), [0061]; *see also id.*, [0001], [0057], [0059]; USAA-1024 (Katayama), [0050].

[6.2] the mobile telecommunications device being configured to receive a user interaction to confirm or deny whether the detected event has actually occurred following said feedback.

247. Katayama teaches providing feedback to the driver when an accident has been detected and prompts the driver to verify the detected accident by providing input data on the recorder (“*receive a user interaction to confirm or deny whether the detected event has actually occurred following said feedback*”) USAA-1024 (Katayama), [0050].

248. As discussed above, it would have been obvious to a POSITA to supplement Peng’s method of detecting NDEs, to further detect an accident, and, upon detecting the accident, apply Katayama’s response technique of verifying the accident by prompting driver’s input to accurately process and communicate data. USAA-1024 (Katayama), [0050]. A POSITA would have understood and/or found it obvious to configure the combination’s input/output devices 38 (e.g., “a touchscreen display 36, keys, **buttons**”) to allow a user to verify an accident based on Katayama’s teaching of using “button switch 5” as an input device for receiving input data to verify the event/accident. USAA-1005 (Peng), [0062], [0063]; USAA-1024 (Katayama), [0041], [0050]. Thus, in the combination, a POSITA

would have configured the handheld mobile device in the combination to receive a user's **input data** via input/output devices to **verify** whether the accident actually occurred after receiving feedback from device 10 (***“confirm or deny whether the detected event has actually occurred following said feedback”***). Based on the above, a POSITA would have found that the Peng-Chatterjee-Katayama combination renders this limitation obvious.

[9.1] the memory comprises: a long term memory for persistently storing driving information and a short term memory for transiently storing driving information,

249. Based on Peng's disclosure, the combination renders obvious using a memory (e.g., memory 30) (***“the memory”***) comprising different types of memory, such as one for **“short-term storage of certain data,”** e.g., data “[stored] in local volatile memory for display” (***“a short term memory for transiently storing driving information”***) and one for **“long-term storage of certain data** as historical driving data 46 (e.g., in non-volatile memory of handheld mobile device 10)” (***“a long term memory for persistently storing driving information”***). USAA-1005 (Peng), [0026], [0058], [0073], [0142], [0026]; Figs.6C-6G. Specifically, the combination would leverage Peng's disclosure of storing data (***“driving information”***) including “time-stamped data,” “filtered data” and “any of the metrics, scores, or other data calculated or proceed [sic by data processing module 42.” USAA-1005 (Peng), [0042], [0058], [0069]-[0071]. A POSITA would have

understood that Peng's disclosed example memory, e.g., nonvolatile memory, used for "long-term storage" constitutes a long term memory for persistently storing driving information while Peng's disclosed example memory, e.g., volatile memory, used for "short-term storage" constitutes a short term memory for transiently storing driving information. USAA-1037 (Hugosson), [0042] (**"The volatile memory 30 is arranged to include the buffer 28 described above and function as temporary storage for the processing unit when operating the camera. The volatile memory may for instance be a Random Access Memory (RAM), (e.g., a Static RAM (SRAM) or a Dynamic RAM (DRAM))."**); [0043] (**The non-volatile memory 32 is arranged for long term storage of potentially interesting video sequences and other data that is required or desired to be accessible even after a power failure or after the video camera has not been provided with power during a substantial time period."**); USAA-1038 (Savolainen), [0043] (**"For example, volatile memory 40 may include Random Access Memory (RAM) including dynamic and/or static RAM, on-chip or off-chip cache memory, and/or the like. Non-volatile memory 42, which may be embedded and/or removable, may include, for example, read-only memory, flash memory, magnetic storage devices (e.g., hard disks, floppy disk drives, magnetic tape, etc.), optical disc drives and/or media, non-volatile random."**); [0046] (**"the memory 312 may comprise a long-**

term memory and/or a short term cache. Data may be temporarily loaded into the short term cache for quick access when needed.”); USAA-1027 (Null), 63-65 (““cache, where data from frequently used memory location may be temporarily stored....Cache is can be made of SRAM (static random access memory), where “RAM is volatile.”).

250. Additionally or alternatively, a POSITA would have recognized and/or found obvious to leverage Katayama’s techniques of using different types or areas of memory for “temporarily stor[ing]” data that has been digitalized in one memory location, e.g., a temporary storage section 802 (“*short term memory for transiently storing*”) and for long term storage of data, in another memory location, e.g., situation data recording section 803 (“*a long term memory for persistently storing*”) in the proposed combination. USAA-1027 (Null), 63-65; USAA-1037 (Hugosson), [0042]-[0043]; USAA-1038 (Savolainen), [0043], [0046]); USAA-1024 (Katayama),[0044]-[0046], [0051], [0053], Fig. 5.

251. As discussed earlier in the Katayama section, Katayama teaches using criteria in determining whether to mark and/or transfer a given set of recorded accelerometer data may include, for example, “whether or not the acceleration” indicated by that data exceeds a predetermined” threshold, and “whether or not the acceleration continues for more than or equal to a certain period [of time].” USAA-1024, [0047]-[0048]. Accelerometer data meeting either of these criteria

may, for example, be marked with a corresponding identifier and transferred to long term storage in “situation data recording section 803.” *See* USAA-1024, [0011]-[0016], [0027], [0046]-[0050], [0054], [0083].

252. To enable these and other determinations to take place, “the value (the content) of each situation data is, for example, digitalized in accordance with the judgment criterion parameter” or parameters against which it will be compared, and the resulting “digitalized” values are temporarily stored. *See* USAA-1024, [0047]-[0049]. “[W]hether or not the content of each situation data meets” a “predetermined condition” for marking and/or transfer may then be judged based on logical comparisons between the stored values and the corresponding parameter(s). USAA-1024, [0049]. For example, “concerning the acceleration,” the predetermined condition may be “satisfied at a time when...both the acceleration data exceeds the predetermined judgment criterion and the acceleration data continues over a certain period [of time].” USAA-1024, [0049].

253. It had been common knowledge to a POSITA that a computer system uses a “hierarchical memory” that includes “a combination of memory types to provide the best performance at the best cost.” USAA-1027 (Null), 64. The hierarchical memory include different areas using different types of memories that have different access speeds and storage capabilities. Common types of memories “constitute the hierarchical memory includes registers, caches, main memory and

secondary memory.” Among them, cache is a short term memory, “where data from frequently used memory location may be temporarily stored.” *Id.* Cache can be implemented by volatile memory such as SRAM (static random access memory). *Id.* The main memory “is typically a medium-speed memory, complemented by a very large second-ary memory.” In some instances, the main memory can be implemented by volatile memory, while the secondary memory can be implemented by non-volatile memory such as ROM (read only memory) (e.g., hard disk) that persistently stores data “does not need to change” and “data recorded on them lasts longer than it would in volatile main memory.” USAA-1027 (Null), 64-65; USAA-1037 (Hugosson), [0042]-[0043]; USAA-1038 (Savolainen), [0043], [0046]. It would have been obvious to a POSITA that different types of memories can be combined and configured to balance the access speed, storage capacity, and cost given different use cases and system requirements.

254. A POSITA reading Katayama would have realized Katayama’s uses of a temporary storage section 802 (“short term memory for transiently storing”) and situation data recording section 803 (“a long term memory for persistently storing”) consistent with the convention of a computer’s “hierarchical memory” that includes “a combination of memory types memory to provide the best performance at the best cost.” USAA-1027 (Null), 64. It would have been obvious

to a POSITA that different types of memory (e.g., RAM, ROM, or a combination of both) can be used to implement Katayama's temporary storage section 802 and situation data recording section 803 ("a long term memory for persistently storing") as long as they meet the functionality of temporary storage section 802 for temporarily storing data and the functionality of situation data recording section 803 for long term storing data, as well as any other design criteria (e.g., cost, access speed, and capacity). USAA-1024 (Katayama), [0044]-[0046], [0051], [0053], Fig. 5; USAA-1027 (Null), 64-65.

255. Katayama and Peng describe storing similar kinds of data and both apply a criteria to that data that determines whether to save the data in long term storage. In Peng, the short term memory data can be "time-stamped data," "filtered raw data," and/or "any of the metrics, scores, or other data calculated" and, in Katayama, its short term data is "digitalized" situation data. For example, Peng teaches storing driving information (e.g., time-stamped data, filtered raw data," and/or "metrics," and "scores") to its short term memory (e.g., volatile memory). Peng discloses that "[a]ny or all data collected...may be time stamped (e.g., time and date)" to "allow for data from different sources (e.g., data from accelerometer **54**, location tracking system **56**, a seat belt sensor, etc.) to be synchronized for analyzing the different data together as a whole." USAA-1005 (Peng), [0042]. Similar to Peng, Katayama teaches saving driving information,

e.g., digitized situation data, in its short term memory (e.g., TDSS 802). *See* USAA-1024, [0011]-[0016], [0027], [0046]-[0050], [0054], [0083].

256. Furthermore, Peng’s HMD “appl[ies] different thresholds for determining certain notable driving events [(NDEs)]” and can “define multiple levels of severity for each type (or certain types) of notable driving events. USAA-1005 (Peng), [0054]. Peng can “identify ‘notable driving events,’ such as instances of notable acceleration, braking, and cornering, as well as the severity of such events.” USAA-1005 (Peng), [0045]-[0053]. For example, HMD can “identify notable driving events using any suitable algorithms,” e.g., “compare acceleration data from accelerometer 54 (raw or filtered) to one or more predefined thresholds for notable acceleration, braking, or cornering.” *Id.*

257. Notably similar to Peng’s application of applying a threshold in determining NDEs, Katayama describes a variety of potential categories of classification, with corresponding identifiers for each category; for example, “categories may be specified according to an event that is estimated to have occurred such as...an accident,” according to an “order of importance,” or “in accordance with a combination of the above or other category system.” USAA-1024 (Katayama), [0012]-[0016]. Furthermore, Katayama applies a criteria for judging data, for example, “whether or not the acceleration” indicated by that data

exceeds a predetermined” threshold, and “whether or not the acceleration continues for more than or equal to a certain period [of time].” USAA-1024 (Katayama), [0047]-[0048].

258. Based on the commonly themed disclosures of Peng and Katayama, it would have been a natural modification for a POSTIA to have adopted Katayama’s technique of storing data that meets a criteria for long term memory storage and to have applied that technique to the combination when applying its criteria for determining NDEs. And, in doing so, it would have been obvious for a POSTA to have arrived at the enhanced combination that would save the driving information data (e.g., e.g., time-stamped data, filtered raw data”) associated with NDEs in its long term memory as “historical driving data 46.” USAA-1005 (Peng), [0058].

259. Thus, the *Peng-Chatterjee-Katayama* combination renders obvious this limitation. *Id.*

[9.2] wherein the short term memory receives driving information at a higher update rate than the long term memory,

260. As discussed above, a POSITA would have been motivated to combine Katayama with the *Peng-Chatterjee-Katayama* combination, which renders obvious this limitation. USAA-1005 (Peng), [0026], [0058], [0142]; USAA-1024 (Katayama), [0044]-[0046], [0053]. Based on Peng’s disclosure, it would have been obvious to configure the combination’s short term memory to

receive driving information frequently or steadily since Peng teaches using “short-term storage of certain data,” e.g., data “displayed in real time,” and to “perform continuously” steps, e.g., collecting and storing data, to enable the HMD to provide the “real time feedback.” USAA-1005, [0071]-[0073], Fig. 3.

261. A POSITA would have understood the term “update rate” in element [9.2] refers to a rate/frequency of the memory receives information/data as the ’879 specification consistently uses the term “update rate” to describe the memory’s operations such as “receiv[ing],” “writ[ing]” and “record[ing]” information. USAA-1001, 7:57-60, 62-65, 8:3-5. Note that another term, “sampling rate,” is recited in dependent claim 5. A POSITA would have understood the term “update rate” in this limitation to be distinct from the “sampling rate” recited in dependent claim 5 because of claim differentiation, and also because the ’879 specification consistently uses the term “sampling rate” to describe a rate of “data” being “processed” or “down-sampled.” USAA-1001, 4:63-5:5, 7:4-6.

262. A POSITA would have understood and/or found it obvious that, in some scenarios, Katayama’s temporary data storage section 802 (“*short term memory*”) obtains situation data more frequently (“*receives...at a higher update rate*”) than situation data recording section 803 (“*a long term memory*”), given Katayama’s disclosure that “temporary data storage section 802 temporarily stores the situation data irrespective of the contents of the situation data **while** the

situation data storage section 803 stores the situation data for the record **basically without updating** the situation data and the situation data is updated after being transferred to other record device,” **i.e., at a lower update rate.** USAA-1024 (Katayama), [0044]-[0046], [0051], Fig. 5.

263. Further, Katayama teaches that its short term memory, e.g., temporary data storage section 802, steadily stores information because it “temporarily stores the situation data irrespective of the contents of the situation data.” Furthermore, Katayama explains that data is occasionally transferred to its long term memory, e.g., situation data storage section 803, because the data is transferred “[o]nly in a case that the content meets the predetermined condition.” *Id.*, [0045]-[0046], [0051]. Thus, based on these teachings, it would have been understood that Katayama’s short term memory, e.g., temporary data storage section 802, would receive data more frequently than its long term memory, e.g., situation data storage section 803.

264. Accordingly, for at least the reasons above, the combination renders obvious this limitation.

[9.3] the mobile telecommunications device being further configured to: write driving information to the short term memory at a predetermined update rate during the driving period in a predetermined sequence; and,

265. As discussed above and based on Peng and Katayama’s teachings, it would have been obvious to configure the combination device to record driving

information to its short term memory (“*write driving information to the short term memory*”) at a constant sampling rate (“*at a predetermined update rate during the driving period*”) and in a chronological order (“*in a predetermined sequence*”).

USAA-1024 (Katayama), [0044]-[0046], [0001], [0016], Fig. 5. As discussed ([1.11], *supra*), the combination leverages Peng’s method of “perform[ing] continuously” steps, e.g., data collection, to enable the HMD to provide “real time feedback.” USAA-1005, [0072]-[0073], Fig. 3.

266. Also, the combination would leverage Katayama’s disclosure of “receiv[ing] the situation data...at a constant sampling time one after another in a chronological order and writes the received situation data one after another in the temporary data storage section 802” *Id.* It would have been understood to a POSITA that Katayama teaches recording the data during the driving period because the recorded data includes “data concerning the behavior, the surrounding situation or the like of the motor vehicle V” that is recorded “during a certain period before and after a time of an accident or a hiyari hatto (risk incident),” and can even be “classified at a time of recording.” USAA-1024 (Katayama), [0001], [0016]; USAA-1039 (Kim), [0003] (“...The disclosed vehicle driving recording apparatus **records image data** collected by a camera **during driving of a vehicle** in a recording/reproduction unit, together with vehicle speed and time data, in a First In First Out (FIFO) structure.”). Based on the above, a POSITA would have

found that the *Peng-Chatterjee-Katayama* combination renders this limitation obvious.

[9.4] overwrite the driving information previously written to the short term memory in accordance with the predetermined sequence.

267. Based on Katayama’s teaching, it would have been obvious to configure the combination to overwrite previously collected situation data stored in its short term memory (“***overwrite the driving information previously written to the short term memory***”) with new driving information data sequentially (“***in accordance with the predetermined sequence***”). USAA-1024 (Katayama),[0044]-[0046], Fig. 5. Specifically, the combination would leverage Katayama’s teaching that “[i]f a capacity of the temporary data storage section 802 runs out, old data is sequentially erased and new situation data is written in the temporary data storage section 802.” *Id.*, [0045]. A POSITA would have understood that, by being “**sequentially** erased,” the old data is erased according to the chronological order that it is written into the temporary data storage section 802, which is First in, First Out (FIFO), a typical replacement policy commonly used to overwrite old data in a memory when the memory is full. USAA-1027 (Null), 70-71; USAA-1039 (Kim), [0003] (“As such a conventional vehicle accident data recording apparatus, a vehicle driving recording apparatus and method is disclosed in Korean Patent Registration No. 0199792. The disclosed vehicle driving recording apparatus records image data collected by a camera during driving of a vehicle in a

recording/reproduction unit, together with vehicle speed and time data, **in a First In First Out (FIFO) structure**, sensing a collision accident of the vehicle with a sensor, and stopping a recording operation and at the same time, holding data being input several minutes before the accident, thereby allowing recorded data to be used as corroborative facts for the accident.”), [0004] (“However, the conventional vehicle accident data recording apparatus stores data **in an FIFO manner and deletes the oldest data corresponding to an excess over capacity upon generation of new data**, in which way the occurrence of a traffic accident is recognized and cause of the traffic accident is analyzed based on only data being stored before and after the accident.”).

268. Accordingly, *Peng-Chatterjee-Katayama* combination renders obvious this limitation.

[10.1] A mobile telecommunications device according to claim 2, wherein the mobile telecommunications device is controlled by the downloaded application to control the mobile device to detect an occurrence of a predetermined event and

269. As discussed previously (e.g., [2], *supra*), the combination is controlled by application 50 to control the device to detect NDEs (“***detect an occurrence of a predetermined event***”), such as “notable acceleration” and “the severity of such events” based on “compar[ing] acceleration data...to one or more predefined thresholds.” USAA-1005 (Peng), [0022], [0053], [0055].

270. Katayama discloses detecting “hiyari hatto (risk incident) or an accident occurs),” for example, based on determining “the predetermined condition is satisfied” when “both the acceleration data exceeds the predetermined judgment criterion and the acceleration data continues over a certain period.” USAA-1024 (Katayama), [0046]-[0051]. Katayama specifies accidents can be “a crash accident or the like.” USAA-1024 (Katayama), [0039], [0075].

271. As discussed above, a POSITA would have been motivated to combine *Peng-Chatterjee-Katayama* and Katayama and would have had reasonable success in the combination because an obvious implementation of the combination would include accidents such as a type of NDE, and configure the combination to detect such accident-type NDEs according to the techniques taught by Katayama (“***detect the occurrence of a predetermined event***”) based on the acceleration data. USAA-1005 (Peng), [0022], [0053], [0055]; USAA-1024 (Katayama), [0046]-[0051]. Based on the above, a POSITA would have found that the *Peng-Chatterjee-Katayama* combination renders this limitation obvious.

[10.2] in response transfer data from the short term memory to the long term memory.

272. Katayama describes transferring situation data (“***data***”) from temporary data storage section 802 (“***short term memory***”) to situation data recording section 803 (“***long term memory***”) in response to satisfaction of predetermined conditions associated with accident detection. USAA-1024

(Katayama), [0046]. The conditions can relate to acceleration data, such as “whether or not the acceleration...exceeds a predetermined judgement criterion,” or “continues for more than or equal to a certain period...” *Id.*, [0048]. A POSITA would have therefore understood that in circumstances where an accident is detected based on acceleration data that also satisfies a predetermined condition for transfer, in the *Peng-Chatterjee-Katayama* combination, the device is configured to transfer the data from temporary data storage section 802 to situation data recording section 803 “*in response to*” the accident being detected.

273. Based on the above, a POSITA would have found that the *Peng-Chatterjee-Katayama* combination renders this limitation obvious.

[14.1] A mobile telecommunications device according to claim 2, wherein the device is controlled by the downloaded application to detect the occurrence of a predetermined event of significance, such as a crash, and

274. As discussed (e.g., [2] *supra*), a POSITA would have found obvious that *Peng-Chatterjee-Katayama*’s mobile device is controlled by application 50 to control the mobile device to detect an event, such as “hiyari hatto (risk incident) or an accident occurs)” (as taught by Katayama) (“***detect occurrence of a predetermined event of significance***”). USAA-1005 (Peng), [0022], [0053], [0055]; USAA-1024 (Katayama), [0009], [0013], [0019], [0046]-[0051].

Katayama further specifies the accidents can be “a **crash** accident or the like.”

USAA-1024 (Katayama), [0039], [0075]. Based on the above, a POSITA would

have found that the *Peng-Chatterjee-Katayama* combination renders this limitation obvious.

[14.2] in response to store driving information associated with that event to the memory.

275. Katayama discloses storing “situation data during a certain period before and after the situation data whose content meets the predetermined condition” (“***driving information associated with that event***”) in “the situation data recording section 803 arranged in the internal memory 82” “[o]nly in a case that the content meets the predetermined condition,” (“***in response to [detecting the occurrence of a predetermined event of significance]***”). USAA-1024 (Katayama), [0046]. Katayama further discloses “the predetermined conditioned” can be “a hiyari hatto (risk incident) or an accident occurs).” USAA-1024 (Katayama), [0050].

276. As another example, Katayama describes, after the data administration section 804 detects that “the predetermined conditioned is satisfied (in case that it is judged a hiyari hatto (risk incident) or an accident occurs), the data administration section 804 reports the driver about this event.” USAA-1024 (Katayama), [0050]. In response, the situation data is stored “to the situation data storage section 803 only after the driver determines the situation as the hiyari hatto (risk incident) or the accident and pushes the button switch 5 and then the data

administration section 804 receives the input data indicating that the hiyari hatto (risk incident) or the accident occurs.” USAA-1024 (Katayama), [0046], [0051].

277. As discussed above, a POSITA would have been motivated to incorporate Katayama’s accident response (e.g., event-triggered storage) techniques in *Peng-Chatterjee-Katayama* system to store relevant driving data to in the memory, in response to detecting the accident. The combination would have been reasonably expected to succeed and provided the combined system with accident response functionalities, as well as other advantages such as storage space saving as discussed *supra*. USAA-1024 (Katayama), [0046], [0051]. Based on the above, a POSITA would have found that the *Peng-Chatterjee-Katayama* combination renders this limitation obvious.

[15.1] A mobile telecommunications device according to claim 2, wherein the device is controlled by the downloaded application to detect the occurrence of a predetermined event of significance, such as a crash, and

278. See [14.1], *supra*.

[15.2] in response to transmit driving information associated with that event via the wireless telecommunication module to a remote data-logging system.

279. Peng discloses “communicat[ing] data associated with application 50” to “a remote data storage system 152” (“a remote data-logging system”) for storage. USAA-1005 (Peng), [0058], [0142].

280. As discussed in [14.2], Katayama discloses, “[o]nly in a case that the content meets the predetermined condition,” such as “a hiyari hatto (risk incident)

or an accident,” (“*in response to [detecting the occurrence of a predetermined event of significance]*”), transferring “situation data during a certain period before and after the situation data whose content meets the predetermined condition” (“*driving information associated with that event*”) to “the situation data recording section 803 arranged in the internal memory 82 **or/and a predetermined area of the removable recording device 7**” USAA-1024 (Katayama), [0046], [0050]. Specifically, “the communication device 6 [] **transmits the situation data** stored in the situation data storage section 803 **to the outside, the detachable record device 7.**” USAA-1024 (Katayama), [0063].

281. As discussed above, a POSITA would have been motivated to incorporate accident response techniques (e.g., event-triggered storage) as taught by Katayama into *Peng-Chatterjee-Katayama* system to enable transmitting relevant driving data to a remote data storage system, in response to detecting the accident. The combination would have been reasonably expected to succeed and provided the combined system with accident response functionalities, as well as other advantages such as storage space saving as discussed *supra*. USAA-1005 (Peng), [0058], [0142]; USAA-1024 (Katayama), [0046], [0050], [0063].

282. Based on the above, a POSITA would have found that the *Peng-Chatterjee-Katayama* combination renders [15] obvious.

1. Claims 26, 32, 33, 35, 36

283. The Peng-Chatterjee-Katayama combination renders these claims obvious in the same manner as explained above for the corresponding claims listed in the table below.

Claim Limitation	Corresponding Limitations
[6.1]	[26.1]
[6.2]	[26.2]
[14.1]	[32.1]
[14.2]	[32.2]
[15.1]	[33.1]
[15.2]	[33.2]
[9.1]	[35.1]
[9.2]	[35.2]
[9.3]	[35.3]
[9.4]	[35.4]
[10.1]	[36.1]
[10.2]	[36.2]

XIV. [GROUND 1D] - PENG, CHATTERJEE, KATAYAMA AND BALACHANDRAN RENDER CLAIMS 7 AND 27 OBVIOUS

A. Proposed Combination

(b) *Peng-Chatterjee-Katayama-Balachandran Combination*

284. Peng is directed to a variety of applications that can use handheld mobile device 10, for example, to “provide data...as a basis to provide a potential customer a quote for insurance” to an insurance provider, “proctor a driver's test

for a candidate to obtain a driver's license,” and “educate drivers about safe driving behaviors.” USAA-1005 (Peng), [0074], [0165]. More specifically, Peng describes that handheld mobile device 10, via driving analysis application 50, “may communicate...data via a network or other communication link for display by...other computer devices,” such that “a parent or driving instructor may monitor the driving behavior of a teen or student driver without having to access the handheld mobile device 10.” USAA-1005 (Peng), [0024].

285. As discussed above, handheld mobile device 10, via driving analysis application 50, “may identify ‘notable driving events,’ such as instances of notable acceleration, braking, and/or cornering, as well as the severity of such events” and provide “real time feedback regarding notable driving events.” USAA-1005 (Peng), [0022], [0055] [0059], [0061], [0068], [0073], [0146] (“data processing and communication of data by computer 150 may be performed in real time”), [0155]. Device 10, via data processing module 42, can also “define multiple levels of severity for each type (or certain types) of notable driving events,” for example, “extreme braking,” and “extreme” “notable driving events.” USAA-1005 (Peng), [0055], [0126], [0136]. Because Peng contemplates identifying extreme notable driving events and corresponding severities and indicates events of importance for an insurance adjuster, it would have been obvious to have extended Peng’s

disclosure to account for and describe identifying potential accidents or emergencies that occur during a driving session.

286. It would have been obvious to a POSITA to have supplemented Peng's method to identify or correlate particular "extreme" notable driving events, such as an accident (or a potential accident) or a vehicle emergency since such events would be highly relevant to Peng's exemplary applications, e.g., to provide relevant information to insurance companies assessing policy cost or a proctor who is monitoring an unexperienced (e.g., teen) driver. Additionally, it would have been obvious to include corresponding actions performed by handheld mobile device 10 in response to a detected accident or emergency to assist the driver who may need assistance due to the accident.

287. Indeed, Peng describes multiple instances in which the detection of accidents would be relevant and helpful to its applications. Peng acknowledges that "motor vehicle crashes are the number one cause of death for American teens," thus, it would have been obvious to a POSITA to have augmented Peng's method to identify "extreme" notable driving events that further identify accidents or emergencies that have occurred during a driving session. USAA-1005 (Peng), [0002]. In another example, Peng describes identifying driving information behaviors that "provide data that could be used as a basis to provide a potential customer a quote for insurance," and explains that the cost of an insurance

policy may be based on “data useful for **predicting the occurrence of accidents**[.]” USAA-1005 (Peng), [0165].

288. As discussed above (*see e.g.*, [2], [6.1], [6.2]), in the *Peng-Chatterjee-Katayama* combination, the handheld mobile device would have been obviously configured to detect vehicle events, e.g., NDEs and/or accidents, by applying the detection techniques and the response techniques of prompting the driver to respond to the detected event, as taught by Katayama. USAA-1024 (Katayama), [0050]. Given the likelihood that NDEs and/or accidents can often involve an emergency situation in which a driver may not be able to respond, a POSITA would have naturally looked to supplement the response technique of the *Peng-Chatterjee-Katayama* combination to further include emergency response techniques that were well-known by the Critical Date. USAA-1007 (Balachandran), 1:11-30 (describes that following an accident, “[t]he subscriber may be unconscious and unable to initiate an emergency call” and/or “in a state of shock or trapped such that they are unable to reach the cellular equipment” where “time is of the essence and delay can result in death or permanent injury.”).

289. As discussed above, Balachandran discloses initiating an emergency call using a cellphone in response to the cellphone’s detection of the vehicle accident. USAA-1007 (Balachandran), Abstract. Specifically, Balachandran describes activating a cellular telephone’s timer with an audio/visual notification and

a “time delay before initiating an outgoing emergency call in response to detection of a vehicle accident.” USAA-1007 (Balachandran), 2:52-63, 4:18-21.

290. A POSITA would have been motivated to supplement the handheld mobile device’s functionality in the *Peng-Chatterjee-Katayama* combination to perform Balachandran’s emergency response techniques, following detection of an accident, and thereby enable device 10 to provide beneficial emergency responses, e.g., calling an emergency operator and preventing injuries/casualties. USAA-1007 (Balachandran), Abstract, 1:6-30. A POSITA would have performed this modification since Balachandran’s emergency response technique would have naturally extended the techniques for verifying accidents already existing in the proposed combination, as discussed above, to further account for circumstances involving an unresponsive driver in distress. *Id.*

291. In the combination, the mobile device, upon having detected an accident as taught by Katayama, would activate a timer within the device, provide notification of timer activation, and delay initiating an emergency call unless aborted by the driver, as taught by Balachandran. USAA-1007 (Balachandran), Abstract, 2:52-63, 4:18-21. Because the combination is capable of making calls, a POSITA would have perceived configuring the device to incorporate the emergency response techniques described Balachandran as an obvious implementation detail. USAA-1005 (Peng), [0148]-[0149], [0024], [0074], Fig. 5.

292. A POSITA would have had a reasonable chance of success in combining Peng, Chatterjee, Katayama, and Balachandran since several vehicle monitoring systems by the Critical Date were similarly capable of providing emergency response techniques. USAA-1021, USAA-1022, USAA-1023. Furthermore, the elements of the resulting combination would each generally perform functions they had been known to perform prior to the combination—the combination device would perform the same functions, as described in Peng, to collect driving data while leveraging general techniques to identify and verify accidents, as taught by Katayama, and, in response to identified accidents, further leverage automatically initiating an emergency response taught by Balachandran. USAA-1005 (Peng), [0006], [0029], [0033]; USAA-1024 (Katayama), [0040], [0048]-[0050]; USAA-1007 (Balachandran), 2:52-63, 4:18-21.

B. Analysis of Claims 7, 27

[7.1]/[27.1] A mobile telecommunications device according to claim 6, wherein the feedback comprises notifying a user that a further action has been scheduled, and will be taken within a predetermined period,

293. As discussed above (*see e.g.*, [6.1]), in the combination, handheld mobile device can “provide the driver real time feedback regarding notable driving events,” such as accidents. USAA-1005 (Peng), [0061], [0001], [0059]; USAA-1024 (Katayama), [0050]. In particular, the combination would leverage Peng’s disclosure of providing feedback, *e.g.*, “displaying data on display device 36 of

handheld mobile device,” and “providing audible feedback via a speaker of handheld mobile device [.]” USAA-1005 (Peng), [0057]. As discussed above , it would have been obvious for a POSITA to supplement the handheld mobile device’s functionality in the *Peng-Chatterjee-Katayama* combination to perform Balachandran’s emergency response techniques and thereby enable the combination to provide beneficial emergency responses, e.g., calling an emergency operator. USAA-1007 (Balachandran), Abstract. In particular, Balachandran teaches that the emergency response includes the cellphone providing feedback , e.g., “[a]n audio or visual indication [that] notifies the passengers of activation of timer 35” (“***feedback comprising notifying a user***”) that “provides a preselected time delay before initiating an outgoing emergency call in response to detection of a vehicle accident.” USAA-1007 (Balachandran), 2:53-60. Thus, in the combination, a POSITA would have configured the mobile device to provide feedback to notify a user that an emergency call has been scheduled (“***a further action has been scheduled***”) after a time period specified by a timer (“***further action...will be taken with a predetermined period***”). *Id.* Based on the above, a POSITA would have found that the combination renders this limitation obvious.

[7.2]/[27.2] the mobile telecommunications device being further configured to receive a user interaction to confirm or deny whether the further scheduled action should be taken within a predetermined period.

294. Balachandran teaches offering the driver an option to abort the emergency call “at any point by a user abort command,” or “cancel initiation of an emergency call if no emergency assistance is required. If the individual discontinues the emergency call through the user interface 45, the timer 35 resets”). USAA-1007 (Balachandran), Abstract, 3:1-5. Thus, a POSITA would have obviously configured the combination to receive a user interaction through the user interface 45, such as a user abort command to cancel an emergency call. USAA-1007 (Balachandran), 2:64-3:6, 4:22-31. Thus, the combination would have been obviously configured to receive a user abort command (“***user interaction***”) to cancel the scheduled emergency call to be initiated after a time period specified by a timer (“***to deny whether the further scheduled action should be taken within a predetermined period***”). *Id.* Based on the above, a POSITA would have found that the combination renders this limitation obvious.

XV. [GROUND 1E] - PENG, CHATTERJEE AND RIEMER RENDER CLAIMS 11-13, 29-31 OBVIOUS

A. Proposed Combination

a) Peng-Chatterjee-Riemer Combination

295. As discussed for [2], in the Peng-Chatterjee combination, the mobile device is controlled by a driving analysis application to perform the disclosed data

collection, processing/evaluation, and providing feedback to a driver when driving. USAA-1005 (Peng), Abstract, [0022]-[0024]. While Peng discloses “handheld mobile device 10 may be a smart phone,” Peng does not explicitly disclose how to handle normal use of the smart phone such as telephone calls and texting when the user is driving, which is a common use case that raises safety concerns and calls for solutions. USAA-1028, [0005]-[0006]. A POSITA looking to implement the Peng-Chatterjee combination in a practical setting would have looked to solutions to handle the normal use of the smart phone to address the user’s need (e.g., “remain connected with peers at all times”) while accounting for “driving safety” as Peng desires. USAA-1028, [0005]-[0006]; USAA-1005 (Peng), [0002]-[0003].

296. In doing so, a POSITA would have recognized that it was well-known by the Critical Date to incorporate safety measures to address the safety concerns associated with using portable electronic devices (e.g., cellular telephones) while driving a vehicle. USAA-1028, [0005]. In fact, “[a] variety of measures have been taken to address such concerns.” USAA-1028, [0005].

297. As discussed above, Riemer discloses example safety features for “managing one or more cellular mobile devices and cellular mobile device operations” “when a cellular device user is driving.” USAA-1028, Abstract, [0002]. A POSITA would have recognized that incorporating Riemer’s features into the the mobile device would allow the user to continue normal use (e.g.,

phone call, texting/messaging) of the device while driving to provide improved safety. USAA-1028, [0031].

298. In fact, Riemer discloses embodiments that “adds to or extends the functionality of a portable electronic device [and] its applications ... while a user with the device is driving” and/or “manages and integrates third party applications [of the portable electronic device].” USAA-1028, [0031], [0034]. It would have been obvious to a POSITA to add/incorporate Riemer’s safety features into the mobile device’s driving analysis application, for example, to “enhance[] the answering and responding to incoming calls, emails, text messages in the environment of a portable electronic device,” and “provide[] hands-free and voice-based mechanisms to respond.” USAA-1028, [0034].

299. A POSITA would have had a reasonable expectation of success in the Peng-Chatterjee-Riemer combination since this would have involved incorporating a known technique (implementing known safety features of a portable device for handling normal uses of the device during driving) into a known system (Peng’s system). Moreover, based on Peng’s disclosure that the handheld mobile device 10 already includes “voice activated interfaces” “allowing a user to interact with handheld mobile device 10, and in particular, with driving analysis application 50.” USAA-1005 (Peng), [0031]. With the “voice activated” hardware already in place, a POSITA would have been further motivated to make use of the available

hardware of the mobile device to provide enhanced user experience and safety measure to “provide[] hands-free and voice-based mechanisms to respond” to “incoming calls, emails, text messages” “while the user is driving a motor vehicle” as taught by Riemer. USAA-1028, [0034].

B. Analysis of Claims 11-13, 29-31

[11]/[29] A mobile telecommunications device according to claim 2, wherein the device is controlled by the downloaded application to manage voice-calls incoming to the mobile telecommunications device during a driving period.

300. As discussed for [2], the mobile device is controlled by a driving analysis application (“***the device is controlled by the downloaded application***”).

301. Riemer describes “[a]n embodiment [that] manages incoming and outgoing calls, alerts, and messages while a user is driving a motor vehicle” (“***manag[ing] voice-calls incoming to the mobile telecommunications device during a driving period***”). USAA-1028, [0032]. “For example, in response to an incoming call or a text based communication the portable electronic device can record the incoming communication on the portable electronic device, while suppressing any visual or audio alerts until the user has stopped driving.” USAA-1028, [0032].

302. As discussed above, it would have been obvious for a POSITA to incorporate Riemer’s safety measures to “add[] to or extend[] the functionality” of driving analysis application of the mobile device, for example, to “manage[]

incoming and outgoing calls, alerts, and messages while a user is driving a motor vehicle.” USAA-1028, [0031]-[0032], [0002]. The resulting combination would achieve benefits including “improv[ed] safety of a driver while using a mobile device, its applications and services by allowing the driver of a motor vehicle to keep focused on the road and hands on the steering wheel instead of on the mobile device,” “while at the same time remaining connected automatically and transparently to other cell phone users via social networks, text messaging and emails.” USAA-1028, [0031], [0002]. Based on the above, a POSITA would have found that the *Peng-Chatterjee-Riemer* combination renders this limitation obvious.

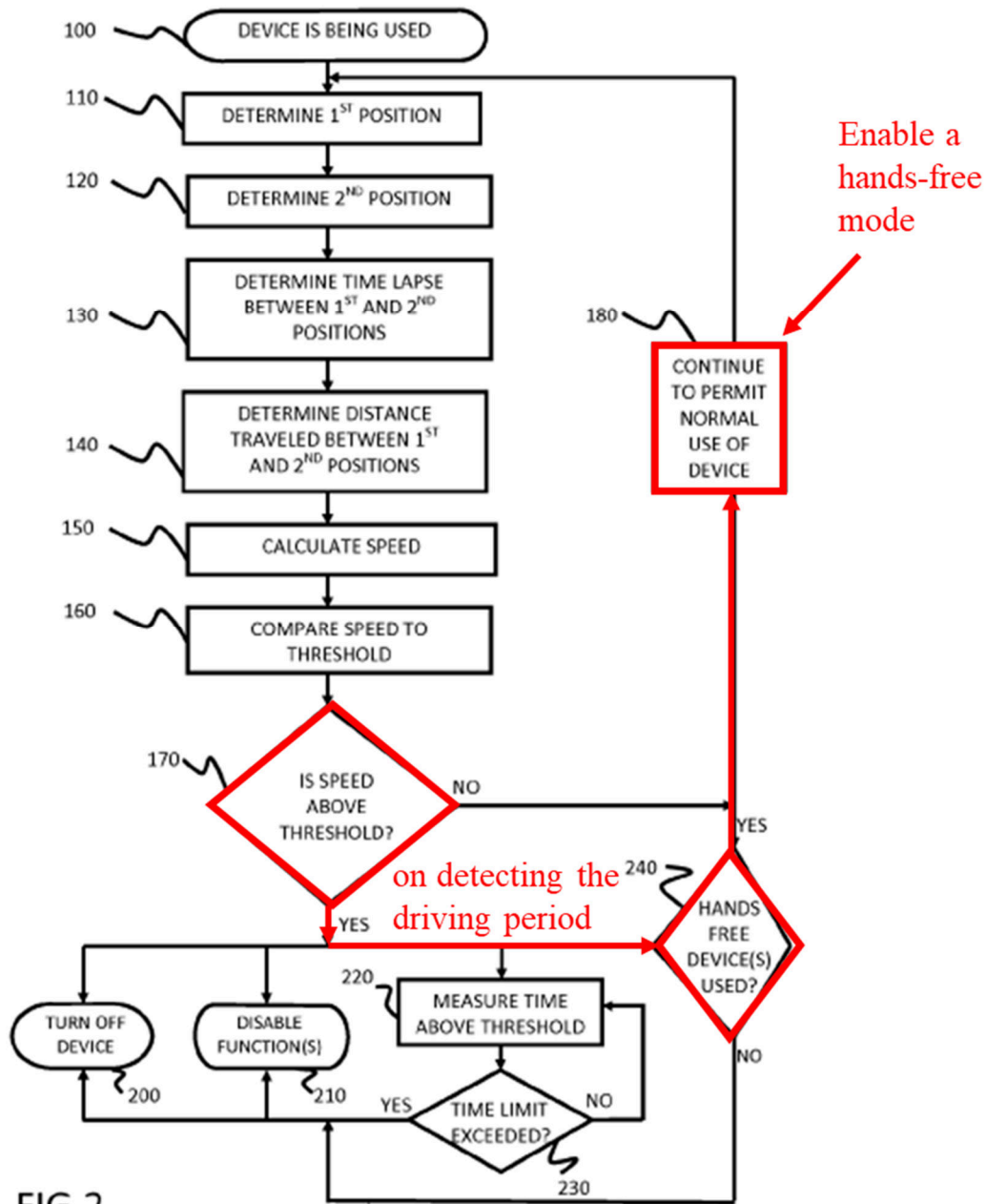
[12]/[30] *A mobile telecommunications device according to claim 2, wherein the device is controlled by the downloaded application to enable a hands-free mode of operation on detection of the driving period.*

303. As discussed for [2] and [1.10], the mobile device is controlled by analysis application 50 (“***the device is controlled by the downloaded application***”) and detects the driving period.

304. As shown in FIG. 2, Riemer describes “upon a determination (170) that the speed is in excess of the threshold” (“***on detection of the driving period***”), “as shown in block (240), a determination is made as to whether the hands-free device is being used. If it is determined (240) that a hands-free device is being used, the method may include continuing to permit normal use of the portable

electronic device (20) as shown in block (180) [with the hands-free device]”

(“*enable a hands-free mode of operation*”). USAA-1028, [0065]. “For instance, in one embodiment of the cell phone example, transmission and reception of voice-only communications is permitted when a hands-free earpiece and microphone attachment is used.” USAA-1028, [0066].



USAA-1028, Fig. 2 (annotated)

305. A POSITA would have recognized that, in Riemer’s context of “managing one or more portable electronic devices and portable electronic device functions” upon “detect[ing] when a portable electronic device user is driving,”

Riemer's disclosure of "upon a determination (170) that the speed is in excess of the threshold" is "*on detection of the driving period*" because Riemer uses the term "driving mode," and "safe driving mode" "to refer to the behavior of a portable electronic device being modified when it is detected that the portable electronic device is traveling at driving speed, or when one or more user defined safety thresholds are met." USAA-1028, [0027]-[0028], [0036] (disclosing detecting a start of the driving period: "detect[ing] when the device is in a moving vehicle from an initial stopped position, at the beginning of a user's journey"). Besides using "the speed detector (30) [] to determine the speed at which the portable electronic device is traveling," Riemer discloses that "other signals could be used in place of a signal indicative of detected speed, such as a manual signal, some form of signal indicating that the phone is in a vehicle, or that the vehicle is turned on, etc." USAA-1028, [0042].

306. A POSITA would have understood that "permit[ting] normal use of the portable electronic device (20) as shown in block (180) [with the hands-free device]" is an example of "*a hands-free mode of operation*" because the hands-free device is used to permit "normal use of the portable electronic device," such as, "transmission and reception of voice-only communications." USAA-1028, [0065]-[0066].

307. As discussed above, it would have been obvious for a POSITA to incorporate Riemer's safety measures to "add[] to or extend[] the functionality" of driving analysis application of the mobile device, for example, to use a hands-free device for hands-free operation of "transmission and reception of voice-only communications," upon detection of the driving period. USAA-1028, [0065]-[0066]. The resulting combination would achieve benefits including "improv[ed] safety" and continued connectivity "to other cell phone users via social networks, text messaging and emails." USAA-1028, [0031], [0002]. Based on the above, a POSITA would have found that the *Peng-Chatterjee-Riemer* combination renders this limitation obvious.

[13]/[31] A mobile telecommunications device according to claim 12, wherein the hands-free mode of operation comprises enabling voice-activated commands on the mobile device.

308. Peng discloses "[i]nput/output devices 38 may include any suitable interfaces allowing a user to interact with handheld mobile device 10, and in particular, with driving analysis application 50," including "voice activated interfaces." USAA-1005 (Peng), [0031].

309. As discussed for [12], Riemer discloses the example of "***the hands-free mode of operation***" of permitting "transmission and reception of voice-only communications" includes "permit[ting] voice activated dialing and/or voice activated answering" ("***enabling voice-activated commands on the mobile***

device”). USAA-1028, [0065]-[0066]. Riemer further explains that “[v]oice activated dialing may also be supported by pressing a specific key or having a specific word uttered by the user. For example, the user could utter the **voice command** “Dial” or “Help” or “Information” and this would allow for the user to dial to a set of numbers such as a spoken number, 911, 411, or other preset number such as the user's home number, the office number, or for one or more priority contacts. Alternatively, the **voice command** to dial could allow the user to dial any number via the voice portal, further described herein.” USAA-1028, [0144], [0130] (“Voice portal 412 provides a set of voice-based services and allows the user to set configuration options related to the set of voice services, which allow a user to use and control the portable electronic device **via voice commands** while engaged in safe mode.”), [0135] (“voice services allows a user to listen to incoming email and SMS messages, and to respond accordingly **using voice commands**. In an embodiment, a user may listen to podcasts or RSS feeds using voice commands as well.”).

310. As discussed above, it would have been obvious for a POSITA to incorporate Riemer’s safety measures to “add[] to or extend[] the functionality” of driving analysis application of the mobile device, for example, to enable voice-activated commands on the device, to permit “transmission and reception of voice-only communications” during the driving period. USAA-1028, [0065]-[0066],

[0144]; USAA-1005 (Peng), [0031]. The resulting combination would achieve benefits including “improv[ed] safety” and continued connectivity “to other cell phone users via social networks, text messaging and emails,” as well as leverage the “voice activated interfaces” already provided in the device 10. USAA-1028, [0031], [0002]. Based on the above, a POSITA would have readily understood that the *Peng-Chatterjee-Riemer* combination as discussed in §III.E.2([12]) renders obvious that *the hands-free mode of operation comprises enabling voice-activated commands on the mobile device*.

XVI. [GROUND 1F] - PENG, CHATTERJEE AND BERKOBIN RENDER CLAIM 55 OBVIOUS

A. Proposed Combination

a) Peng-Chatterjee-Berkobin Combination

311. Techniques for using artificial intelligence (AI) to evaluate driver information well-known by the Critical Date. USAA-1010 (Berkobin), [0031]; USAA-1025, [0047]; USAA-1014, [0094]. Also well-known were the improvements offered by artificial intelligence, such as offering superior performance when the inputs are complex, features of the input data cannot be readily discerned, or the relationships between input data are complex and nonlinear. Artificial intelligence algorithms are also sophisticated, automatic, and objective for analysis of high-dimensional and multimodal motion data. *Id.* A

POSITA would have therefore been motivated to employ artificial intelligence to identify unsafe driving behaviors from motion data recorded for a vehicle.

312. Peng describes processing the driving data to calculate one or more driving behavior metrics and/or scores, identify “notable driving events” (NDEs), and determine the severity of such events. USAA-1005 (Peng), [0068]. Peng gives example algorithms for such calculation, for example, by using look-up tables and equations, and comparing with thresholds. USAA-1005 (Peng), [0078]-[0138]. A POSITA would have recognized that these calculation can be advantageously accomplished by using AI algorithms because statistical classification algorithms that use AI technology “are typically used in pattern recognition systems” and are particularly suitable for handling multi-dimensional data such as Peng’s “driving data [that] may include, e.g., driving behavior data collected by accelerometer 54, location tracking system 56, etc. and/or driving environment data collected by environmental data applications 58.” USAA-1025, [0047]; USAA-1005 (Peng), [0044], [0066].

313. Moreover, a POSITA would have been motivated to incorporate AI technologies (e.g., as taught by Berkobin) into *Peng-Chatterjee* system to calculate driving behavior metrics and/or scores and identify NDEs because AI technologies can have improved flexibility, scalability, and accuracy in predicting and identifying unsafe driving behaviors, especially in view of Peng’s desire to “leverage smart

phones to quantify and differentiate an individual's insurance risk base [sic] on actual driving behaviors and/or driving environment” and “to educate drivers about safe driving behaviors.” USAA-1005 (Peng), [0165].

314. Additionally, a POSITA would have looked to techniques for improving accuracy in driver safety monitoring, and in doing so, identified AI as an available tool to process motion data recorded by handheld mobile device 10 in identifying unsafe driving behaviors. A POSITA would also have had a reasonable expectation of success in incorporating AI functionality as taught by Berkobin into the *Peng-Chatterjee* system since this would have involved incorporating a known technique (using AI to evaluate motion data recorded by a mobile device) into a known system (e.g., a vehicle monitoring system).

B. Elements of Claim 55

315. *Peng-Chatterjee-Berkobin* renders obvious the following limitations of claim 55 in the same manner as explained above for the corresponding claim 54 limitations listed in the table below.

Claim 1 Limitation	Corresponding Limitations
[54.1]	[55.1]
[54.2]	[55.2]
[54.3]	[55.3]
[54.4]	[55.4]
[54.5]	[55.5]

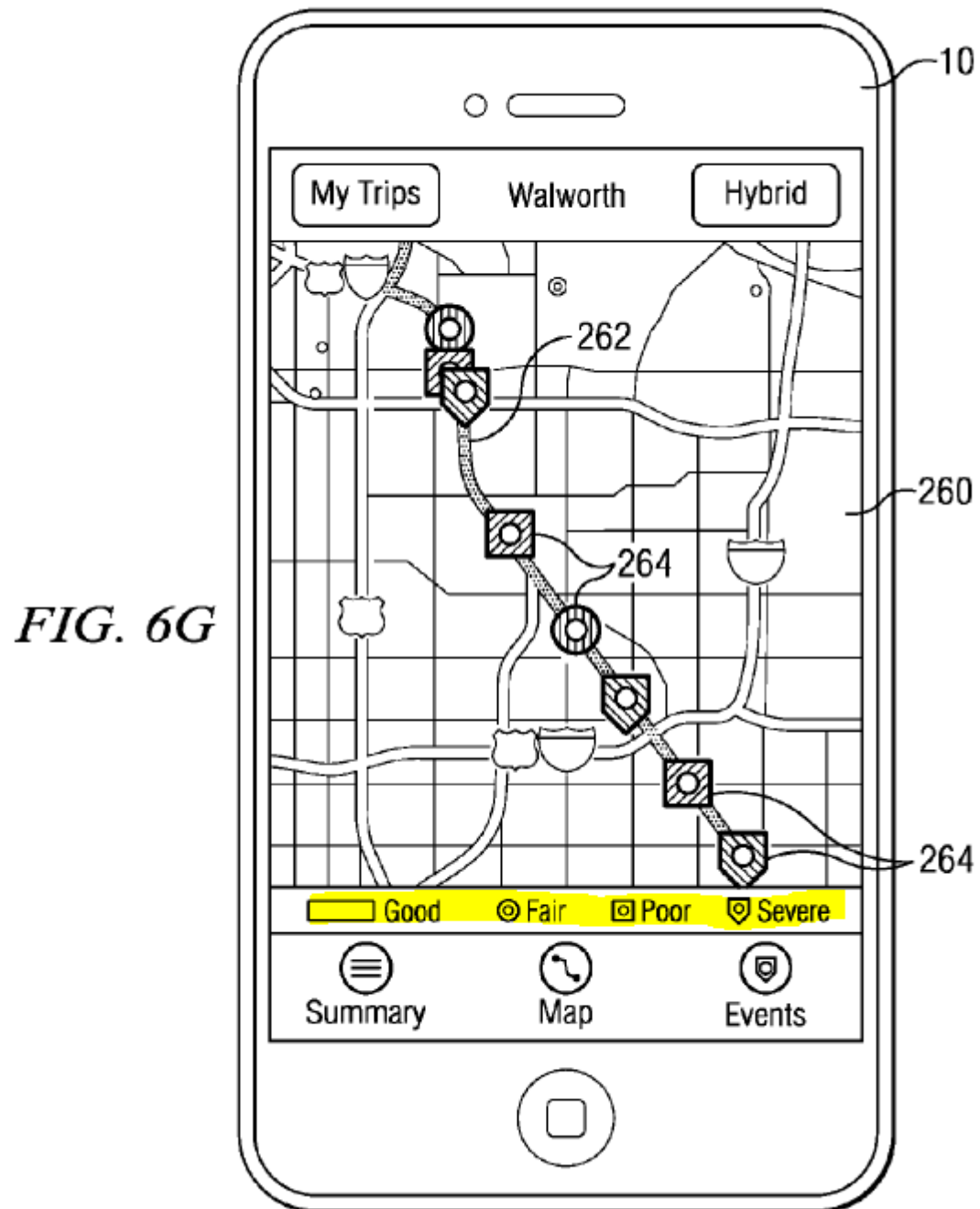
Claim 1 Limitation	Corresponding Limitations
[54.6]	[55.6]
[54.7]	[55.7]
[54.8]	[55.9]
[54.9]	[55.10]
[54.10]	[55.11]

[55.8] the processing involving the use of a neural network on the mobile telecommunications device to determine whether the driving information represents an acceptable or unacceptable driving pattern; and,

316. The term “neural network” appears once in the ’879 patent specification and relevant disclosure closely repeats the language recited by this claim limitation. USAA-1001, 6:61-7:3 (“use of virtual neural networks can be used to determine whether the driving information represents acceptable or unacceptable driving patterns”). Beyond these general descriptions, the ’879 patent specification lacks any discernible disclosure relating to which types of specific neural networks are used to evaluate sensor data to identify acceptable or unacceptable driving patterns.

317. Peng discloses processing the driving information to “calculate one or more driving behavior metrics and/or scores” and identify NDEs, “such as instances of notable acceleration, braking, and/or cornering, as well as the severity of such events,” such as “three progressively severe levels of particular notable driving events: (1) caution, (2) warning, and (3) extreme,” or four levels such as

“good,” “fair,” “poor,” and “severe,” shown in FIG. 6G. USAA-1005 (Peng), [0022], [0055], [0133], [0163].



USAA-1005 (Peng), FIG. 6G.

318. Peng teaches such information can be used to “to help drivers improve their driving behavior” for example by “identify[ing] one or more areas of needed improvement (e.g., braking or cornering) and display[ing] driving tips specific to the areas of needed improvement.” USAA-1005 (Peng), [0023] [0060]. It would have been obvious to a POSITA that NDEs with a “good” or “caution” level would represent an acceptable driving pattern, whereas NDEs with a “severe” level would represent unacceptable driving pattern. *Id.*

319. Berkobin describes using AI techniques such as a neural network to process sensor data and evaluate driving information (“*processing involving the use of a neural network*”). USAA-1010 (Berkobin), [0002], [0031]. As discussed above, in the Peng-Chatterjee-Berkobin combination, the mobile device would have been obviously configured to use a neural network to determine whether the collected driving data represents a NDE with a “good” or “caution” level (“*an acceptable [driving pattern]*”) or a NDE with a “severe” level (“*unacceptable driving pattern*”). USAA-1005 (Peng), [0022], [0055], [0133], [0163], FIG. 6G.

320. Based on the above, a POSITA would have found that the *Peng-Chatterjee-Berkobin* combination renders this limitation obvious.

XVII. CONCLUSION

321. The findings and opinions set forth in this declaration are based on my work and examinations to date.

322. I may continue my examinations. I may also receive additional documentation and other factual evidence over the course of this IPR that will allow me to supplement and/or refine my opinions. I reserve the right to add to, alter, or delete my opinions and my declaration upon discovery of any additional information. I reserve the right to make such changes as may be deemed necessary.

323. In signing this declaration, I recognize that the declaration will be filed as evidence in an IPR before the PTAB. 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.

APPENDIX A

Curriculum Vitae for William R. Michalson

Research Associates, LLC
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Douglas, MA 01516
Email: wrn@wmichalson.com
Cell: (508) 331-4134

1. Personal:

1.1 Education

Ph.D. in Electrical Engineering, 1989, Worcester Polytechnic Institute, Worcester, Massachusetts.

Dissertation: *A Parallel Computer Architecture for Real-Time Decision Making*. The dissertation develops a hierarchical, multiple processor, computer architecture for executing artificial intelligence programs in real-time. Dissertation Directors: Dr. Peter E. Green and Dr. R. James Duckworth.

Minor Areas: Minor sequences completed in Mathematics and Physics.

Specialties: Area examinations passed in the fields of Computer Architecture, Probabilistic Systems Analysis, and State Space Analysis.

M.S. in Electrical Engineering, 1985, Worcester Polytechnic Institute, Worcester, Massachusetts.

Specialties: The courses taken stressed Computer Architecture, Communications Systems, and Solid-State Physics.

B.S. in Electrical Engineering, 1981, Syracuse University, Syracuse, New York.

1.2 Work experiences - Academic.

1991-Present Worcester Polytechnic Institute

Professor of Electrical and Computer Engineering; also holds collaborative appointments as a Professor of Computer Science, a Professor of Mechanical Engineering and a Professor of Robotics Engineering.

Effective Sep, 2016 Granted a collaborative appointment as a Professor of Mechanical Engineering.

Effective July 1, 2005 Promoted to the rank of Full Professor (Professor of Electrical and Professor of Computer Science)

<i>November 17, 2004</i>	Appointed dual professorship, adding the title of Associate Professor of Computer Science.
<i>July 1, 1998</i>	Granted tenure and promoted to the rank of Associate Professor.
<i>August 1, 1992</i>	Assistant Professor of Electrical Engineering (tenure-track).
<i>August 1, 1991</i>	Visiting Assistant Professor of Electrical Engineering.
<i>January 1, 1990</i>	Adjunct Assistant Professor of Electrical Engineering.

1.3 Work experiences other than teaching (chronological).

2012-2014 Grid Roots, LLC

Grid Roots, LLC is a company which was formed in 2012 for the purpose of commercializing a navigation and tracking device for use by children and the elderly to allow caregivers to non-intrusively monitor their activities. The system under development integrates GPS, inertial and beacon-based navigation technologies to develop a system for users to track deployed devices. My responsibilities within Grid Roots, LLC relate to hardware and software engineering, as well as the development of IP related to tracking individuals.

1995-Present Research Associates, LLC

Research Associates, LLC is a company I formed in which I perform engineering and consulting in the areas of computer systems, communications and navigation. All of my litigation-related and other consulting activities are performed through Research Associates, LLC.

1988-1991 Raytheon Company

Subsequent to receiving my Ph. D., I returned to the Equipment Division of the Raytheon Company. Shortly after I returned, I was promoted to a title of Engineer, Design and Development which was the highest title I could hold based on my level of education and years of experience. Within a year, I was selected to sit on the engineering staff of a newly formed System Engineering Department of the Division's Computer and Displays Laboratory. In this department I acted primarily as a consultant to other departments within the laboratory. My responsibilities ranged from leading the hardware/software development of supercomputer-class computer systems to performing applied research into the exploitation of new technology. My role was similar to that of a Principle Investigator in an academic setting as I was responsible for securing funding and personnel, leading research efforts, interacting with the research sponsor, and reporting results. At the time of my departure I was involved with the following projects:

Fault-Tolerant Multiprocessor

The development of a highly fault tolerant, highly reliable, real-time computer system intended for long-duration spaceborne applications. This system is designed to produce in excess of one gigaoperation per second of raw processing power.

Optimal Task Allocation

A program of applied research into the use of Genetic Algorithms for deriving optimal mappings of software tasks to the hardware processing elements in distributed systems.

Performance Modeling and Scaling

This project focused on the development of simulation models for characterizing the performance of a large scale multiple processor system. These models formed a basis for predicting system performance for several different hardware configurations to ensure compliance with system specifications.

High Clutter Signal Detection

A program of applied research into the use of Neural Networks to detect the presence of targets in extremely high clutter environments.

Power Efficient Computing

A program of applied research into an Integrated Optical computer structure that is designed to maximize the number of computations that can be performed per unit of power.

1985-1988 Raytheon Company (Leave of Absence)

In 1985 I became one of two people in the Equipment Division to receive Aldo Miccioli Fellowships. This Fellowship was awarded to allow me to pursue full-time study towards the Ph.D. degree. I returned to Raytheon during the summer of 1986, but otherwise remained on leave of absence to dedicate my time to my studies.

1982-1985 Raytheon Company

Engineer in the VLSI Design Department of the Computer and Displays Laboratory within Raytheon's Equipment Division. I was lead engineer for the design of several semi-custom VLSI circuits for both signal and data processing applications.

1981-1982 Raytheon Company

Engineer in the Cursive Displays Department of the Computer and Displays Laboratory. I designed and debugged circuit assemblies which were used in vector displays for air traffic control applications.

1.4 Consulting experiences.

1.4.1 Law-Related

Volvo Penta of the Americas, LLC. v. Brunswick Corporation

Retained by Kilpatrick Townsend & Stockton, LLP as an expert on behalf of petitioner Volvo Penta. Provided declarations in support of multiple IPR filings (IPR2022-01366, IPR2022-01367, IPR2022-01368, IPR2022-01369, and IPR2022-01424). Retained 6/22.

Textron Innovations INC. v. SZ DJI Technology Co, LTD. and DJI Europe B.V.

Retained by Baker Botts, LLP as an expert on behalf of plaintiff Textron. Retained 2/22, deposed 1/22/23 and 1/24/23.

Smartsky Networks, LLC, v. GOGO Business Aviation, LLC and GOGO INC.

Retained by Sidley Austin, LLP as an expert on behalf of defendant Gogo. Case before the United States District Court for the District of Delaware (Case No. 22-266 UNA). Deposed 5/19/22. Retained 3/22.

Via Transportation, Inc. v. RideCo Inc.

Retained by Erise, IP on behalf of defendant RideCo. Case before the United States District Court for the Western District of Texas, (Case No. No. 6:21-cv-00457). Retained 1/22.

BillJCo, LLC v. Cisco Systems, Inc., Apple Inc., Hewlett Packard Enterprise Co. and Aruba Networks, LLC

Retained by the law firms of Merchant & Gould, P.C., DLA Piper, and Greenberg Traurig, LLP Purpose on behalf of their clients Cisco Systems, Inc., Apple Inc., Hewlett Packard Enterprise Co. and Aruba Networks, LLC for the analysis of certain patents relating to methods and systems for location tracking of mobile devices. Submitted declaration related to IPR2022-420 and IPR2022-00427. Retained 12/21.

Mark Adams, Sr., v. Cataldo Ambulance Service, Inc,

Retained by Morrisson Mahoney, LLP on behalf of defendant Cataldo Ambulance Service. Case before Middlesex Superior Court, Commonwealth of Massachusetts, Civil Action No. 19-CV-1931. Retained 10/21.

LoganTree, LP v. Garmin International, Inc. and Garmin USA, Inc.

Retained by EriselP on behalf of defendant Garmin. Case before the District of Kansas, Case No. 17-cv-01217 2:16-cv-190 involving U.S. Patent No. 6,059,576. Submitted Expert Report on Non-Infringement; Deposed 12/1/21; testified in Court 10/26/22; Retained 7/21 - 10/22.

Allstate Insurance Company V. Atos, LLC

Retained by Sidley Austin, LLP on behalf of petitioner Allstate Insurance Company challenging the validity of US Patent Nos. 8,527,140; 9,152,609; and 9,846,174 at the Patent Trial and Appeal Board of the U.S. Patent Office. Submitted declarations in IPR2021-01118, IPR2021-01209, and IPR2021-01449. Deposed 3/31/22 and 4/7/22; Retained 2/21.

R&R Packaging, Inc. D/B/A R&R Solutions v. Evenflo Company, Inc.

Retained by Polsinelli on behalf of Plaintiff R&R. Case before the Western District of Arkansas (Fayettevill Division), Case No. 5-20-cv-05095. Submitted Reports on Claim Construction; Deposed 7/21; Retained 11/20.

InfoGation Corporation v. Google LLC.

Retained by O'Melveny & Meyers, LLP as an expert on behalf of defendant Google Inc. Patents-in-suit are U.S. Patents 6,199,014. Case before the United States District Court for the

Southern District of California, San Diego Division (Case No. 3:21-CV-00843-H-JLB).
Deposed 2/27/13 - 2/28/13. Retained 8/20 to 6/22.

WSOU Investments LLC v. Dell Technologies Inc. et al.

Retained by Gibson-Dunn on behalf of defendant Dell. Case before the United States District Court for the Western District of Texas, (Case Nos. 20-cv-00473-ADA; 20-cv-00474-ADA; 20-cv-00475-ADA; 20-cv-00476-ADA; 20-cv-00477-ADA; 20-cv-00478-ADA; 20-cv-00479-ADA; 20-cv-00482-ADA). Retained 7/20.

Apple v. LBS Innovations, LLC.

Retained by Ericson on behalf of petitioner Apple, Inc., challenging the validity of U.S. Patent No. 6,091,956 at the Patent Trial and Appeal Board of the U.S. Patent Office, IPR2020-00696. Retained 02/20. Submitted declaration.

Makor Issues & Rights Ltd. v. Google LLC et al.

Retained by Arnold & Porter Kaye Scholer LLP on behalf of defendant Google. Case before the District of Delaware, Case No. 1:16-cv-00100. Retained 12/19.

Intellectual Ventures I, LLC and Intellectual Ventures II, LLC v. NetApp, Inc.

Retained by Gibson Dunn on behalf of defendant NetApp, Inc. Case before the District of Massachusetts, Case No. 1:16-cv-10868-PBS. Retained 09/19. Submitted Expert Reports on Invalidity and Non-Infringement.

Google, LLC v. Traxcell Technologies, LLC.

Retained by Finnegan, Henderson, Farabow, Garrett & Dunner, LLP on behalf of petitioner Google, Inc., challenging the validity of U.S. Patent Nos. 9,918,196 and 10,820,147 at the Patent Trial and Appeal Board of the U.S. Patent Office, IPR2021-01004 and IPR2022-00442. Retained 06/18. Submitted declarations.

Lipton, et al. v. Knight, et al.

Retained by Campbell Conroy & O'Neil, PC on behalf of defendant First Student. Case before the Superior Court of Massachusetts, Plymouth, Case No. PLCV 2014-00528. Retained 05/19-8/19. Submitted Expert Disclosure.

PPS Data, LLC., v. Jack Henry & Associates, Inc.

Retained by Polsinelli on behalf of defendant Jack Henry and Associates. Case before the Eastern District of Texas. Retained 11/18-9/19. Submitted Expert Reports on Invalidity and Non-Infringement; Deposed 5/29/19, testified in Court 9/11/19.

Cisco Systems, Inc. v. TracBeam, LLC.

Retained by Haynes Boone, LLP on behalf of petitioner Google, Inc., challenging the validity of U.S. Patent Nos. 7,525,484 9,277,525, and 7,298,327 at the Patent Trial and Appeal Board of the U.S. Patent Office, IPR2018-01722 - IPR2018-01728. Retained 06/18. Submitted declarations.

Burris Company, Inc. v. Garmin International, Inc.

Retained by Shook Hardy and Bacon on behalf of defendant Garmin. Case before the District of Oregon, Case No. 6:18-CV-00700. Submitted Declaration wrt Invalidity; Testified in Court (PI hearing) 07/11/18; Retained 04/18-08/18.

American GNC Corporation v. LG Electronics Inc., LG Electronics Mobilecomm U.S.A., Inc., and LG Electronics Mobile Research U.S.A., LLC.

Retained by White & Case on behalf of defendant LG. Case before the Southern District of California, Case No. 3:17-CV-01090-BAS-BLM. Retained 11/17. Submitted Declaration wrt Claim Construction; Deposed 1/18.

Qualcomm v. Apple

Retained by Quinn-Emanuel on behalf of plaintiff Qualcomm. Case before the Southern District of California, Case Nos. 3:17-cv-00108-GPC-MDD and 3:17-cv-01010-GPC-MDD. Retained 10/17-5/19; Submitted Expert Report; Deposed 10/18.

Samantha Ingram v. New England Beauty Academy, LLC a/k/a Toni&Guy Hairdressing Academy, Newell Rubbermaid INC. and Goody Products, INC. d/b/a Solano.

Retained on behalf of plaintiff Samantha Ingram. Case before the Worcester Superior Court, Commonwealth of Massachusetts, Civil Action 1385CV02129D. Retained 09/17-09/18; Submitted Expert Disclosure.

FISERV, INC., Jack Henry & Associates, Inc., Q2 Software, Inc., American National Bank of Texas and Hanmi Bank, Petitioners v. Mirror Imaging LLC., Patent Owner.

Retained by Polsinelli on behalf of petitioners to provide declarations for multiple petitions for covered business methods review. See CBM2018-00012, CBM2018-00014, and CBM2018-00015. Retained 1/18-03/18.

Acceleron v. Dell Inc.

Retained by Baker Botts on behalf of defendant Dell. Case before the Northern District of Georgia, Case No. 1:12-cv-04123-TCB. Submitted Expert Reports related to Claim Construction, Invalidity and Non-Infringement; Deposed 10/13/17 and 6/20/19; Trial 9/6/21 to 9/17/21; Retained 7/17 to 9/21.

Omega Patents, LLC v. CalAmp Corp.

Retained by Sidley Austin on behalf of defendant CalAmp. Case before the Middle District of Florida, Case No. 6:13-cv-1950 involving U.S. Patent Nos. 6,346,876; 6,756,885; 7,671,727 and 8,032,278. Retained 5/17 to 12/17.

Unified Patents, Inc.

Retained by Unified Patents to provide declarations for multiple petitions for *inter partes* review related to patents U.S. Patent No. 7,650,234 and 8,538,498. Retained 03/17-05/17.

Garmin Switzerland GmbH, and Garmin Corporation v. Navico Inc., C-MAP USA, Inc., and C-MAP/Commercial, Ltd.

Retained by Shook, Hardy & Bacon, L.L.P. on behalf of plaintiff Garmin. Case before the District of Kansas, Case No. 16-cv-2706 involving U.S. Patent Nos. 7,268,703 and 6,459,987. Submitted Declaration On Claim Construction; Deposed 12/21/17; Retained 10/16 to 02/18.

Navico Inc. and Navico Holdings AS, v. Garmin International, Inc. and Garmin USA, Inc.

Retained by Paul Weiss on behalf of defendant Garmin. Case before the Eastern District of Texas, Case No. 2:16-cv-190 involving U.S. Patent Nos. 9,223,922 and 9,244,168. Submitted Expert Report on Non-Infringement; Deposed 12/14/16, 5/25/17; Testified in Court 9/7/17; Retained 8/16 to 9/17.

Orbcomm, Inc. v. CalAmp Corp.

Retained by Sidley Austin on behalf of defendant CalAmp. Case before the Eastern District of Virginia, Case No. 3:16-cv-208 involving U.S. Patent Nos. 6,292,724, 6,611,686, 6,651,001, 6,735,150, and 8,855,626. Expert Declaration on Claim Construction, Reports on Invalidity and Non-Infringement; Retained 5/16 to 2/17.

Navico Inc. and Navico Holdings AS, v. Garmin International, Inc. and Garmin USA, Inc.

Retained by Paul Weiss on behalf of defendant Garmin. Case before the Northern District of Oklahoma, Case No. 14-cv-303 involving U.S. Patent Nos. 8,300,499, 8,305,840, and 8,605,550. Deposed 11/8/15; Retained 10/15 to 10/17.

Johnson Outdoors Inc. and Johnson Outdoors Marine Electronics, Inc., v. Garmin International, Inc. and Garmin USA.

Retained by Paul Weiss on behalf of defendant Garmin. Case before the Middle District of Alabama, Case No. 14-cv-683 involving U.S. Patent Nos. 7,652,952, 7,710,825, and 7,755,974. Retained 10/15 to 5/16. Case dismissed.

Google, Inc. v. Silver State Intellectual Technologies, Inc.

Retained by Paul Hastings on behalf of petitioner Google, Inc. to provide declarations for multiple petitions for *inter partes* review. See IPR2015-01737 and IPR2015-01738. Retained 10/15 to 12/15.

Vehicle IP LLC v. AT&T Mobility, LLC, et al.

Retained by Akin Gump and by Perkins-Coie on behalf of defendants AT&T Mobility LLC; Cellco Partnership; Networks In Motion, Inc.; TeleCommunications Systems, Inc.; and Telenav Inc. Case before the District of Delaware, Case No. 1:09-cv-01007-LPS involving U.S. Patent No. 5,987,377. Expert Report on Invalidity; Deposed 5/20/16; Retained 9/15 to 1/17. Matter settled.

TracBeam, L.L.C. v. T-Mobile US, Inc., et al.,

Retained by Baker Botts on behalf of defendant T-Mobile US, Inc., et al. Case before the Eastern District of Texas (6:14-cv-678-RWS). See also IPR2015-01681, IPR2015-01682, IPR2015-01684, IPR2015-01686, IPR2015-01687, IPR2015-01708, IPR2015-01709, IPR2015-01711, IPR2015-01712, and IPR2015-01713. Expert Report on Invalidity; Deposed 10/04/16; Retained 7/15 to 12/16. Matter settled.

Google, Inc. v. Porto Technology Co., Ltd.

Retained by Fish and Richardson on behalf of petitioner Google, Inc., patent owner Porto Technology Inc. IPR2016-00022 and IPR2016-00045. Expert Declarations; Deposed: 7/14/16 (IPR2016-00022); 7/14/16 (IPR2016-00045). Retained 7/15 to 7/20.

Bradium Technologies LLC v. Microsoft Corporation,

Retained by Perkins Coie on behalf of defendant Microsoft Corporation. Case before the District of Delaware (15-0031-RGA). See also IPR2015-01432, IPR2015-01434, IPR2015-01435, IPR2016-00448 and IPR2016-00449. Expert Declarations; Deposed 8/5/16, 02/21/17; (IPR2015-01432); Retained 3/15 to 10/17.

ACQIS LLC v. EMC Corp.,

Retained by Gibson Dunn on behalf of defendant EMC Corp. Case before the District of Massachusetts (1:14-cv-13560). Expert Report on Invalidity; Retained 2/15 to 2/21.

Locata LBS LLC v. YellowPages.com LLC,

Retained by Baker Botts on behalf of defendant YellowPages.com. Case before the Central District of California (2:13-cv-07664). See also IPR2015-00151. Submitted Declaration. Retained 9/14 to 4/15. Matter settled.

M/A-COM Technology Solutions Holdings, Inc. v. Laird Technologies, Inc.

Retained by Erise IP on behalf of Laird Technologies, Inc., for invalidity consulting regarding U.S. Patent No. 6,272,349. Retained 6/14 to 9/14.

Certusview Technologies, LLC v. S&N Locating Services, LLC and S&N Communications, Inc.,

Retained by Baker & McKenzie on behalf of defendant S&N. Patents-in-suit are U.S. Patents 8,265,344, 8,290,204, 8,340,359, 8,407,001, and 8,532,341. Case before the Eastern District of Virginia, (2:13-cv-346). Expert Report on Non-Infringement; Deposed 11/8/14; Retained 6/14 to 12/14.

adidas AG and adidas America, Inc. v. Under Armour, Inc. and MapMyFitness, Inc.

Retained by Kilpatrick Townsend on behalf of plaintiff adidas. Case before the District of Delaware, (1:14-cv-00130). See also IPR2015-00697, IPR2015-00698, and IPR2015-00700. Deposed: 10/21/16 and 10/22/16 relative to 1:14-cv-00130; 2/5/16 relative to IPR2015-00697; 2/5/16 relative to IPR2015-0068; 2/5/16 relative to IPR2015-0700. IPR Declarations, Expert Report on Validity; Deposed 02/05/16; Retained 5/14 to 7/16.

GeoTag, Inc., v. AT&T Mobility LLC and AT&T Services, Inc.,

Retained by Baker Botts as an expert on behalf of defendant AT&T. Patent-in-suit is U.S. Patent 5,930,474. Case before the Northern District of Texas, Dallas Division, (3:13-cv-00169). Expert Report on Invalidity; Deposed 5/29/14; Retained 1/14 to 9/14. Matter settled.

Nokia Corp v. HTC Corp.

Retained by Quinn Emanuel as an expert on behalf of defendant HTC. Case being litigated in Germany. Patent number EP0766811B1. Retained 12/13 to 2/14. Matter settled.

Porto Technology, Co., Ltd. et al. v. Cellco Partnership d/b/a Verizon Wireless

Retained by Wiley-Rein as an expert on behalf of defendant Verizon. Case before the United States District Court for the Eastern District of Virginia (Case No. 3:13-cv-00265). Declaration ISO Claim Construction and Summary Judgement of Invalidity; Expert Report on Invalidity; Retained 10/13 to 2/14. Matter dismissed.

Nokia Corp v. HTC Corp.

Retained by McDermott Will and Emery and White & Case as an expert on behalf of defendant HTC. Case before the United States District Court for the District of Delaware (Case No. Case No. 1:12-cv-00550-UNA and Case No. 1:12-cv-551-UNA. Retained 6/13 to 2/14. Matter settled.

NXP B.V. v. Research In Motion, Ltd., et al.

Retained by Fish and Richardson as an expert on behalf of defendant Research In Motion. Patent-in-suit is U.S. Patent 6,501,420. Case before the United States District Court for the Middle District of Florida (Case No. 6:12-cv-00498). Expert Report on Invalidity, Expert Report on Non-Infringement; Deposed 9/18/13; Testified in Court: 4/1/14 and 4/2/14; Retained 5/13 to 4/14.

Vehicle IP LLC v. Wal-Mart Stores Inc., et al.

Retained by Polsinelli-Shugart, as an expert on behalf of defendant Werner Enterprises. Patent-in-suit is U.S. Patent 5,694,322. Case before the United States District Court for the District of Delaware (Case No. 1:10-cv-00503). Expert Report on Invalidity, Expert Report on Non-Infringement; Deposed 7/15/13 and 9/20/13; Testified in Court: 9/27/13 and 9/30/13; Retained 4/13 to 9/13.

Commonwealth Scientific and Industrial Research Organisation v. Realtek Semiconductor Corporation

Retained by Sidley Austin, LLP as an expert on behalf of defendant Realtek Semiconductor Corporation. Patent-in-suit is U.S. Patent 5,487,069. Case before the United States District Court for the Eastern District of Texas (Tyler Division) (Case No. 6:12-cv-00578). Expert Report on Invalidity, Expert Report on Non-Infringement; Deposed 3/6/15; Retained 4/13 to 4/15. Matter settled.

TracBeam, LLC v. Google Inc.

Retained by Quinn-Emanuel as an expert on behalf of defendant Google. Patents-in-suit are U.S. Patents 7,764,231 and 7,525,484. Case before the United States District Court for the Eastern District of Texas (6:11-cv-00093). Deposed 2/5/14; Retained 3/13 to 6/14.

Microsoft Corporation and Google Inc., v. GeoTag, Inc.

Retained by Perkins-Coie as an expert on behalf of plaintiff Microsoft Corporation. Patent-in-suit is U.S. Patents 5,930,474. Case before the United States District Court for the District of Delaware (1:11-cv-00175). Retained 1/13 to 9/14.

GeoTag, Inc., v. Frontier Communications Corp., et al.,

Retained by multiple firms as an expert on behalf of defendants. Patent-in-suit is U.S. Patents 5,930,474. Case before the Eastern District of Texas, Marshall Division, (2:10-cv-00265; other defendants are listed in case numbers 2:10-cv-00265, 2:10-cv-00272, 2:10-cv-00437, 2:10-cv-00569, 2:10-cv-00570, 2:10-cv-00571, 2:10-cv-00572, 2:10-cv-00573, 2:10-cv-00574, 2:10-cv-00575, 2:10-cv-00587, 2:11-cv-00175, 2:11-cv-00404, 2:11-cv-00421, 2:11-cv-00424, 2:11-cv-00425, 2:11-cv-00570, 2:12-cv-00043, 2:12-cv-00051, 2:12-cv-00436, 2:12-cv-00438, 2:12-cv-

00439, 2:12-cv-00441, 2:12-cv-00442, 2:12-cv-00444, 2:12-cv-00445, 2:12-cv-00446, 2:12-cv-00447, 2:12-cv-00448, 2:12-cv-00449, 2:12-cv-00450, 2:12-cv-00452, 2:12-cv-00454, 2:12-cv-00456, 2:12-cv-00459, 2:12-cv-00460, 2:12-cv-00462, 2:12-cv-00464, 2:12-cv-00466, 2:12-cv-00468, 2:12-cv-00469, 2:12-cv-00470, 2:12-cv-00471, 2:12-cv-00473, 2:12-cv-00474, 2:12-cv-00475, 2:12-cv-00476, 2:12-cv-00476, 2:12-cv-00477, 2:12-cv-00480, 2:12-cv-00481, 2:12-cv-00482, 2:12-cv-00482, 2:12-cv-00483, 2:12-cv-00486, 2:12-cv-00487, 2:12-cv-00520, 2:12-cv-00521, 2:12-cv-00523, 2:12-cv-00524, 2:12-cv-00525, 2:12-cv-00527, 2:12-cv-00528, 2:12-cv-00530, 2:12-cv-00532, 2:12-cv-00534, 2:12-cv-00535, 2:12-cv-00536, 2:12-cv-00537, 2:12-cv-00542, 2:12-cv-00543, 2:12-cv-00545, 2:12-cv-00547, 2:12-cv-00548, 2:12-cv-00549, 2:12-cv-00550, 2:12-cv-00551, 2:12-cv-00552, 2:12-cv-00555, 2:12-cv-00556, 2:12-cv-00570, 2:12-cv-00572, 2:12-cv-00573, 2:12-cv-00575, 2:12-cv-00587, 3:13-cv-00217). Deposed 5/29/14; Retained 1/13 to 9/14.

MOSAID Technologies Inc., v. Realtek Semiconductor Corporation

Retained by Sidley Austin, LLP as an expert on behalf of defendant Realtek Semiconductor Corporation. Patents-in-suit are U.S. Patents 5,131,006; 5,151,920; 5,422,887; 5,706,428; 6,563,786; and 6,992,972. Case before the United States District Court for the Eastern District of Texas (Tyler Division) (Case No. 2:11-cv-00179). Retained 12/12 to 12/12. Matter settled.

Hoyt A. Flemming v. Cobra Electronics Corporation

Retained by Sidley Austin, LLP as an expert on behalf of defendant Cobra Electronics Corporation. Patents-in-suit are U.S. Patents RE39038, RE40653 and RE41905. Case before the United States District Court for the District of Idaho (Case No. 1:12-cv-00392). Retained 11/12 to 06/13. Matter settled.

LBS Innovations LLC v. Aaron Bros., Inc., et al.

Retained as an expert on behalf of defendants Whole Foods Marketplace, Comerica, Hotels.com, Academy, Ltd., and Homestyle Dining. Patent-in-suit is U.S. Patent 6,091,956. Case before the Eastern District of Texas, Marshall Division, (Case No. 2:11-cv-00142-MHS-CMC. Deposed 10/5/12; Retained 7/12 to 12/12. Plaintiff moved to dismiss.

Advanced Media Networks, L.L.C. v. Gogo LLC et al.

Retained by Sidley Austin, LLP as an expert on behalf of defendant Gogo. Patent-in-suit is U.S. Patent 5,960,074. Case before the United States District Court for the Central District of California (Case No. 11-cv-10474). Deposed 2/6/13. Retained 7/12 to 8/13.

Walker Digital, LLC v. Google Inc.

Retained by O'Melveny & Meyers, LLP as an expert on behalf of defendant Google Inc. Patents-in-suit are U.S. Patents 6,199,014. Case before the United States District Court for the District of Delaware (Case No. 1:11-cv-00309-SLR). Deposed 2/27/13 - 2/28/13. Retained 6/12 to 8/13.

Silver State Intellectual Technologies, Inc. v. Garmin International, Inc., et al.

Retained by Erise IP, P.A. as an expert on behalf of defendants Garmin International, Inc. and Garmin USA, Inc. Patents-in-suit are U.S. Patents 6,525,768; 6,529,824; 6,542,812; 7,343,165; 7,522,992; 7,593,812; 7,650,234; 7,702,455 and 7,739,039. Case before the United States

District Court for the District of Nevada (Case No. 2:11-cv-1578). Deposed 2/19/14; Testified in Court: 5/21/15; Retained 4/12 to 5/15.

Beacon Navigation GmbH v. Toyota Motor Corporation, et al.

Retained by Kirkland & Ellis, LLP on behalf of defendants Toyota Motor Corporation; Toyota Motor North America, Inc.; Toyota Motor Sales, U.S.A. Inc.; Toyota Motor Engineering & Manufacturing North America, Inc.; Toyota Motor Manufacturing, Indiana, Inc.; Toyota Motor Manufacturing, Kentucky, Inc.; Toyota Motor Manufacturing Mississippi, Inc.; Mazda Motor Corporation; Mazda Motor of America, Inc.; Fuji Heavy Industries, Ltd.; Fuji Heavy Industries U.S.A. Inc.; Subaru of America, Inc.; Jaguar Land Rover North America, LLC; Jaguar Cars Limited; Land Rover; Volvo Car Corporation; and Volvo Cars of North America, LLC; Adduci Mastriani & Schaumberg, LLP on behalf of defendants Suzuki and Garmin; Crowell-Moring on behalf of General Motors; Dickstein Shapiro on behalf of Chrysler Group, LLC; Finnegan, Henderson, Farabow, Garrett & Dunner on behalf of Bayerische Motoren Werke AG, BMW of North America, LLC, and BMW Manufacturing Co. LLC; Fish & Richardson on behalf of Honda Motor Co., Ltd., Honda North America, Inc., American Honda Motor Co., Inc., Honda Manufacturing of Alabama, LLC, Honda Manufacturing of Indiana, LLC, and Honda of America, Mfg., Inc.; Frommer Lawrence and Haug, LLP on behalf of Dr. Ing. h.c.F. Porsche AG and Porsche Cars North America, Inc.; Hogan Lovells on behalf of Daimler AG, Mercedes-Benz USA, LLC, or Mercedes-Benz U.S. International, Inc.; Quinn-Emanuel on behalf of Nissan and Ford. Case before the US International Trade Commission, Washington D.C., in the matter of: “Certain Automotive Navigation Systems, Components Thereof, and Products Containing Same, Inv. No. 337-TA-814. Case withdrawn by Plaintiff. Retained 1/12 – 4/12.

Beacon Navigation GmbH v. Toyota Motor Corporation, et al.

Retained by Kirkland & Ellis, LLP on behalf of defendants Toyota Motor Corporation; Toyota Motor North America, Inc.; Toyota Motor Sales, U.S.A. Inc.; Toyota Motor Engineering & Manufacturing North America, Inc.; Toyota Motor Manufacturing, Indiana, Inc.; Toyota Motor Manufacturing, Kentucky, Inc.; Toyota Motor Manufacturing Mississippi, Inc.; Mazda Motor Corporation; Mazda Motor of America, Inc.; Fuji Heavy Industries, Ltd.; Fuji Heavy Industries U.S.A. Inc.; Subaru of America, Inc.; Jaguar Land Rover North America, LLC; Jaguar Cars Limited; Land Rover; Volvo Car Corporation; and Volvo Cars of North America, LLC. Multiple cases before the United States District Court for the District of Delaware. Case numbers 1:11-cv-00942-UNA, 1:11-cv-00941-UNA, 1:11-cv-00951-UNA, 1:11-cv-00952-UNA, 1:11-cv-00936-UNA, 1:11-cv-00937-UNA, 1:11-cv-00955-UNA, 1:11-cv-00959-UNA, and 1:11-cv-00960-UNA. Currently stayed. Retained 1/12.

Beacon Wireless Solutions, Inc., et al., v. Garmin International, Inc., et al.

Retained by Shook, Hardy and Bacon, LLP as an expert on behalf of defendant Garmin. Matter involves alleged trade secret misappropriation. Case before the United States District Court for the Western District of Virginia, Harrisonburg Division (Case No. 5:11-cv-00025). Testified in Court: 5/25/12. Retained 12/11 to 5/25/12.

Tramontane IP, LLC v. Garmin Int’l, Inc., et al.

Retained by Shook, Hardy and Bacon, LLP as an expert on behalf of defendant Garmin. Patents-in-suit are U.S. Patents 6,526,268 and 7,133,775. Case before the United States District Court for the Eastern District of Virginia (Case No. 1:2011-cv-00918). Case Settled. Retained 11/11 to 12/11.

Sourceprose, Inc. v. AT&T, Inc., MetroPCS Communications, Inc., et al.

Retained by Kilpatrick Townsend as an expert on behalf of defendant AT&T. Patents-in-suit are US Patent Nos. 7,142,217 and 7,161,604. Case before the United States District Court for the Western District of Texas, Austin Division. Case number 1:11-cv-00117. Retained 11/11 to 3/16.

Furuno Electric Co., Ltd. and Furuno U.S.A., Inc. v. Honeywell International, Inc.

Retained by Quinn-Emanuel as an expert on behalf of complainant Furuno. Case before the US International Trade Commission, Washington D.C., in the matter of: "Certain GPS Navigation Products, Components Thereof, and Related Software," Investigation number 337-TA-810. Patents-in-suit are U.S. Patent Nos. 6,084,565; 7,095,367; 7,089,094; and 7,161,561. Case settled. Retained 8/11 – 12/11.

Honeywell International, Inc. v. Furuno Electric Co., Ltd. and Furuno U.S.A., Inc.

Retained by Quinn-Emanuel as an expert on behalf of respondent Furuno. Case before the US International Trade Commission, Washington D.C., in the matter of: "Certain GPS Navigation Products, Components Thereof, and Related Software," Investigation number 337-TA-783. Patents-in-suit are U.S. Patent Nos. 7,209,070; 6,865,452; 5,461,388; and 6,088,653. Case Settled. Retained 8/11 – 12/11.

Triangle Software, Inc. v. Garmin International, Inc.

Retained by Weil, Gotshal & Manges, LLP., as an expert on behalf of defendant Garmin. Patents-in-suit are US Patents 7,557,730, 7,221,287, 7,375,649, 7,508,321 and 7,702,452. Case before the United States District Court, Eastern District of Virginia, Case No. 1:10-cv-1457 CMH/TCB. Deposed 7/28/11; Testified in Court: 11/3/11 (jury trial). Retained 4/11 to 11/11.

Garmin International, Inc. v. Pioneer Corporation and Pioneer Electronics (USA), Inc.

Retained by Shook, Hardy and Bacon, LLP as an expert on behalf of plaintiff Garmin. Patents-in-suit are U.S. Patents 5,365,448; 5,424,951; and 6,122,592. Case before the United States District Court for the District of Kansas. Case No. 10-CV-2080 JWL/GLR. Declarative Judgment action stayed. Retained 3/11 to 11/11.

Visteon Global Technologies, Inc. And Visteon Technologies, LLC v. Garmin International, Inc.

Retained by Shook, Hardy and Bacon as an expert on behalf of defendant Garmin. Patents-in-suit are US Patents 5,544,060, 5,654,892, 5,832,408, 5,987,375 and 6,097,316. Case before the United States District Court, Eastern District of Michigan, Case No. 2:10-cv-10578--PDB-MAR. Deposed 10/9/12; Retained 12/10 to 10/17.

Thomson Licensing SAS and Thomson Licensing, LLC. v. Realtek Semiconductor Corporation

Retained by Sidley-Austin as an expert on behalf of respondent Realtek Semiconductor. Case before the US International Trade Commission, Washington D.C., in the matter of: "Certain Liquid Crystal Display Devices, Including Monitors, Televisions, Modules, And Components Thereof," Investigation number 337-TA-741. Patent-in-suit is US Patent 6,121,941. Deposed 6/29/11; Testified in Court: 9/15/11 and 9/16/11. Retained 11/10 – 9/11.

Ambato Media, LLC. v. Clarion Co., LTD., et al.

Retained by Traurig-Greenberg as an expert on behalf of defendant Garmin. Patent-in-suit is US Patent 5,432,542. Case before the United States District Court for the Eastern District Of Texas, Marshall Division. Case number 2:09-CV-242. Deposed 4/26/12 and 5/10/12; Testified in Court: 7/11/12. Retained 10/10 to 7/12.

Gabriel Technologies Corporation and Trace Technologies, LLC, v. Qualcomm Incorporated, Snaptrack, Inc. and Norman Krasner

Retained by Cooley-Godward as an expert on behalf of defendants Qualcomm, Snaptrack, and Krasner. Trade secret misappropriation case related to US Patents 6,377,209, 6,583,757, 6,661,372, 6,799,050, 6,861,980, 6,895,249, 7,254,402, 7,289,786, 7,319,876, 7,421,277, 7,446,655, 7,570,958, 7,574,195, and 7,660,588. Case before the Southern District of California San Diego Division, Case No. 08-cv-1992 MMA POR. Retained 6/10 to 7/12.

SiRF/CSR v. Global Locate/Broadcom Corporation

Retained by Wilmer-Hale as an expert on behalf of defendant Global Locate / Broadcom. Patents-in-suit are US Patents 5,663,735, 6,480,150, 6,519,466, 6,650,879, 6,882,827, 6,934,322, 7,412,157, 7,236,883, and 7,573,422. Case before the Central District of California, Case No. 8:06-cv-01216 and Case No. 8:10-cv-01281. Retained 9/10 to 1/11.

Pioneer Electronics v. Garmin Corporation

Retained by Shook, Hardy and Bacon, LLP as an expert on behalf of respondent Garmin In the matter of Certain Multimedia Display and Navigation Devices and Systems, Components Thereof, and Products Containing Same; Inv. No. 337-TA-694. Patents-in-suit are U.S. Patents 5,365,448; 5,424,951; and 6,122,592. Case before the U.S. International Trade Commission. Deposed on 7/29/10; Testified at technology tutorial (8/27/10) and in the evidentiary hearing (9/20/10). Retained 4/10 to 9/10.

EMSAT Advanced Geo-Location Technology, LLC and Location Based Services LLC, v. AT&T Mobility, LLC

Retained by Baker-Botts as an expert on behalf of defendant AT&T Mobility, LLC. Patents-in-suit are U.S. Patents 7,289,763; 5,946,611; 6,324,404; and 6,847,822. Case before the U.S. District Court for the Northern District of Ohio, Eastern Division, Civil Action No. 4:08 CV 822. Deposed 5/4/10; Testified in Court: 5/10/10 (Markman hearing). Retained 12/09 to 3/11.

Tendler Cellular of Texas, LLC v. AT&T Mobility, LLC, et al.

Retained by Baker-Botts as an expert on behalf of defendants AT&T Mobility, LLC, et al. Patents-in-suit are U.S. Patents 7,447,508; 7,305,243; 7,050,818; and 6,519,463. Case before the U.S. District Court for the Eastern District of Texas (Tyler), Civil Action No. 6:09-CV-00115. Retained 8/09 to 7/10.

Ambit Corporation v. Delta Air Lines, Inc., and Aircell LLC.

Retained by Sidley Austin, LLP., as an expert on behalf of defendants Delta Airlines, Inc., and Aircell, LLC. Patent-in-suit is US patent 7,400,858. Case before the US District Court, District of Massachusetts, Boston, Civil Action No. 1:09-CV-10217-WGY. Deposed 12/4/09; Testified in Court: 12/7/09 (evidentiary hearing), 7/10 (jury trial). Retained 8/09 to 7/10.

GPS Industries, Inc. and Optimal I.P. Holdings, L.P. v. Altex Corporation, et. al.

Retained by Hitchcock-Evert as an expert on behalf of defendants Altex Corporation, Deca International Corporation, Golflogix, Inc. and L1 Technologies. Patent-in-suit is US patent 5,364,093. Case before the US District Court, Northern District of Texas, Dallas Division, Civil Action No. 3-07-CV0831-K. Deposed 6/30/09. Retained 5/08 through 7/09.

Satellite Tracking of People, LLC v. Omnilink Systems, Inc.

Retained by DLA Piper as an expert on behalf of defendant Omnilink Systems, Inc.. Patent-in-suit is US patent RE39,909. Case before the US District Court, Eastern District of Texas, Marshall Division, Civil Action No. 2-08CV-116. 12/08 – 1/11.

SiRF Technology, Inc. v. Global Locate, Inc.

Retained by DLA Piper/WilmerHale as an expert on behalf of Global Locate. Patents-in-suit include US patents 6,304,216; 6,417,801; 6,606,346; 6,651,000; 6,704,651; 6,937,187; 7,043,363; 7,091,904; 7,132,980 and 7,158,080. Case before the US International Trade Commission, Washington D.C., in the matters of: “Certain GPS Devices and Products Containing Same,” Investigation number 337-TA-602 (Global Locate, plaintiff) and “Certain GPS Chips, Associated Software and Systems, and Products Containing Same,” Investigation number 337-TA-596 (SiRF Technologies, plaintiff). My work focused on the 7,043,363 and 7,091,904 patents in defense of Global Locate/Broadcom from June 2007 through March 2008. Deposed 1/18-1/19/08; testified at trial 3/18-3/19/08.

Intellectual Science and Technology

Retained Dykema Gossett, PLLC as a technical expert on patent infringement issues related to “suspend-to-RAM” technologies in personal computers. Pre-litigation work.

Intellectual Science and Technology, Inc., v. Sony, JVC and Panasonic

Retained Dykema Gossett, PLLC as a technical expert on patent infringement issues related to US Patent 5,748,575, US Patent 6,222,799, US Patent 6,785,198, US Patent 6,662,239 and US Patent 6,717,890. Sony Electronics Inc., case number 2:06-CV-10406, JVC Americas Corp., case number 2:06-CV-10409 and Panasonic Corporation of North America case number 2:06-CV-10412. Cases heard in United States District Court, Eastern District of Michigan, Southern Division. Expert for Intellectual Science and Technology, Inc. Dec 2006 – 2008..

Kirsch Technologies v. Xerox, Canon

Retained Dykema Gossett, PLLC as an Expert Witness on patent infringement issues related to US Patent 4,816,911, Canon case number CA 00-72775, Xerox case number CA 00-72778, cases heard in United States District Court, Eastern District of Michigan, Southern Division. Expert for Kirsch Technologies. Nov 2006 – 2008..

American Video Graphics v. ATI Technologies

Retained by Sidley, Austin, Brown & Wood, Dallas, TX as a technical expert on patent infringement issues related to US Patents 5,132,670, 5,109,520, 5,084,830, 4,761,642, 4,742,474, 4,734,690, 4,730,185 and 4,694,286. Hewlett-Packard Co., et al., defendants, case number CA 6:04-CV-379-LED and Sony Corporation of America et al., defendants, case number CA 6:04-CV-399-LED. Cases heard in United States District Court, Eastern District of Texas, Tyler Division. Expert for ATI Technologies, intervener. Jan 2005 – Sep 2005.

Microsoft v. EMC

Dewey Ballantine, LLP, Washington, D.C., as a technical expert on patent infringement issues related to US Patents 5,588,147; 5,689,700; 6,393,466; 6,424,151; 6,490,594; and 6,632,248. Wrote a declaration on behalf of Microsoft. Oct 2004 – Jan 2005.

Optimum Return v. Meier Brothers

Retained by Sidley, Austin, Brown & Wood, Dallas, TX as a technical expert on Copyright infringement allegations related to software owned by Optimum Return, LLC. Cyberkatz Consulting, Inc., Handsquare, LLC, Meier Brothers, et al., defendants, case number CA 3-03CV1064-D. Case heard in United States District Court, Northern District of Texas, Dallas Division. Expert for Meier Brothers. July 2004.

Parental Guide of Texas, Inc. v. Funai Corp., et. al.

Technical expert for defendants JVC and Panasonic in their dispute over non-infringement of US Patent number 4,605,964.

Elonex I.P. Holdings, LTD. and Elonex PLC, Phase II

Expert witness for defendants Chuntex, Acer, Tatung, Lite-On, Daewoo and Envision in their dispute with Elonex non-infringement and validity for US Patent numbers 5,389,952; 5,648,799; and 5,880,719.

Storage Computer Corporation vs. Veritas Software

Technical expert for the plaintiff in matters involving Patents US 5,257,367; US 5,893,919; and US 6,098,128.

Storage Computer Corporation vs. Seagate Technology LLC

Technical expert for the defendant in matters involving US Patent RE 34,100.

Elonex I.P. Holdings, LTD. and Elonex PLC, vs. Packard Bell et. al., CA 98-689-GMS

Expert witness for defendants ViewSonic Corp., Dell Computer Corporation, MAG Technology USA, Princeton Graphic Systems, Inc., Micron Electronics, Sony Electronics and Capetronic Computer USA in their dispute with Elonex non-infringement and validity for US Patent numbers 5,389,952; 5,648,799; and 5,880,719.

1.4.2 Engineering Consulting**Offspring Media Inc.**

Technical consultant for the development of real-time auralization algorithms for integration into a consumer electronics product. Sep 2004.

Raytheon Company, Sudbury, MA

Development of techniques and requirements for implementing a fault tolerant computer system using software implemented fault tolerance (SIFT) techniques on commercial off-the-shelf processing hardware. The resultant system is to be used for highly reliable radar data and signal processing.

TVM Techno Venture Management

Provided consulting services to assist in assessing the technical claims of a company pursuing venture capital investment for a hardware implemented RAID 5 system .

Keyhold Engineering Inc., Northboro, MA.

Development of a prototype system for automatically calibrating multiple channel audio systems.

American Navigation Systems Inc., Milbury, MA.

Consulting on the development of the hand-held personal navigation and mapping system.

Lincoln Laboratory, Bedford, MA.

Simulated, tested and evaluated a GPS integrity monitoring algorithm developed at Lincoln Laboratories.

1.5 Licenses and Certifications

1.5.1 Commercial Radio Operator

General Radiotelephone Operator License
Ship RADAR endorsement

1.5.2 Amateur Radio Operator

Amateur Extra class radio operator license.

1.5.3 Diving Certifications

PADI Open Water Diver (ISO 24801-2 Diver Level 2 – Autonomous Diver)

2. Courses Taught at WPI

2.1 Course Descriptions

Short descriptions of the courses taught are as follows:

EE572N Advanced System Architecture

This course focuses on the architectural techniques used to achieve high-performance in SISD and SIMD computer systems. In this course the interaction between the software application and hardware architecture and the effect of this interaction on achievable

performance is stressed. The course begins by covering the basic architectural tricks used to enhance system performance and ends with a series of case studies that analyze specific architectures such as the CRAY and CDC vector supercomputers, the MasPar, the Connection Machine, the ICL DAP, and others.

ECE505 Computer Architecture

This course is an introductory graduate course in computer architecture. Most aspects of CPU architecture are covered using a combined hardware/software approach. Specific topics include datapath design, memory systems, microprogramming, memory management, operating systems, and instruction set design.

ECE579M Real-Time System Design

This course focuses on the design of computer systems for which the timeliness of producing results is a critical factor for establishing the correctness of the system design. Topics covered include hardware specification, real-time operating systems and programming, scheduling, communications, and validation/verification. Issues and choices arising for single processor and distributed systems are also covered. Both hard and soft real-time system issues and the interactions between real applications and real systems is stressed.

ECE2010 Introduction to Electrical and Computer Engineering.

The objective of this course is to introduce students to the broad field of electrical and computer engineering within the context of real world applications. This course is designed for first-year students who are considering ECE as a possible major or for non-ECE students fulfilling an out-of-major degree requirement. The course will introduce basic electrical circuit theory as well as analog and digital signal processing methods currently used to solve a variety of engineering design problems in areas such as entertainment and networking media, robotics, renewable energy and biomedical applications. Laboratory experiments based on these applications are used to reinforce basic concepts and develop laboratory skills, as well as to provide system-level understanding. Circuit and system simulation analysis tools are also introduced and emphasized.

ECE2019 Sensors, Circuits, and Systems.

This course investigates commonly used sensors such as resistive temperature sensors, capacitive touch sensors, and inductive motion sensors and actuators. Numerous applications are presented to motivate coverage of fundamental operating principles of circuit elements such as resistors, capacitors, and inductors; model the signals produced by these sensors; and analyze the circuits and systems used to amplify and process these signals. After a review of Kirchhoff's current and voltage laws, fundamental analysis techniques such as Thevenin and Norton's theorems and the superposition principle are used to model and analyze sensors, circuits, and systems. Concepts from analysis of linear, time-invariant continuous-time signals and systems are introduced as necessary, including Fourier series and characterization of systems such as filters in both the frequency domain (bandwidth, transfer function) and time domain (rise time,

step response). Capacitance, inductance and mutual inductance are explored as energy storage elements, including consideration of resonance and energy losses in power systems. Concepts will be reinforced with the use of laboratory exercises and computer simulation. Recommended background: ECE 2010, MA 1024 (or equivalent), PH 1120/21 and MA 2051 (concurrent) Note: Students who have received credit for ECE 2111 may not receive credit for ECE 2019.

ECE2022 Introduction to Digital Circuits and Computer Engineering.

The objective of this course is to expose students (including first year students) to basic electrical and mathematical concepts that underlie computer engineering while continuing an introduction to basic concepts of circuits and systems in a hands-on environment. Experiments representing practical devices introduce basic electrical engineering concepts and skills which typify the study and practice of electrical and computer engineering. In the laboratory, the students construct, troubleshoot, and test analog and digital circuits that they have designed. They will also be introduced to the nature of the interface between hardware and software in a typical microprocessor based computer.

ECE2801 Foundations of Embedded Systems

This course teaches the principles of programming microprocessors and microcontrollers for real-time applications. Students are introduced to software engineering principles and are taught how to translate product specifications into engineering solutions.

ECE2799 ECE Design

This is a new course added to the curriculum that teaches sophomore Electrical Engineering students the basic principles of design. Topics are covered which range from project planning and management through manufacturing and implementation. Students are exposed to external factors influencing design such as safety, liability, cost, and other constraints.

ECE3801 Logic Circuits

This is an introductory course in logic circuit design. Topics covered include Boolean Logic, Algebraic minimization of logic equations, Karnaugh Maps, sequential machine design and timing analysis.

ECE3803 Introduction to Microprocessor Systems

This is an undergraduate-level first-course in microprocessor design. Topics covered include timing analysis, address decoding, memory system design, assembly language programming, programmed I/O, and digital/analog interfacing. Experiments are run using ISA-bus interfaces to standard PCs.

ECE3810 Advanced Digital System Design

This course addresses the design of advanced digital logic systems using VHDL to design, synthesize and model digital circuits, and to implement these circuits using Xilinx FPGA devices. The course emphasizes understanding functional design, designing for speed and power objectives, and testing. The course ends with students designing moderately complicated “system on a chip” (SOC) based systems

ECE4815 Computer Architecture (crosslisted as CS4515)

A first course in computer architecture. Essential aspects of CPU architecture are covered using a combined hardware/software approach. Students learn how a CPU interprets and processes instructions. Issues associated with interfacing hardware with software are covered in detail as are the hardware/software tradeoffs associated with performance optimization.

ECE4801 Microprocessor System Design

Microprocessor System Design is the second course in the microprocessor sequence. In this course, students learn the advanced concepts used in modern microprocessor systems. Topics such as system organization, dynamic and cache memory systems, communications, mixed language programming, and device driver design are covered.

ECE430X Fundamentals of Navigation Systems

This course introduces students to the fundamentals of navigation using electronic systems. The course covers types of navigation systems, how to interpret sensor data and sources of navigation system error. Topics include: types of navigation systems (dead reckoning, inertial, radio based systems), sensors and error sources, coordinate frames and transformations, system dynamics and measurement processing. Case studies explore the use of accelerometers, gyroscopes, GPS (including, differential and assisted GPS) as well as other types of navigation systems.

RBE 3001 Unified Robotics III

Third of a four-course sequence introducing foundational theory and practice of robotics engineering from the fields of computer science, electrical engineering and mechanical engineering. The focus of this course is actuator design, embedded computing and complex response processes. Concepts of dynamic response as relates to vibration and motion planning will be presented. The principles of operation and interface methods various actuators will be discussed, including pneumatic, magnetic, piezoelectric, linear, stepper, etc. Complex feedback mechanisms will be implemented using software executing in an embedded system. The necessary concepts for real-time processor programming, re-entrant code and interrupt signaling will be introduced. Laboratory sessions will culminate in the construction of a multi-module robotic system that exemplifies methods introduced during this course.

RBE 3002 Unified Robotics IV

Fourth of a four-course sequence introducing foundational theory and practice of robotics engineering from the fields of computer science, electrical engineering and mechanical engineering. The focus of this course is navigation, position estimation and communications. Concepts of dead reckoning, landmark updates, inertial sensors, vision and radio location will be explored. Control systems as applied to navigation will be presented. Communication, remote control and remote sensing for mobile robots and tele-robotic systems will be introduced. Wireless communications including wireless networks and typical local and wide area networking protocols will be discussed. Considerations will be discussed regarding operation in difficult environments such as underwater, aerospace, hazardous, etc. Laboratory sessions will be directed towards the solution of an open-ended problem over the course of the entire term.

RBE 400x Robot System Engineering and Design

The designers of robotic systems start with a system requirement to define the mechanical, electrical and software systems which must work together to achieve the system goals. Typically, parallel teams of engineers will work concurrently to create the requirements document as well as model various aspects of the system to verify operational capabilities and the ability to meet time and budget constraints. For complex systems, the development of such teams can itself be a complex problem since the project has to be organized in such a way that parallel teams can work independently, yet have excellent communication channels and information passing to insure project success.

This course explores the tools and techniques used to develop complex systems. The topics covered include: requirements development; system architecture and partitioning; requirements flowdown; functional and interface specifications; trade studies; system modeling and simulation; system integration; as well as design verification and validation.

RBE500 Foundations of Robotics

Foundations and principles of processing sensor information in robotic systems. Topics include an introduction to probabilistic concepts related to sensors, sensor signal processing, multi-sensor control systems and optimal estimation. The material presented will focus on the types of control problems encountered when a robot must operate in an environment where sensor noise and/or tracking errors are significant. Techniques for assessing the stability, controllability and expected accuracy of multi-sensor control and tracking systems will be presented. Lab projects will involve processing live and synthetic data, robot simulation and projects involving the control of robot platforms.

RBE502 Robot Control

This course reviews the interplay between control and robotics through introducing theory and demonstrating applications. It aims to provide an in-depth coverage of control design for robotic manipulators and mobile robots. We focus primarily on fundamental theory, control design methods, and their application on practical robotic systems. Topics may include modeling of robotic systems, linear/nonlinear control of robotic systems, control of under-actuated robotic systems, optimal control, adaptive control, behavior-based robots. Course projects will emphasize modeling, simulation and practical implementation of control systems for robot applications.

RBE594 Capstone Project Experience In Robotics Engineering

This project-based course integrates robotics engineering theory and practice, and provides the opportunity to apply the skills and knowledge acquired in the Robotics Engineering curriculum. The project is normally conducted in teams of two to four students. Students are encouraged to select projects with practical significance to their current and future professional responsibilities. The projects are administered, advised, and evaluated by WPI faculty as part of the learning experience, but students are also encouraged to seek mentorship from experienced colleagues in the Robotics Engineering profession.

3. List of Publications:

3.1 Journal Papers

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- [2] T. Padir, W.R. Michalson, et. al., "Implementation of an Undergraduate Robotics Engineering Curriculum," *Computers in Education Journal*, vol. I, no. 3, pp. 92-101, 2010.
- [3] W. R. Michalson, A. Navalekar and H. Parikh, "Error mechanisms in indoor positioning systems without support from GNSS," *The Journal of Navigation*, Cambridge University Press, vol. 62, no. 2, pp. 239-49, 2009.
- [4] H.K. Parikh and W. R. Michalson, "Impulse Radio - UWB or Multicarrier UWB for Non-GPS based Indoor Precise Positioning Systems," *NAVIGATION J. Inst. Nav.*, Vol. 55, no. 1, 2008.
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- [14] W. R. Michalson, "Auralization on a Laptop PC," abstract appears in *The Journal of the Acoustical Society of America* , vol. 100 No. 4, Pt 2, pp. 2608, October 1996.
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3.2 Conference Papers

- [1] E. Skorina, R. Rameshwar, S. Pirasmepulkul, T. Khuu, A. Caracappa, P. Luxsuwong, M. Luo, W. R. Michalson, and C. Onal, "Soft Robotic Glove System for Wearable Haptic Teleoperation," WM Symposium 2018, March 18 - 22, 2018 - Phoenix Convention Center.
- [2] K.C. Seals, W.R. Michalson, R.J. Hartnett and P.F. Swaszek, "Using Both GPS L1 C/A and L1C: Strategies to Improve Acquisition Sensitivity," Proc. 26th International Technical Meeting of the Satellite Division of the Institute of Navigation (ION GNSS 2013), Sep. 16-20, 2013.
- [3] K.C. Seals, W.R. Michalson, R.J. Hartnett and P.F. Swaszek, "Semi-Coherent and Differentially Coherent Integration for L1C Acquisition," Proc. 2013 International Technical Meeting of the Institute of Navigation (ION ITM 2013), Honolulu, HI, Apr. 22-25, 2013.
- [4] J.M. Barrett, M.G. Gennert, W. R. Michalson, et. al., "Development of a Low-Cost, Self-Contained, Combined Vision and Inertial Navigation System," 2013 International Conference on Technologies for Practical Robotic Applications, Boston, MA Apr. 22-23, 2012.

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- [9] W.R. Michalson, and F. J. Looft, "Designing Robotic Systems: Preparation for an Interdisciplinary Capstone Experience," American Society of Engineering Educators 2010 Annual Conference, Louisville, KY, Jun 20-23, 2010.
- [10] W.R. Michalson, S.J. Bitar and R.C.Labonte, "The Technical, Process, and Business Considerations For Engineering Design – A 10 Year Retrospective," American Society of Engineering Educators 2010 Annual Conference, Louisville, KY, Jun 20-23, 2010.
- [11] M. Gennert, M. Demetrio and W. R. Michalson, "A Robotics Engineering M.S. Degree," American Society of Engineering Educators 2010 Annual Conference, Louisville, KY, Jun 20-23, 2010.
- [12] R. Beach, W. R. Michalson, et. al., "Robotics Innovations Competition and Conference (RICC): Building Community Between Academia and Industry Through a University-Level Student Competition," American Society of Engineering Educators 2010 Annual Conference, Louisville, KY, Jun 20-23, 2010.
- [13] G. Tryggvason, W.R. Michalson, et. al., Teaching Multidisciplinary Design to Engineering Students: Robotics Capstone," American Society of Engineering Educators 2010 Annual Conference, Louisville, KY, Jun 20-23, 2010.
- [14] A.C.Navalekar, W.R. Michalson, "Asymmetric throughput problem due to Push-to-talk (PTT) delays in CSMA/CA based heterogeneous Land Mobile Radio (LMR) networks", accepted for publication, Milcom 2009.
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- [18] M. DiBlasi, W. R. Michalson, et. al., "Social Networking in the FIRST Robotics Competition Community," ASEE Northeast Section Conference, University of Bridgeport, Apr 3-4, Bridgeport, CT, 2009.
- [19] A. Navalekar, H.K Parikh and William R. Michalson, "Error Mechanisms in Indoor Positioning Systems without Support from GNSS", RIN NAV 08.
- [20] A. Navelekar, W.R. Michalson, et. al., "Effects of Push-To-Talk (PTT) delays on Throughput Performance of CSMA/CA based Distributed Digital Radios (DDR) for Land Mobile Radio (LMR) Networks," 37th International Conference on Parallel Processing (ICPP-08), Portland, OR, Sep. 8-12, 2008.
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- [29] C.W. Kelley, W. R. Michalson, et. al., "Discrete vs. Continuous Carrier Tracking Loop Theory, Implementation, and Testing with Large BnT," *Proc. Institute of Navigation GNSS 2007*, Fort Worth, TX, September 25-28, 2007.

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3.3 Book Chapters

- [1] W. Michalson and E. Schnieder, "An Approach for Implementing a Reconfigurable Optical Interconnection Network for Massively Parallel Computers," in *Optical Interconnection - Foundations and Approaches*, C. Tocci and H. J. Caulfield Eds., Artech House, proposed release January 1994.

3.4 Patents

Haptic glove as a wearable force feedback user interface

United States Patent 10,551,923, Issued February 4, 2020

A toroidal actuator is responsive to a teleoperator for providing haptic feedback responsive to a curvature or articulated movement applied to a gripped object. The toroidal actuator surrounds an operator member such as a finger, and is responsive to pneumatic pressure for increasing telepresence force defined by resistance encounter against a teleoperated robotic claw. As the teleoperated claw grips an object, increased pneumatic pressure in the toroidal actuator tends to elongate the toroidal shape in a linear manner and oppose a curvature force applied by an inserted operator finger. Resistive force is based on soft sensing of the gripped object, thus the toroidal actuator applies an increasing resistive force to curvature as the robotic claw closes around a gripped object by solenoid regulated air pressure.

Precision location methods and systems

United States Patent 8,928,459, Issued January 6, 2015

The invention describes systems and methods for determining the location of a transmitter by jointly and collectively processing the full sampled signal data from a plurality of receivers to form a single solution.

Tracking device and remote monitoring system

United States Patent Application US20140274115A1

A system includes a remote monitoring device configured to detect and measure one or more signals and to convey detected and measured signal information to a central location. The central location is configured to determine the location of the remote monitoring device based on the received signal information and is also configured to determine at least one hypothetical path of the remote monitoring device. Abandoned.

Apparatus and methods for addressable communication using voice-grade radios

United States Patent 8,284,711, Issued 9 October 2012

The invention relates to methods and apparatus for conducting directed communication using voice-grade radios. The methods and apparatus can be used to form a packet-switched wireless network using legacy analog transceivers, providing, e.g., both data and voice-over-Internet Protocol communication.

Multi-channel electrophysiologic signal data acquisition system on an integrated circuit.

United States Patent 7,896,807, issued 3 March 2011.

A physiologic data acquisition system includes an analog input, a sigma-delta front end signal conditioning circuit adapted to subtract out DC and low frequency interfering signals from and amplify the analog input before analog to digital conversion. The system can be programmed to acquire a selected physiologic signal, e.g., a physiologic signal characteristic of or originating from a particular biological tissue. The physiologic data acquisition system may include a network interface modulating a plurality of subcarriers with respective portions of an acquired physiologic signal. A receiver coupled to the network interface can receive physiologic data from, and send control signals and provide power to the physiologic data acquisition system over a single pair of wires. The network interface can modulate an RF carrier with the plurality of modulated subcarriers and transmit the resulting signal to the receiver across a wireless network. An integrated circuit may include the physiologic data acquisition system. Also included are methods for acquiring physiologic data comprising the step of selectively controlling an acquisition circuit to acquire the physiologic signal.

Methods and apparatus for high resolution positioning. United States Patent 7,292,189. The invention relates to a method of signal analysis that determines the location of a transmitter and to devices that implement the method. The method includes receiving by at least three receivers, from a transmitter, a first continuous-time signal having a first channel. The first channel includes a first plurality of signal carriers having known relative initial phases and having known frequencies which are periodically spaced and which are orthogonal to one another within a first frequency range. The signal analysis method also includes determining the phase shifts of the carriers of the first channel resulting from the distance the carriers traveled in reaching the first receiver. Analysis of the phase shifts yields time difference of arrival information amongst the receivers, which is further processed to determine the location of the transmitter. 6 Nov 2007.

A Reconfigurable Indoor Geolocation System, US Patent Number 7,079,025. A portable reconfigurable geolocation system is provided. The system includes a portable user node and one or more portable pseudolite nodes in communication one another and with the user node. Each of the user nodes and pseudolite nodes includes a transmitter that generates a signal on one or more carrier frequencies. Each signal is modulated with digital signals necessary to establish distances between the nodes and to convey data between the nodes. Each node also includes a receiver for receiving and demodulating the signals transmitted between the nodes, and a processor for receiving the demodulated signals, extracting data values and derived values from the demodulated signals and determining a three-dimensional position of each node in the system. Issued 18 Jul 2006.

Auto-Calibrating Surround System, United States Patent 7,158,643. A multi-channel surround sound system and method is described that allows automatic and independent calibration and adjustment of the frequency, amplitude and time response of each channel of the surround sound system. The disclosed auto-calibrating surround sound (ACSS) system includes a processor that generates a test signal represented by a temporal maximum length sequence (MLS) and supplies the test signal as part of an electric input signal to a loudspeaker. A microphone coupled to the processor receives the signal in a listening environment. The processor correlates the received sound signal with the test signal in the time domain and determines from the correlated signals a whitened response of the audio channel in the listening environment. Issued 2 Jan 2007.

Hand-held GPS-mapping device, US. Patent Number 5,987,380. A hand-held navigation, mapping and positioning device contains a GPS receiver, a database capable of storing vector or bit mapped graphics, a viewing port, an embedded processor, a simplified user interface, a data compression algorithm, and other supporting electronics. The viewport is configured such that the data presented in the viewport is clearly visible in any ambient light condition. The database stores compressed image data which might include topographical map data, user annotations, building plans, or any other image. The system includes an interface to a personal computer which may be used to annotate or edit graphic information externally to the device for later upload. In addition, the device contains a simple menu-driven user interface which allows panning and zooming the image data, marking locations of interest, and other such functions. The device may be operated from an internal rechargeable battery, or powered externally. Issued 16 Nov 1999.

Hand-held GPS-mapping device, US. Patent Number 5,902,347. A hand-held navigation, mapping and positioning device contains a GPS receiver, a database capable of storing vector or bit mapped graphics, a viewing port, an embedded processor, a simplified user interface, a data compression algorithm, and other supporting electronics. The viewpoint is configured such that the data presented in the viewport is clearly visible in any ambient light condition. The database stores compressed image data which might include topographical map data, user annotations, building plans, or any other image. The system includes an interface to a personal computer which may be used to annotate or edit graphic information externally to the device for later upload. In addition, the device contains a simple menu-driven user interface which allows panning and zooming the image data, marking locations of interest, and other such functions. The device may be operated from an internal rechargeable battery, or powered externally. Issued 11 May 1999.

3.5 Professional Presentations

American Ambulance Association Annual Meeting: Low-cost VHF/UHF Interoperability for digital telemetry, Las Vegas, NV, Dec. 2005.

California Ambulance Association, Keynote address: Alternatives to solving interoperability problems in Land Mobile Radios, Lake Tahoe, NV, July 2005.

Museum of Science Lecture Series: The Next Generation of Information and Communications Technologies-What does the Future Hold?, William R. Michalson and Brian King, January 14, 2004.

Agilent Wireless Technology Summit: Dynamic Node Location in an Ad Hoc Indoor Communications and Positioning Network, William R. Michalson, January 27, 2004

Security & Technology Online (SATO) Security Leadership Council. Panel discussion on Smart Surveillance, Command and Control, Oct 28-29, 2004.

“*Worcester Polytechnic Institute Barcelona Summit: The Future of Information Technology*,” delivered presentation entitled “Personal Navigation in the Information Age,” Apr 2001.

4. Projects advised (undergraduate).

4.1 Major Qualifying Projects (current)

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- [2] *SailBot 2021*, C.J. Burri, M.J. Laks, L.C. Zebrowski, N.H. Jackson, C.J. Scholler, N.J. Eusman, A.V. Thammana, MQP-WZM-SB21, 2021.
- [3] *Ship Recycling Robot*, N.M. Kalsih, S.I. Morales, J. Cybul, J.D. Hoy, T.H. Reiser, MQP-BC2-SRR1, 2021.
- [4] *Tethered Submersible Surveyor*, B.L. Ward, L.C. Reid, J.A. Conklin, J.Y. Huang, MQP-YGB-SUB2/MQP-WZM-SUB1, 2021.
- [5] *Underwater Communications*, L. Spalding, MQP-WZM, 2021.
- [6] *Lionfish III*, MQP-CBP, 2021.

4.2 Major Qualifying Projects (completed)

- [7] **Remote Water Monitoring*, Daniel Shrives, T. Vose, and B. Rolfes, MQP-WZM-AB0R, 2020. [* Winner – Provost’s MQP Award in Robotics Engineering]
- [8] *SailBot 2019-2020 MQP*, I. Lavryonova, T. Andrews, M. Guzman, and K. Reese, MQP-WZM-ABWT, 2020.
- [9] *Firefighting Remote Exploration Device II*, J. Cheng, D. Karavoussianis, A. Moseley, and L. Sahyun, CP4-MQP-FIRE, co-advised, 2020.
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- [11] *Lionfish Harvesting Robot – Phase III*, M. Abadjiev, Q. Chen, C. Ewen, N. Johnson, N. Olgado, H. Saperstein, O. Strickland, and C. Whimpenny, WZM-MQP-ABVF, 2020.

- [12] *Underwater 3D Data Collection*, D. Pelaez, T. LaCroce, and N. Budris, WZM-MQP-ABVK, 2020.
- [13] *Efficient Multi Robot Mapping: Quick and Sustained Environmental Surveying with Limited Communication*, D. Abraham, T. Bergeron, and C. Dembski, WZM-MQP-AB0P
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- [15] *Sailbot 2018-19*. S. T. Palmer, K.B. Randall and S. A. Fisher, MQP-KZS-SBOT/MQP-WZM-SAIL, 2019.
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- [17] *Vertical Take-Off and Landing Autonomous Aircraft Design*, Q. C. Barker, T. P. Bergeron, J. A. Goldsberry, J. Romelle, B. H. Pasculano, B. M. Waterman, T. M. Weiss, and Z. J. Zolotarevsky, MQP-RVC-1901, 2019.
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- [23] *Localization for FRC*, Hu, J., Mitrano, P., Puczydowski, K. and Vere, N., 2017.
- [24] **Sailbot 2017-2018 Final Report*, Burklund, J., Johnson, H., Norris, T. and Shanahan, L. 2018. [* Winner – Provost’s MQP Award in Robotics Engineering, Winner – Professional Writing Award].
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- [30] *Fire Response Drone*, John Lomi, Zachary Hood, Kyle Young, Chase St. Laurent, and William Boyd, MQP-WZM-16A3, 2017.

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- [34] **Body Armor Impact Map System*, Carolyn S. Keyes, ME; Nicholas B. Potvin, ECE; and Zachary R. Richards, CS, MQP-WZM-15A1, 2016. [* winner of the Mechanical Engineering Department's MQP Award].
- [35] *Highway Safety Merge System*, Dante A. Pace, ECE; and Sunghoon Yoon, CS, MQP-MYE-AAS5, 2016.
- [36] *Highway Safety Merge System*, Christopher M. Ellen, RBE; MQP-MYE-AATK, 2016.
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- [38] *De-Mining with UAVs*, Gregory G Tighe
- [39] *Arc-Liberation of Intermolecular Bond Energy for Marine Propulsion*, Rohan Jhunhunwala, ME; James Deane Jackman, CS; Tyler Jon Ewing, ME; Christopher Michael Byrne, ECE; Christopher William Egan, ECE, 2015.
- [40] *Glovesense Data Glove*, Nathan William Joseph Wiegman, ECE,; Nathan Harrison Wells, ECE; Russell Hagan Hedlund, ECE,; and Mert Can Erad, ECE, 2015.
- [41] *Mobile Motion Capture*, Robert Patrick Dabrowski, ID; and Matthew Stephen Costi, ID, 2014.
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- [45] *Real Time Person Tracking and Identification using the Kinect sensor*, Nikolaos Matthiopoulos and Matthew Francis Fitzpatrick, 2013.
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- [48] *Improved Intelligence and Systems Integration for WPI's UGV – Prometheus*, Gregory Duncan McConnell, RBE; Samson Michael King, RBE; Craig Alan DeMello, RBE; Michael A. Rodriguez, RBE; and Eric J. Fitting, ID, 2012.

- [49] *Aeacus – development of a bio-inspired robotic platform for swarm-based multi-object transport over uneven terrain*, N. Anderson, D. Praetorius and C. Roddy, co-advised with S. Nestinger, 2011.
- [50] *Realization of Performance Advancements for WPI's UGV-Prometheus*, M. Akmanalp, R. Doherty, J. Gorges, P. Kalasuskas, E. Peterson and F. Polido, co-advised with T. Padir, S. Nestinger, M. Ciraldi, K. Stafford, 2011.
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- [24] *Public Safety Integration Center*, P. Lucia, I. Levin and M. Barone, WZM-1A08, 2008.
- [25] *Aircraft Lasercom Terminal Compact Optical Module*, B. Scoville and S. Rose, Lincoln Laboratory Project Center, WZM-2A08, 2008.
- [26] *PANSAT Triple Modular Redundant (TMR) Satellite Flight Computer v3*, Kevin Zhang, ECE; and Karim G. Makram, ECE, 2006.
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- [42] *Ballistic Missile Defense Analysis Toolkit*, Winfield Peterson, Doug Tilkin and Benjamin Wilson, Lincoln Laboratories Project Center, 2002.
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- [44] WZM-MQP-1A00: *StrongArm-Based Computer System*, Bradford Snow, 2001.
- [45] WZM-MQP-1C01: *PC Controlled Laser Light Show Device*, Joel Smith, 2001.
- [46] WZM-MQP-1E00: *PIC-based MIDI Sequencer* Malcolm Beaulieu, 2001.
- [47] WZM-MQP-2A00: *Automotive PC Development Platform* Travis Pouliot and David Philips, 2001.
- [48] *The RoadCom Automotive Computing System*, Benjamin Kennedy and John Pong, 2000.
- [49] WZM-MQP-1A99: *Compressed Sample Wavetable Synthesizer*, Justin Brzozoski, 2000.
- [50] WZM-MQP-3499, *Automatically Equalizing Monitor*, Fernando Braghin, Tenzin Lama, Rahul Bhan and Dion Soetadi, 2000.
- [51] 99D163M: *Railroad Communication*, Benjamin Richards, 2000.
- [52] CS-MXC-IE00: *PIC Real-Time Sequencer*, Alexander Goodrich, 2000.
- [53] 99D514M: *Design of a Microphone Preamplifier*, Eric Reuter, 2000.
- [54] WZM-MQP-1A99, *MPEG Audio Deck*, Justin Brzozoski, 2000.
- [55] *Digital Image Enhancement*, Julie Bolduc, Wei Fu and Joseph Perry, 2000.
- [56] WZM-MQP-4A98, *Railroad Communications System*, Matthew Lug, 1999.
- [57] 99D078M: *Modular Effects Processor II*, Erik Neyland, 1999.

- [58] 99D176M: *Portable Digital Audio Recorder* Eric Toledo and Duc Truong, 1999.
- [59] EE-WZM-1A97, *C Sound Synthesizer*, Ross E. Borgeson, Michael W. Hamel and Matthew S. Walsh, 1998.
- [60] EE-WZM-4A97, *Firewire Audio Device*, Daniel R. Stutzbach, 1998.
- [61] EE-WZM-2A97, *Modular Effects Processor*, Michael J. Dellisanti, 1998.
- [62] EE-WZM-3A97, *GPS Personal Navigation*, Jeffery A. Alderson and Helder Machado, 1998.
- [63] HU-FB-CS01, *C Sound Synthesizer*, Peter W. DeBonte (co-advised).
- [64] EE-WZM-1E97, *PM Measurement System*, Yevgeniy Bogdanov.
- [65] EE-REL-C008, *Design and Development of a Microprocessor-Based Gaussmeter*, David M. Burnham.
- [66] EE-WZM-RC01, *Acoustic Guitar Amplifier*, Christopher Thomas.
- [67] EE-WZM-GSD1, *Guitar Sustaining Device*, Paul D'Ambra.
- [68] EE-RXV-5260, *Audio Feedback Elimination System*, Ross D. Pease and John R. Pelliccio.
- [69] EE-RJD-M963, *Embedded Systems Design*, Christopher A. Briggs and Anthony J. Viapiano.
- [70] EE-WHE-9601, *GPS Hazard Detector*, Michael Roberts, William Cidela, and Chris Mangiarelli.
- [71] EE-WZM-2C96, *Flexible Synthesis*, Noah T. Vawter and Luke Demoracski.
- [72] EE-WZM-1A96, *Tap Dancer MIDI Interface*, Thomas Trela and William Dowell.
- [73] EE-WZM-2A96, *GPS Hazard Detector II*, Will Brothers, Jon Day, and John Zaghi.
- [74] EE-WZM-3A96, *Loudspeaker Data Acquisition System*, Adam Gross.
- [75] EE-WZM-4A96, *Audio Morphing Processor*, William Butterfield and Ted Phipps.
- [76] EE-WZM-5A96, *Acoustic Modeling*, Peter DeBonte.
- [77] EE-WZM-1B96, *Distributed Audio Controller*, Stephen S. Richardson.
- [78] EE-WZM-1A95, *Acoustic Hazard Meter*, Ronald D. Slack.
- [79] EE-WZM-2A95, *Forest Service DGPS*, Joshua J. Single and Michael T. Spadazzi.
- [80] EE-WZM-1C95, *Audio to MIDI Converter*, Jennifer R. Principe.
- [81] EE-WZM-1D95, *Low Cost Auralizer*, Jason R. Hills and Mark R. Paulson.
- [82] EE-WZM-3A95, *Passive Radiator Design*, Kevin R. Weldon.
- [83] EE-WZM-1C94, *Char Model Generation*, Colin J. Florendo.
- [84] EE-WZM-1D94, *Wide Area DGPS Simulator*, Daniel Cohen and Robert Schroter.
- [85] EE-WZM-2D94, *Digital Soundcard*, Timothy Alsberg (Russian Project Center).

- [86] EE-WZM-3D94, *Digital Univibe*, Andrew Willis and Daniel Toohey.
- [87] EE-WZM-1A94, *DSP Based Real-Time Audio Feedback Eliminator*, Kevin M. Eddy.
- [88] EE-WZM-2A94, *Digital LCD Oscilloscope*, William F. Brown and John F. Ebersole.
- [89] 93D236M, *MIDI Mapper*, Jonathan Kemble and Brian Candiloro.
- [90] EE-WZM-1C93, *Fault-Tolerant Computer*, Frederick N. Parmenter.
- [91] EE-WZM-1A93, *Wireless MIDI Controller*, Sanjay Raja, Charles Cimalore, Ty Panagoplos.
- [92] EE-WZM-2A93, *Multiple Pitch Detector*, Jeanne A. Sawtelle.
- [93] EE-WZM-3A93, *Multiprocessor Cache Coherence*, Lauren C. Lind and Norman E. Rhodes.
- [94] EE-WZM-1C92, *A Simulation of the DLX Architecture*, Lisa Harlow.
- [95] EE-WZM-2C92, *A New Microprocessor Development System*, Gregory B. Burlingame, David J. Fortin, Kevin S. Pearson.
- [96] EE-WZM-1A92, *Digital Audio Sampler*, Roger D. Gagnon and James M. Lach.
- [97] EE-WZM-2A92, *Intelligent Harmonizer*, Prabhjot S. Anand and Aftab M. Yusuf.
- [98] EE-WZM-3A92, *Computerized Audio Mixer*, Richard J. Wood.
- [99] EE-WZM-1B92, *Real-Time Harmonizer*, Mohiuddin M. Kahn.
- [100] EE-WZM-1A91, *Residue Number System Processor*, Ravdeep S. Anand and Christine A. Easton.
- [101] EE-WZM-2A91, *SCSI Bus Analyzer*, Brian Costello, George Delouriero, Matthew Maguire, and Keith Nevins.

4.3 Interactive Qualifying Projects (completed)

- [1] *Bell Towers*, Bowman, I.H., Casciola, I.O., Adiletta, M.J., Bruneau, C.D., WPI Venice Project Center, advised by W. Michalson and F. Carrera, 2019.
- [2] *Creating a Circular Economy with Urban Farming*, Ward, B.L., Cyran, B., Premo, J., Soens, N., WPI Venice Project Center, advised by W. Michalson and F. Carrera, 2019.
- [3] *Plastic-Free Venice*, S.L. Bonanno, V.C.Nguyen, A.H. Hagedorn, T.S. Howlett, WPI Venice Project Center, advised by W. Michalson and F. Carrera, 2019.
- [4] *30th Anniversary Exhibit*, N. Bajakian, J. Wong, J. DeDonato, and N. Stallings, WPI Venice Project Center, advised by W. Michalson and F. Carrera, 2019.
- [5] *Venice Crowdfunding*, T. Ferrara, F de Leo, M. Bernardo and S. O'Connell, WPI Venice Project Center, advised by W. Michalson and F. Carrera, 2019.
- [6] *Visitor Experiences in Venice*, T. King, C. Anderson, M. Laks, and C. Hoey, WPI Venice Project Center, advised by W. Michalson and F. Carrera, 2019.

- [7] *Venice From Above: Preserving Venetian Bell Towers*, Iuliano, C.T., Kavassalis, F.I., Colucci, N.D., Lessard, P., WPI Venice Project Center, advised by W. Michalson and F. Carrera, 2018.
- [8] *Celebrating 30 Years of the Venice Project Center*, Ellis, E.J., Morton, K.J., Carpinì, N.A.D., Hale, S.A., WPI Venice Project Center, advised by W. Michalson and F. Carrera, 2018.
- [9] *PreserVenice Launch: A Crowdfunding Solution to Preserving Venetian Heritage*, Hetherington, B.F., Berardi, D., Thompson, K.R., Joy, S.P., WPI Venice Project Center, advised by W. Michalson and F. Carrera, 2018.
- [10] *Tech Mecca in Giudecca*, McMahon, A.J., Hiscox, C.A., Maida, P.J., Lee, R.T., WPI Venice Project Center, advised by W. Michalson and F. Carrera, 2018.
- [11] *Exploring Urban Permaculture: Initializing a Path to a Greener Venice*, Jordan, A.S., O'Driscoll, K.J., Manca, R. A., WPI Venice Project Center, advised by W. Michalson and F. Carrera, 2018.
- [12] *Open For Business: Analyzing Venetian Storefronts*, Bartone, J.R., Scales, K.J., Racca, S.R., Chen, Y., WPI Venice Project Center, advised by W. Michalson and F. Carrera, 2018.
- [13] *Venice Without Obstacles*, DeRusha, A.C., Abenante, E.R., DiStefano, M.S., Jones, S.A., WPI Venice Project Center, advised by W. Michalson and F. Carrera, 2018.
- [14] *Documenting and Promoting the Impacts of the Melbourne Project Center*, Seely, C.A., Day, J.L., Cochran, I.L., and Carlson, K.A.M., WPI Melbourne Project Center, advised by S. McCauley and W. Michalson, 2017.
- [15] *Students' Mental Wellbeing in Universities Located in Melbourne*, Isaro, A., WPI Melbourne Project Center, advised by S. McCauley and W. Michalson, 2017.
- [16] *I See a Psychologist -- Reducing Stigma through Normalizing Mental Health Care in Australia*, Vayas, NN., Daci, E.G., and Bianco, C.E., WPI Melbourne Project Center, advised by S. McCauley and W. Michalson, 2017.
- [17] *Improving Web Presence and Stakeholder Interaction for the Emergency Services Foundation*, Savage, H.A, Sanchy, M.T., Capozzi, R. and Babel, B.M., WPI Melbourne Project Center, advised by S. McCauley and W. Michalson, 2017.
- [18] *Understanding Visitor Experiences at the Pauline Gandel Children's Gallery*, Nigro, J.T., France, G.T., Coppolino, J.R. and Blakslee, B.S., WPI Melbourne Project Center, advised by S. McCauley and W. Michalson, 2017.
- [19] *A Citizen Science Platform for Long-Term Monitoring of Microplastic Pollution in Port Phillip Bay*, Bayas, A.C., Buckley, M.J., Ford, C.K. and Lawes, J.A., WPI Melbourne Project Center, advised by S. McCauley and W. Michalson, 2017.
- [20] *A Comprehensive Methodology for Assessing the Quality of Solar Photovoltaic Systems*, Arthur, D.P., Hoey, C.J., Laffer, T. and Westgate, B., WPI Melbourne Project Center, advised by S. McCauley and W. Michalson, 2017.
- [21] *High Efficiency Power Inverter*, Grzegorz J. Klos and Robert Hall, 2015.

- [22] *An Analysis and comparison of affordable and ecological short-term transportation energy solutions*, Bryan Thomas Gleason, 2009.
- [23] *Lens and Lights Operational Overview*, Andrew Thomas Wilkins, ECE; Matthew Houstle, ECE; and Anthony R. Azersky, CS, 2009.

4.4 Graduate Theses Advised and Co-Advised

4.4.1 MS Theses (current)

- [1] Pratik Jawahar, “High-Level Exogenous Fault Detection in Multi Robot Systems with Variational Autoencoders and Normalizing Flows,” MS Thesis, co-advisor, 2022.
- [2] Rohan Walia, “Formation-Centric Software Interface,” MS Thesis, co-advisor, 2022.

4.4.2 MS Theses (completed)

- [1] Nathaniel Michaels, “A Modular Robotic AFO for detecting phase changes during Walking Gait,” MS Thesis, co-advisor, 2020.
- [2] Hernandez, A. C., “Implementing and Comparing Image Convolution Methods on an FPGA at the Register-Transfer Level,” MS Thesis, co-advisor, 2019.
- [3] Katie Gandomi, “Implementation of a Modular Software Architecture on a Real-Time Operating System for Generic Control over MRI Compatible Surgical Robots,” MS Thesis, co-advisor, 2018.
- [4] Adhavan Jayabalan, “Decentralized Persistent Connectivity Deployment in Robot Swarm,” MS Thesis, co-advisor, 2018.
- [5] Janani Mohan, “Dynamic Task Allocation in Robot Swarms with Limited Buffer and Energy Constraints,” MS Thesis, co-advisor, 2018.
- [6] Rogers, J.P., GNSS and Inertial Fused Navigation Filter Simulation, MS Thesis, co-advisor, 2018.
- [7] Christopher Bove, “Constrained Motion Planning System for MRI-Guided, Needle-Based, Robotic Interventions,” MS Thesis, co-advisor, 2018.
- [8] Vyas, Shivang, “Feature detection in an indoor environment using Hardware Accelerators for time-efficient Monocular SLAM,” MS Thesis, primary advisor, Worcester Polytechnic Institute, 2015.
- [9] Morin, Russell, “A Novel Localization System For Experimental Autonomous Underwater Vehicles,” MS Thesis, co-advisor, Worcester Polytechnic Institute, 2010.
- [10] Navalekar, Abhijit, “Design of an OFDM-Based VHF Modem,” MS Thesis, primary advisor, Worcester Polytechnic Institute.
- [11] Ahlehagh, Hasti, “Techniques for Communications and Geolocation Using Wireless Ad Hoc Networks,” MS Thesis, primary advisor, Worcester Polytechnic Institute, 2004.
- [12] Sebastian, Dalys, “Development of a Field-Deployable Ultrasound Scanner System,” MS Thesis, co-advisor, Worcester Polytechnic Institute, 2004.

- [13] Tobgay, Sonam, "Novel Concepts for RF Surface Coils with Integrated Receivers," MS Thesis, co-advisor, Worcester Polytechnic Institute, 2004.
- [14] Breen, Daniel, "Characterization of Multi-Carrier Locator Performance," MS Thesis, co-advisor, 2004.
- [15] Aghogho, Obi, "A Novel Radio Frequency Coil Design for Breast Cancer Screening in a Magnetic Resonance Imaging System," MS Thesis, co-advisor, Worcester Polytechnic Institute, 2003.
- [16] Fei, Ming, "Electromagnetic Detection, Infrared Visualization and Image Processing Techniques for Non-Metallic Inclusions in Molten Aluminum," MS Thesis, co-advisor, 2002.
- [17] Lavoie, Bruce, "Design and Implementation of an N-Channel Self Calibrating Audio System," MS Thesis, primary advisor, Worcester Polytechnic Institute, 2000.
- [18] Bogdonov, Gene, "Theoretical and Practical Implementation of Electrical Impedance Material Inspection of Powder Metallurgy Compacts," MS Thesis, co-advisor, Worcester Polytechnic Institute, 1999.
- [19] Messier, Andrew, "Modeling the Effects of Terrain Masking on GPS Accuracy and Integrity," MS Thesis, primary advisor, Worcester Polytechnic Institute, 1998.
- [20] Antonescu, Bogdan, "Elliptic Curve Cryptosystems on Embedded Microprocessors," Bogdan Antonescu, MS Thesis, co-advisor, Worcester Polytechnic Institute, 1998.
- [21] Lai, Qiang, "Ground-Penetrating Radar Data Processing System," MS Thesis, co-advisor, Worcester Polytechnic Institute, 1998.
- [22] Soria-Rodríguez, Pedro, "Multicast-Based Interactive-Group Object-Replication For Fault Tolerance," MS Thesis, co-advisor, Worcester Polytechnic Institute, 1998.
- [23] Hoy, William, "Audio Signal Denoising Using Wavelets," MS Thesis, primary advisor, Worcester Polytechnic Institute, 1997.
- [24] Proгри, Ilir, "Harmonic Flow Monitoring by means of Global Positioning System," MS Thesis, primary advisor, Worcester Polytechnic Institute, 1997.
- [25] Bretchko, Pavel, "Pulsed Hysteresis Graph System," MS Thesis, co-advisor, Worcester Polytechnic Institute, 1997.
- [26] Repkin, Dmitry V., "A Hierarchical Neural Network Based Data Processing System for Ground Penetrating Radar," MS Thesis, co-advisor, Worcester Polytechnic Institute, 1997.
- [27] Metsis, Sophocles, "Design of a Real-Time Capable, Fault-Tolerant, Distributed System," MS Thesis, primary advisor, Worcester Polytechnic Institute, 1996.
- [28] Hill, Jonathan, "Efficient Implementation of Mesh Generation and FDTD Simulation of Electromagnetic Fields," MS Thesis, primary advisor, Worcester Polytechnic Institute, 1996.
- [29] Dunkelberg, John, "FEM Mesh Mapping to a SIMD Machine Using Genetic Algorithms," MS Thesis, co-advisor, Worcester Polytechnic Institute, 1996.

- [30] Leuenberger, Georg, "Design and Development of a Microprocessor Based Gauss Meter," MS Thesis, co-advisor, Worcester Polytechnic Institute, 1995.
- [31] Valentino, Ralph, "DISC: A Dynamic Instruction Set Coprocessor," MS Thesis, primary advisor, Worcester Polytechnic Institute, 1995.
- [32] Muley, Aalok, "A Fault Tolerant Network for a Real-Time Environment," MS Thesis, primary advisor, Worcester Polytechnic Institute, 1994.
- [33] Mohan, Surrender, "Automatic Surface Mesh Generation for 3D Solid Models Using Delaunay Algorithm," MS Thesis, co-advisor, Worcester Polytechnic Institute, 1994.
- [34] Petrangelo, John, "Experimental Preconditioners for Large Dense Systems," MS Thesis, co-advisor, Worcester Polytechnic Institute, 1994.
- [35] Schneider, Eric, "Design, Simulation, and Analysis of a 3D Integrated Optical Computer," MS Thesis, primary advisor, Worcester Polytechnic Institute, 1993.
- [36] Palmer, Bradley, "A Comparison of Three Protocols Supporting Time-Dependent and Time-Independent Communications," MS Thesis, primary advisor, Worcester Polytechnic Institute, 1992.
- [37] Clayton, Shawn, "An Analysis of the Real-Time Behavior of Galactica Net," MS Thesis, primary advisor, Worcester Polytechnic Institute, 1992.
- [38] Levergood, Thomas, "An Experimental Evaluation of Split User/Supervisor Cache Memories," MS Thesis, primary advisor, Worcester Polytechnic Institute, 1992.
- [39] Lavalee, James, "The Design and Development of Real-Time Systems Using Ada and the Activation Framework," MS Thesis, co-advisor, Worcester Polytechnic Institute, 1992.
- [40] Velazques, Javier, "The Development of a Real-Time Environment Using the Activation Framework," MS Thesis, co-advisor, Worcester Polytechnic Institute, 1992.

4.4.3 Ph. D. Dissertations (current)

- [1] Vincenzo Diluoffo, "Security in the Robot Operating System Version 2 (ROS 2) Environment," primary advisor.
- [2] Jitesh, "Ad-Hoc Networking for Bandwidth Limited LMR Systems," primary advisor.

4.4.4 Ph. D. Dissertations (completed)

- [1] Carvalho, P. A., "Advancing Technologies for Interventional MRI Robotics with Clinical Applications," 2019.
- [2] Ferreira, PVR "SRML: Space Radio Machine Learning," Ph.D. Dissertation, co-advisor, Worcester Polytechnic Institute, 2017.
- [3] Iyer, Vishwanath, "Broadband Impedance Matching of Antenna Radiators," Ph.D. Dissertation, co-advisor, Worcester Polytechnic Institute, 2010.
- [4] Navalekar, Abhijit, "Distributed Digital Radios For Land Mobile Radio Applications," Ph.D. Dissertation, primary advisor, Worcester Polytechnic Institute, 2009.

- [5] Parikh, Hemish, “Design of an OFDM Transmitter and Receiver for Precision Personnel Location,” primary advisor.
- [6] Proгри, Ilir, “An Assessment of Indoor Geolocation Systems,” Ph.D. Dissertation, primary advisor, Worcester Polytechnic Institute, 2003.
- [7] Li, Xinrong, “Super-Resolution TOA Estimation with Diversity Techniques for Indoor Applications,” Ph.D. Dissertation, co-advisor, Worcester Polytechnic Institute, 2003.
- [8] Leuenberger, Gerog H. W., “Electrostatic Density Measurements in Green-State PM Parts,” Ph.D. Dissertation, co-advisor, Worcester Polytechnic Institute, 2003.
- [9] Bogdanov, Gene, “Radio-Frequency Coil Design for High Field Magnetic Resonance Imaging,” Ph.D. Dissertation, co-advisor, Worcester Polytechnic Institute, 2002.
- [10] Elbirt, Adam J., “Reconfigurable Computing for Symmetric-Key Algorithms,” Ph.D. Dissertation, co-advisor, Worcester Polytechnic Institute, 2002.
- [11] Bretchko, Pavel, “Design and Development of Ultra-wideband DC-Coupled Amplifier,” Ph.D. Dissertation, co-advisor, Worcester Polytechnic Institute, 2001.
- [12] Hill, Jonathan, “Development of an Experimental Global Positioning System (GPS) Receiver Platform for Navigation Algorithm Evaluation,” Ph.D. Dissertation, primary advisor, 2001.
- [13] Spasojević, Mirko, “Creation of Sparse Boundary Element Matricies for 2-D and Axi-symmetric Electrostatic Problems Using a Bi-orthogonal Wavelet,” Ph.D. Dissertation, co-advisor, Worcester Polytechnic Institute, 1997.
- [14] Shi, Funan, “Optimal Designs of Gradient and RF Coils for Magnetic Resonance Imaging (MRI) Instrument,” Ph.D. Dissertation, co-advisor, Worcester Polytechnic Institute, 1996.

5. Proposals and Funding:

5.1 Funding Received

\$300,000	MRI: Development of an autonomous, Connected and Data-Driven Vehicle for Multi-Disciplinary Research, Co-PI, 09/13/16.
\$200,000	Advanced Bayesian Methods for Autonomous Navigation, Co-PI, 07/25/11.
\$50,524	PCOG Broadband Modem, PI, \$50,524, 05/15/09.
\$839,000	Real-Time Troop Physiological Status Monitoring System, Co-PI, 09/06/07.
\$83,726	State Communications Interoperability, PI, 07/18/07.
\$224,822	MANET Protocols for Capacity-Limited Channels, PI, 03/08/07.
\$44,366	TATRC: Wireless Sensor Communications, Co-PI, 12/20/06.
\$95,000	Real-Time Troop Physiological Status Monitoring System, Co-PI, 02/13/06.
\$3,225,000	Real-Time Troop Physiological Status Monitoring System, Co-PI, 12/19/05.
\$1,973,286	Precision Indoor/Outdoor Personnel Locator, Co-PI, 09/23/05.

\$25,000	Sensor-on-a-Chip for Electrophysiological Monitoring, Co-PI, 08/08/05.
\$1,245,000	Real-Time Troop Physiological Status Monitoring System, Co-PI, 12/23/04.
\$1,370	WPI-NanoSAT Program, Co-PI, 11/03/04.
\$37,408	Precision Indoor/Outdoor Personnel Locator, Co-PI, 10/05/04.
\$74,048	Real-Time Troop Physiological Status Monitoring System, PI, 09/15/04.
\$813,141	Real-Time Troop Physiological Status Monitoring System, PI, 12/08/03.
\$255,496	Precision Indoor/Outdoor Personnel Locator, Co-PI, 10/31/03.
\$3,246	WPI-NanoSAT Program, Co-PI, 10/20/03.
\$2,789	WPI-NanoSAT Program, Co-PI, 03/06/03.
\$827,000	Real-Time Troop Physiological Status Monitoring System, PI, 11/22/02.
\$14,866	Norfolk County Sheriff's Office Data Mining, Co-PI, 02/01/02.
\$54,483	Auto-calibrating surround sound system, PI, 2001.
\$11,252	Auto-calibrating surround sound system, PI, 2000.
\$18,977	GPS-Based Attitude Determination System, PI, 07/1998.
\$70,000	Development of an Electric Resistivity Instrument for the Testing of Green-State P/M Compacts, Co-PI, 01/1997.
\$10,550	GPS Hazard Detection, Co-PI, 1996.
\$200,000	Integrity for the Global Positioning System - Supplemental Funding I, Co-PI, 1995.
\$3,000	GPS-Based Tracking of Forest Vehicles, PI, 1995.
\$7,200	Acoustic Identification of Mosquito Species, Co-PI, 1995.
\$9,978	Acoustic Identification of Mosquito Species, Co-PI, 1995.
\$11,527	Laboratory Equipment for Microkernel Based Embedded Systems, Co-PI, 1995.
\$74,388	RF Circuit and Antenna Modeling on High Performance Computers, Co-PI, 1994.
\$199,075	Integrity for the Global Positioning system, PI, 1994.
\$326,336	3D Modeling of Microwave Antennas on High-Performance Parallel Computers, Co-PI, 1993.
\$338, 687	Integrity for the Global Positioning system, Co-PI, 1993.

6. Honors, Awards, and Recognitions:

Elected Senior Member of the IEEE.

Joseph Samuel Satin Distinguished Fellowship awarded for the 1994-1995 academic year.

Aldo Miccioli Fellowship recipient from Raytheon Equipment Division.

ION Best Paper Award - GPS-96 for W. R. Michalson, W. Cidela, et. al., “A GPS-Based Hazard Detection and Warning System,” in review, " *ION GPS-96, 9th International Meeting of the Satellite Division of the Institute of Navigation*, pp. 167-175, Kansas City, MO, Sep 17-20, 1996

2nd Place - 2004 ECE Department MQP Award / Provost’s MQP Award for *GPS-Based Orbit and Attitude Determination System for PANSAT*, Joshua Holwell, Andrew Coonradt and Himanshu Agrawal.

1st Place - 2003 ECE Department MQP Award / Provost’s MQP Award for *Personal Inertial Navigation System*, Jason DeChiaro and Chris Struus.

1st Place - 2002 ECE Department MQP Award / Provost’s MQP Award for *Handspring Digital Voltmeter*, Andrew Young and Pavel Loven.

3rd Place - 1998 ECE Department MQP Award / Provost’s MQP Award for *Design of a Personal Handheld GPS Receiver*, Jeffery Alderson and Helder Machado.

2nd Place - 1997 ECE Department MQP Award / Provost’s MQP Award for *Distributed Audio Controller*, EE-WZM-1B96, Stephen S. Richardson.

3rd Place - 1997 ECE Department MQP Award / Provost’s MQP Award for *GPS Hazard Detector II*, EE-WZM-2A96, Will Brothers, Jon Day, and John Zaghi.

1st Place - 1996 ECE Department MQP Award / Provost’s MQP Award for *GPS Hazard Detector*, EE-WHE-9601, Michael Roberts, William Cidela, and Chris Mangiarelli.

6.1 Memberships and offices held in professional society

- Institute of Electrical and Electronic Engineers, Senior Member
- Institute of Navigation
- Royal Institute of Navigation
- American Society of Engineering Educators
- National Academy of Inventors
- Society of Automotive Engineers

6.2 Professional Service

Massachusetts Board of Bar Overseers Hearing Committee Member, 2010-Present.

Steering Committee – 2009 First Annual Robotics Innovations Competition and Conference (RICC '09), Nov 7-8, Worcester, MA, 2009.

Conference Technical Co-Chair – 2009 IEEE International Conference on Technologies of Practical Robot Applications (TePRA 2009), Nov. 9-11, Woburn, MA, 2009.

Reviewer – Proposal number CRDPJ 379622-08, Natural Sciences and Engineering Research Council of Canada (NSERC), Mar. 2009

Co-Chair – Urban and Indoor Geolocation, Institute of Navigation International Technical Meeting (ITM2009), Anaheim CA, Jan. 2009.

Reviewer – Proposal number CRDPJ 379622-08, Natural Sciences and Engineering Research Council of Canada (NSERC), Mar. 2009