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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

UNIFIED PATENTS INC.
Petitioner

v.

COLLISION AVOIDANCE TECHNOLOGIES INC.
Patent Owner

IPR2017-01355
Patent 6,268,803

DECLARATION OF MYLES H. KITCHEN

US PATENT 6,268,803 – CLAIMS 21, 22, AND 24-28

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I, Myles H. Kitchen, declare as follows:

I. INTRODUCTION

1. I have been retained by Unified Patents Inc. ("Unified" or "Petitioner") as an independent expert consultant in this proceeding before the United States Patent and Trademark Office.

2. I understand that this proceeding involves US Patent No. 6,268,803 to Richard A. Gunderson (the "'803 patent"), (attached as EX1001 to Unified's petition). I have reviewed the specification, file history and claims of the '803 patent.

3. I understand that the application for the '803 patent was filed on August 6, 1998. I also understand that the '803 patent is currently assigned to Collision Avoidance Technologies Inc.

4. I have been asked to consider whether certain references disclose or suggest the features recited in the claims of the '803 patent.

5. I have also been asked to consider the state of the art and the prior art available as of August 6, 1998. In particular, I have been asked to consider the collision avoidance related aspects in the '803 patent and compare those to the prior art available as of August 6, 1998. My opinions are provided below.

6. I have reviewed and understand US Patent 5,654,715 ("Hayashikura") (EX1002).

7. I have reviewed and understand the certified English translation of Japanese Patent Publication JPH07-092265 ("JP '265") (EX1004).

8. I have reviewed and understand US Patent 5,235,315 ("Cherry") (EX1005).

9. I have been retained by Petitioner Unified Patents Inc. as an expert in the field of vehicle systems, and more particularly, sensor systems for vehicles.

10. I am being compensated at my normal consulting rate for my work. My compensation is not dependent on and in no way affects the substance of my statements in this declaration.

11. To the best of my knowledge, I have no financial interest in Petitioner. Petitioner's counsel has informed me that Collision Avoidance Technologies Inc. ("CAT") purports to own the '803 patent. To the best of my knowledge, I have no financial interest in CAT, and I have had no contact with CAT. To the best of my knowledge, I similarly have no financial interest in the '803 patent. To the extent any mutual funds or other investments I own have a financial interest in the Petitioner, Unified Patents Inc., or the '803 patent, I do not knowingly have any financial interest that would affect or bias my judgment.

II. QUALIFICATIONS

12. Since 1986 I am sole proprietor of a consulting practice that specializes in Automotive Electronics related matters. The facts contained herein

are within my personal knowledge and experience. I have over forty four (44) years of technical experience in the automotive electronics field, including design, development, manufacturing, testing, and analysis of electrical/electronic circuits, on-board vehicle electronic systems, and electro-mechanical components, as used in all facets of vehicle electronics, including specifically, cruise controls (including adaptive cruise controls and their proximity sensors), instrumentation/displays, logic systems, engine/fuel/throttle controls, airbag/occupant restraint systems, and more.

13. I first earned an Associate Degree in Electronic Engineering Technology from the University of Cincinnati in 1971, and a Bachelor of Science in Electrical Engineering from the University of Kentucky in 1973. In addition, I have completed additional courses in pursuit of a Master of Science in Electrical Engineering at the University of Kentucky (1973), and courses in pursuit of a Masters of Business Administration at Northern Illinois University (1974/1975).

14. In 1973, I began working as a Product Development Engineer and later as Technical Product Marketing Manager in the Automotive Products Division of Motorola, Inc. in Schaumburg, Illinois (now acquired by Continental AG) from 1973 to 1978. While at Motorola, I was involved in the design of electronic ignitions, fuel management systems, engine control systems, electronic

service test equipment, and automotive sensors for customers such as Ford, Magneti Marelli, GM, and the aftermarket.

15. In 1978 I moved to Silicon Valley where I became Director of Automotive Marketing and Strategic Marketing Manager for Automotive at National Semiconductor Corp. in Santa Clara, California. At National my job involved understanding the technical requirements of automotive electronic systems, and then translating that understanding into new semiconductor products and business opportunities for the company's then 13 different and distinct product lines of electronic semiconductor components used in such automotive systems. National Semiconductor has now been acquired by Texas Instruments.

16. From 1980 to 1981, I was recruited and hired by Intel Corporation, also in Santa Clara, and served as their Automotive Strategic Development Manager/Automotive Marketing Manager. During this time, I worked closely with Intel's semiconductor engineers on the development of a custom Intel/Ford EECIV/8061 custom engine control microprocessor chip development, and other OEM customer development projects with customers such as Delco Electronics, Magneti Marelli, and others, primarily involving Intel's microprocessors, microcontrollers, and memory chips as used in advanced automotive electronic systems.

17. From 1981 to 1986, I joined Bay Area automotive electronics startup, Zemco Group Inc., and served as Director of Product Development, and later also as Vice President of Sales/Marketing. Zemco Group, Inc. was based in San Ramon, California as a designer of automotive electronic systems that it manufactured at its plant in Taiwan (later acquired by LITEON Technology Corporation of Taiwan). At Zemco, I was responsible for the design, development and sales of products such as OEM and Aftermarket cruise controls, trip computers, security systems, remote keyless entry systems, lighting controls, instrumentation products, electronic compasses, and other electronic devices. During this time, I was directly involved with OEM automotive customers, including Chrysler, GM, Ford, Nissan, and Toyota. During my tenure at Zemco, I directly oversaw a research and development project involving Adaptive Cruise Controls and object detection sensors (see more below).

18. In 1986, I founded M.H. Kitchen consulting as a sole proprietor consulting practice, focused primarily on transportation/automotive electronics, and have served as the owner and principal consultant for this consulting practice now headquartered in Aptos, California. My client base has included a wide range of companies, from start-ups to Fortune 100 firms globally, the majority of which have been involved with Automotive Electronics systems, and related components, and software/firmware. I have worked on numerous projects involving nearly

every aspect of automotive electronics systems and components. This has included providing such services as contract engineering services, design review and analysis, forensic analysis and expert testimony for civil and criminal matters, consulting on intellectual property matters, performing due diligence, market research, and business analysis and strategy.

19. Since 1973, I am now a lifetime member of the Society of Automotive Engineers. In 2003, I served as a member the SAE Tire Pressure Monitoring Technical Committee which drafted SAE J2657, a standard for Tire Pressure Monitoring Systems, and in 2016 I have served on the SAE J3061 Technical Committee drafting standards and practices for Automotive Cybersecurity assurance and testing practices.

20. In addition to the information above, I have been a "hands-on" automotive enthusiast since childhood. Since 1966, I have personally restored and rebuilt several vehicles, and perform a substantial portion of my own automotive repair. I am a graduate of the Jim Russell British School of Motor Racing, a three-time graduate of the Bob Bondurant Racing School, and have been enlisted on various occasions as an on-track performance driving instructor for the Ferrari Club of America, the Shelby American Automobile Club, and Classic Sports Racing Group.

21. During my tenure at Zemco Group in the mid to late 1980's as described above, I directly directed a research and development engineering project for an Adaptive Cruise Control system involving object sensing technologies. Zemco was a pioneer in the design, manufacture and sale of cruise control products for both OEM and Aftermarket sale with advanced electronic features. Prior to that, many cruise controls were electromechanical devices only. Zemco created a development project for the specific purpose of research and development of a cruise control with sensors to adjust a vehicle's speed according to the flow of traffic, a product which is now commonly referred to as an Adaptive Cruise Control, and is a predecessor to more complex systems that are now being used to implement Autonomous Driving. During this activity I, along with Zemco's engineers, investigated appropriate sensor technology solutions that included ultrasonic sensing, infrared laser sensing, and radar sensing as solutions for such a device. I researched prior work done in this area, and actively stayed abreast of developments occurring in this vein. During this period, we built and evaluated bench test and vehicle installed prototypes using these various sensing techniques and made determinations about the suitability of these devices for the sensing of objects imipacting vehicle operation. From this experience, my team and I arrived at a number of conclusions from this work which pre-dated the introduction of such Adaptive Cruise Controls commercially. Among them, that

these individual sensing technologies had various pros and cons for such an application, and that using multiple sensing technologies for specific applications and purposes could be beneficial. Further, that of the sensing technology choices mentioned, radar sensing offered the best results at that time for detecting objects in a vehicle's path at appropriate range values for highway speeds and conditions, and that using multiple sensors for a given application's specific requirements showed merit.

22. Additional detailed information regarding my background, experience, and professional qualifications may be found in the attached Curriculum Vitae.

III. TECHNOLOGY BACKGROUND

23. Systems that monitor vehicle surroundings generally determine where an object within the surroundings is located. Such systems make vehicle drivers aware of obstacles they otherwise may not see or notice. For example, when a driver operates his vehicle, a monitoring system may detect an obstacle that is not within the driver's line of sight and alert the driver. Monitoring systems may also alert a driver when his vehicle is too close to an object.

24. Monitoring systems may utilize one or more sensors to make determinations regarding objects. For example, monitoring systems may transmit a signal into the surroundings, and one or more sensors may record reflected

portions of the transmitted signal. Using the reflected portions, the object can be detected. Such sensors may be radar, sonar, ultrasonic, infrared, or microwave sensors, for example.

25. Well before the filing date of the ’803 patent, multiple types of systems that monitor vehicle surroundings were developed. For example, US Patent 5,574,426 (“*Shisgal*”) (EX1007), which issued in 1996, disclosed an obstacle detection system for guiding and warning a motorist of obstacles in a detection area while backing up. (*Id.* at Abstract (EX1007)). Even earlier, US Patent 4,240,152 (“*Duncan*”) (EX1008), which issued in 1980, disclosed a system for locating and determining a distance to an object with respect to a movable vehicle, and scanning an area transversed to the back of a truck for objects. (*Id.* at Abstract, 4:38-40 (EX1008)).

IV. OVERVIEW OF THE ’803 PATENT

26. The ’803 patent concedes that “[s]ystems for making drivers aware of objects external to their vehicle have been around for a long time.” (’803 patent at 1:19-21 (EX1001)). The Background section describes that several companies have developed systems that use “sensors to locate objects external to the vehicle.” (*Id.* at 1:54-55 (EX1001)). For example, the Background discusses a sensor system in the market that includes “ultrasonic sensors mounted on the back and sides of the vehicle…[where] each ultrasonic sensor continuously monitors a

defined detection zone for objects moving within the zone. When a vehicle enters the detection zone, the sensor measures the time between sending the sound wave and receiving its reflection and sends that measurement to the cab." (*Id.* at 1:58-65 (EX1001)).

27. The '803 patent alleges that its disclosure relates to a "collision avoidance system" that overcomes various deficiencies of the prior art. (*Id*. at Abstract, 2:44-45 (EX1001)). Figure 1, illustrated below, shows a collision avoidance system 10 according to the '803 patent.

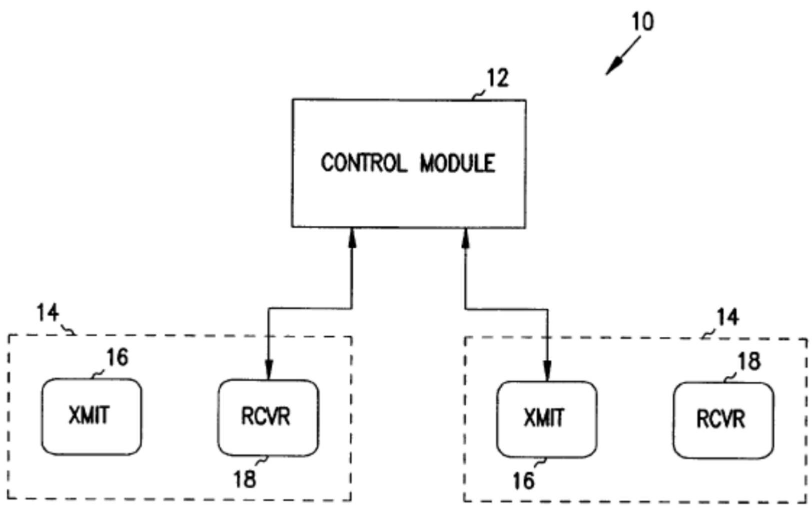


FIG. 1

Collision avoidance system 10 includes a control module 12 that is connected to sensors 14. (*Id.* at 3:36-38 (EX1001)). Each sensor 14 includes a transmitter 16 and a receiver 18. (*Id.* at 3:38-39 (EX1001)). One of ordinary skill in the art would have understood that a sensor including a transmitter and a receiver is a transceiver (*e.g.*, a device that acts both as a transmitter and receiver).

28. Transmitters 16 and receivers 18 may be transducers. ('803 patent at 14:44 (EX1001)). For example, transmitter 16 can be a transmitting transducer that sends sound energy into an environment. (*Id.* at 14:47-48 (EX1001)). The sound energy bounces off an object and is received by receiver 18, which is a receiving transducer. (*Id.* at 14:49 (EX1001)). The '803 patent states that in acoustic applications of the system, "distance [to the object] is then calculated as a function of time of return." (*Id.* at 14:50-51 (EX1001)).

29. The calculated distance, as well as a location of the object, is displayed by an operator interface unit 32. (*Id.* at 4:45-46, Figs. 4a-4c (EX1001)). An example operator interface unit 32 as shown in Figure 4a is illustrated below.

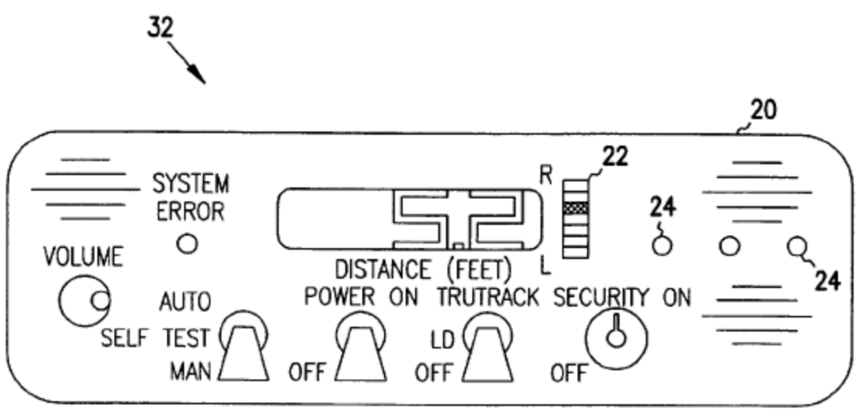


FIG. 4a

30. The '803 patent describes that the bar graph 22 of the interface may display a "transverse" location of the object. (*Id.* at 4:40-42, 46; 5:59-63

(EX1001)). Independent claims 1, 5, and 10 each reflect this "transverse" aspect of the '803 patent. For example, claims 1 and 10 recite that "measurement circuitry [is] used to…calculate a transverse location of an object" and that a "display means" is used to display the "transverse location." (*Id*. at 17:28-32; 18:49-51 (EX1001)). Claim 5 recites a method that calculates and displays a "transverse location." (*Id*. at 17:57-60 (EX1001)). Independent claim 9 reflects the "perpendicular distance" aspect described by the '803 patent, reciting a method that determines a "perpendicular distance" and a "distance…as a function of…the perpendicular distance." (*Id*. at 18:24-29 (EX1001)).

31. The system recited by the challenged independent claim 21, however, does not specify the "transverse" or "perpendicular" aspects of the '803 patent. In particular, independent claim 21 recites:

> "wherein the control module measures the return signals, detects an object as a function of the return signals, calculates a *distance to* and *location of* the object and displays the *distance to* and the *location of* the object."

(*Id.* at 20:11-14 (emphases added) (EX1001)). Unlike independent claims 1, 5, 9, and 10, independent claim 21 does not specify that its claimed "distance" is a *perpendicular distance*, or that its claimed "location" is a *transverse location*. Additionally, dependent claim 25 narrows claim 21 by reciting that the claimed system "determines whether it can *triangulate* and calculates an *actual* *perpendicular distance* to the object and *location* of the object with respect to the vehicle." (*Id.* at 20:27-30 (emphases added) (EX1001)). Therefore, one of ordinary skill in the art would have understood that claim 21 does not require the "transverse" or "perpendicular" aspects described by the '803 patent.

32. As the cited references demonstrate, the system recited by challenged claims 21, 22, and 24-28 was well known in the prior art before the time of the alleged invention. At least the primary references Hayashikura (EX1002) and *JP '265* (EX1004) and the combinations discussed herein show that claims 21, 22, and 24-28 are unpatentable.

A. Level of Ordinary Skill in the Art

33. In my opinion, a person having ordinary skill in the art for the '803 patent at the time of the invention would have a B.S. degree in Electrical Engineering, or an equivalent field as well as at least 2-3 years of academic or industry experience in automotive electronics, including control systems and sensors.

B. Understanding of the Law

34. I am not an attorney. For the purposes of this declaration, Petitioner's counsel has informed me about certain aspects of the law that are relevant to my opinions.

35. Petitioner's counsel have informed me that a patent claim may be "anticipated" if each element of that claim is present either explicitly or inherently in a single prior art reference. Petitioner's counsel have informed me that to be inherently present, the prior art reference must necessarily disclose the limitation, and the fact that the reference might possibly practice or contain a claimed limitation is insufficient to establish that the reference inherently teaches the limitation.

36. Petitioner's counsel have informed me that a patent claim can be considered to have been obvious to a person of ordinary skill in the art at the time the application was filed. This means that, even if all of the requirements of a claim are not found in a single prior art reference, the claim is not patentable if the differences between the subject matter in the prior art and the subject matter in the claim would have been obvious to a person of ordinary skill in the art at the time the application was filed.

37. Petitioner's counsel have informed me that a determination of whether a claim would have been obvious should be based upon several factors, including, among others:

- the level of ordinary skill in the art at the time the application was filed;
- the scope and content of the prior art;

- what differences, if any, existed between the claimed invention and the prior art.

38. Petitioner's counsel have informed me that a single reference can render a patent claim obvious if any differences between that reference and the claims would have been obvious to a person of ordinary skill in the art. Alternatively, the teachings of two or more references may be combined in the same way as disclosed in the claims, if such a combination would have been obvious to one having ordinary skill in the art. In determining whether a combination based on either a single reference or multiple references would have been obvious, it is appropriate to consider, among other factors:

- whether the teachings of the prior art references disclose known concepts combined in familiar ways, and when combined, would yield predictable results;
- whether a person of ordinary skill in the art could implement a predictable variation, and would see the benefit of doing so;
- whether the claimed elements represent one of a limited number of known design choices, and would have a reasonable expectation of success by those skilled in the art;
- whether a person of ordinary skill would have recognized a reason to combine known elements in the manner described in the claim;

- whether there is some teaching or suggestion in the prior art to make the modification or combination of elements claimed in the patent; and
- whether the innovation applies a known technique that had been used to improve a similar device or method in a similar way.

39. Petitioner's counsel have informed me that one of ordinary skill in the art has ordinary creativity, and is not an automaton. Petitioner's counsel have informed me that in considering obviousness, it is important not to determine obviousness using the benefit of hindsight derived from the patent being considered.

V. CLAIM CONSTRUCTION

40. I have been informed that claim terms of an unexpired patent in *inter partes* review are given the broadest reasonable construction in light of the specification. I have also been informed that under the broadest reasonable interpretation standard, claim terms are given their ordinary and customary meaning, as they would be understood by one of ordinary skill in the art, in the context of the disclosure.

41. I understand that Petitioner provided constructions for the terms "location" and "distance" recited in challenged claim 21, and for the term "fuses" recited in challenged claim 22. I agree with the proposed constructions.

A. "location"

42. Claim 21 recites that the claimed control module "displays the … *location* of the object" (emphasis added). The construction of the term "location" as a "positional relationship between the object and the vehicle" is consistent with the '803 patent. For example, Figure 6a of the '803 patent shows a display 129 that represents whether the object is on the "left" or "right" side of the vehicle. ('803 patent at 5:55–63 (EX1001)). An indication of whether the object is on the left or right side of the vehicle is an example of a positional relationship between the object and the vehicle. Thus, the proposed construction is consistent with the specification of the '803 patent, and with the ordinary use of the term "location."

B. "distance"

43. Claim 21 recites that the claimed control module "displays the *distance to … the object*." (emphasis added). The construction of the term "distance to … the object" as "a numerical description of how far the object is from the vehicle" is consistent with the '803 patent. While the '803 patent describes a "perpendicular distance," Patent Owner decided not to limit claim 21 to such "perpendicular distance," and instead recited "an actual perpendicular distance" in claim 25, which depends from claim 21. Claim 21 broadly recites only "a distance." Thus, the proposed construction is consistent with the

specification of the ’803 patent, and with the ordinary use of the term “distance to … the object.”

C. “fuses”

44. Claim 22 recites that the claimed control module “*fuses* data received from the plurality of sensors….” (emphasis added). The ’803 patent does not specifically define “fuses.” However, the ’803 patent indicates that “[t]he present invention relates generally to sensor-based systems, and more particularly to a multi-sensor collision avoidance system which *combines data* from two or more sensors to provide range, range rate, or location information.” (’803 patent at 1:6–9 (emphasis added) (EX1001)). The ’803 patent further discusses a “Data Fusion Algorithm” and states that the algorithm “uses a technique called Deepest Hole *to combine the data* from multiple sensor and Kinematic Combination to fuse this data together.” (*Id.* at 14:24–26 (emphasis added) (EX1001)). Thus, the proposed construction is consistent with the specification of the ’803 patent, and with the ordinary use of the term “fuses.”

VI. SUMMARY OF OPINIONS

A. Ground I: Claims 21, 22, and 26-28 are rendered obvious by Hayashikura

1. Overview of Hayashikura

45. Hayashikura is not of record in the ’803 patent. Hayashikura is directed to a monitoring system that surrounds a vehicle by using a plurality of

electromagnetic wave transmitter and receiver sections ("radar devices") provided along the periphery of the vehicle. (Hayashikura at 1:6–10 (EX1002)). The system has a 360° detection range around the vehicle, as show below in Figure 1. (*Id*. at 3:28–31 (EX1002)). Figure 2 of the '803 patent is also reproduced below to show the similarities with Hayashikura.

FIG.1

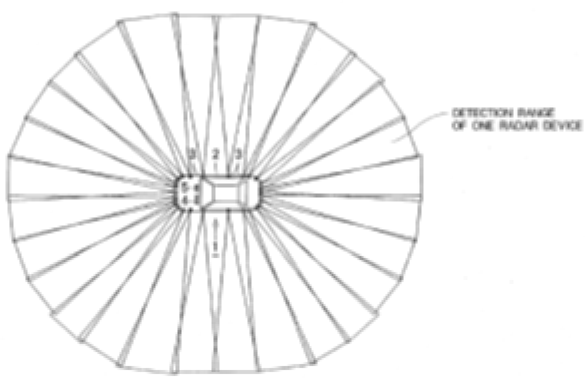


Figure 1 of Hayashikura

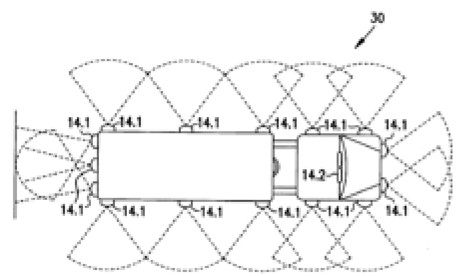
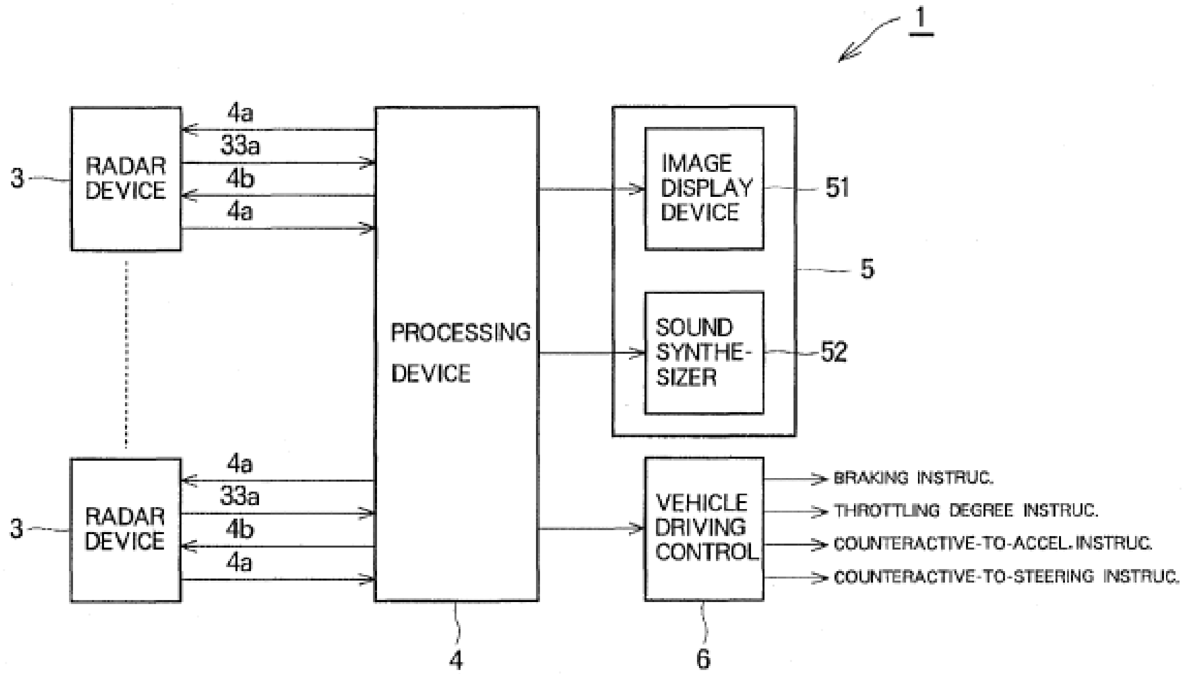


FIG. 2

Figure 2 of '803 patent

46. Figure 4 of Hayashikura is reproduced below to show the radar devices 3, processing device 4, and display section 5. (*Id*. at 3:24–28 (EX1002)). Radar devices 3 include a transmitter section 10 and a receiver section 20. (*Id*. at 3:36–39, Figure 2 (EX1002)). The display section includes an image display device 51 and a sound synthesizer 52. (*Id.* at 4:66–67 (EX1002)).

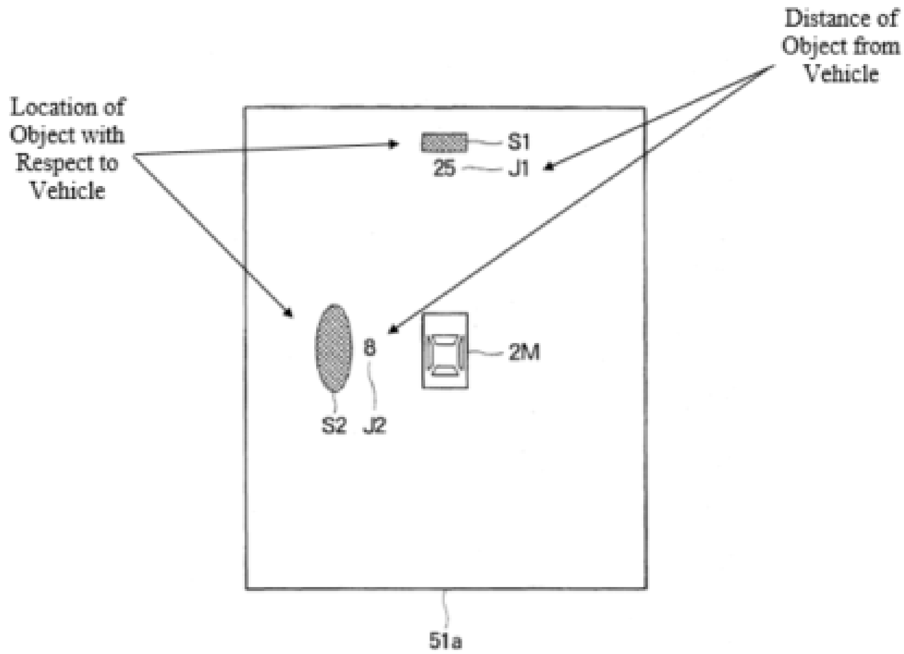
FIG.4



47. In use, the processing device 4 calculates and displays a distance to an object. (*Id*. at 4:42–45, Figure 5 (EX1002)). As shown below in annotated Figure 5, the processing device 4 also causes the display 51 to show locations of objects:

> "[A] mark 2M indicating the user's vehicle on a virtually middle portion of the display screen 51a, and also marks S1 and S2 indicative of the positions of detected obstacles along with the determined distances J1 and J2 to the obstacles."

Id. at 5:7–12.



Id. at Figure 5.

2. Claim 21 is obvious in view of Hayashikura

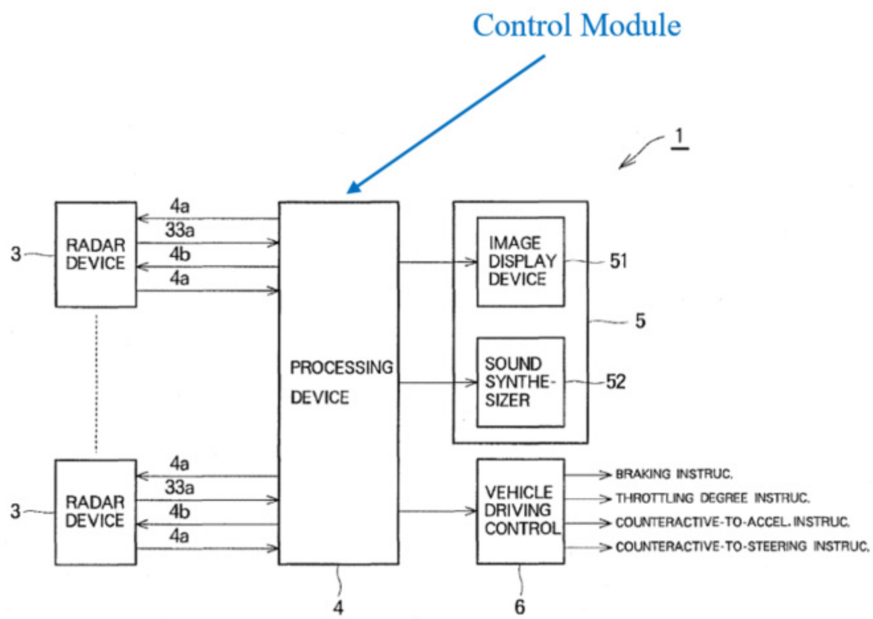
a) "A collision avoidance system, which provides object detection around the exterior of a vehicle, comprising:"

48. Hayashikura discloses a monitoring system that surrounds a vehicle by using a plurality of electromagnetic wave transmitter and receiver sections ("radar devices") provided along the periphery of the vehicle. (Hayashikura at 1:6–10 (EX1002)). Hayashikura discloses that its system provides object detection. For example, Hayashikura discloses that a wave is "radiated via the transmitting antenna 14 and reflected from *an object* is picked up by the receiving antenna 21…." (*Id*. at 4:3–8 (emphasis added); *see also* 1:6–14; 4:42–46; 6:14–19 (EX1002)). Thus, Hayashikura discloses a collision avoidance system, which

provides object detection around the exterior of a vehicle, as recited in the preamble of claim 21.

b) "a control module;"

49. Hayashikura discloses a control module in the form of a processing device as shown below in annotated Figure 4.



(Hayashikura at Fig. 4 (EX1002) (annotation added).

50. The processing device 4 provides various forms of control, including signal processing with respect to the radar devices, image and sound control, and general vehicle control. (*Id*. at 3:56–60; 4:38–46; 4:66–5:5; 5:27–42; Fig. 4 (EX1002)). Thus, Hayashikura discloses a control module, as recited in element (b) of claim 21.

c) "a plurality of transmitting devices connected to the control module, wherein each of the plurality of transmitting devices transmits a signal;"

51. Hayashikura discloses a plurality of radar devices. (Hayashikura at 3:24–27; Figs. 1, 2, 4, 6, 8, 10 ("This vehicle-surroundings monitoring apparatus 1 comprises a *plurality of radar devices 3* provided on and along the periphery of a vehicle …." (emphasis added); *see also* Figs. 2, 4, 6, 8, 10 (EX1002)). Hayashikura discloses that the radar devices include transmitters. (*Id*. at 3:36–38 ("As illustrated, the radar device 3 comprises a set of *transmitter* and receiver sections 10 and 20….") (emphasis added); *see also* Figs. 2, 4, 6, 8, 10 (EX1002)). The '803 patent similarly discloses to integrate a transmitting component and a receiving component into a single device or transceiver. ('803 patent at 3:62-63; 11:35-36; 17:33-35 (EX1001)).

52. One of ordinary skill in the art would have understood that the transmitters 10 are connected to the processing device 4 at least due to them being communicatively coupled. For example, Fig. 2 shows one of a plurality of transmitters 10 connected to the phase difference detector section 30 that is part of the processing device. (Hayashikura at 3:37–38 ("phase difference detector section 30 constitut[es] a part of the processing device 4.") (EX1002)). Similarly, Fig. 10 discloses the phase difference detector section 30 within the processor 102. (*Id*. at

6:58–61; 7:37–40; Fig. 10 (EX1002)). Accordingly, Hayashikura discloses a plurality of transmitting devices connected to the control module.

53. The transmitters of Hayashikura transmit a signal in the form of an "electromagnetic wave." (*Id*. at 3:60–67; 6:14–17 (EX1002)). Hayashikura does not disclose any transmitter which does not transmit a signal. Thus, Hayashikura discloses that each of the plurality of transmitting devices transmits a signal, as recited in element (c) of claim 21.

d) "a plurality of receiving devices connected to the control module,

54. Hayashikura discloses that the radar devices include receivers 20. (Hayashikura at 3:36–38 ("As illustrated, the radar device 3 comprises a set of transmitter and *receiver* sections 10 and 20….") (emphasis added); *see also* Figs. 2, 4, 6, 8, 10 (EX1002)).

55. The plurality of receivers 20 are connected to the processing device 4. One of ordinary skill in the art would have understood that the receivers 20 are connected to the processing device 4 at least due to them being communicatively coupled. For example, Fig. 2 shows one of a plurality of receivers 20 connected to the phase difference detector section 30, which is part of the processing device, as noted earlier. (*Id*. at 3:37–38 (EX1002)). Thus, Hayashikura discloses a plurality of receiving devices connected to the control module, as recited in element (d) of claim 21.

e) "wherein each of the plurality of receiving devices receives a return representative of one of the plurality of transmitted signals and"

56. Hayashikura discloses that receivers 20 each receive a return representative of one of the plurality of electromagnetic wave signals. For example, Hayashikura discloses that the transmitters transmit electromagnetic waves that are subsequently received by the receivers. (Hayashikura at 2:12–13 ("each of the transmitter sections transmitting an electromagnetic wave, each of the receiver sections receiving a reflective wave from an object …."; *see also* 3:64–67; 4:1–3; 4:25–30; 6:14–19 (EX1002)). Hayashikura also discloses that the radar devices may be activated simultaneously or sequentially "so that an electromagnetic wave radiated from the transmitting antenna of one radar device 3 will not be received by the receiving antenna of another radar device 3." (*Id.* at 4:58–63 (EX1002)). Thus, Hayashikura discloses that each of the plurality of receiving devices receives a return representative of one of the plurality of transmitted signals, as recited in element (e) of claim 21.

f) "wherein each of the plurality of receiving devices transmits to the control module a return signal representative of the return received by that receiving device; and"

57. The receiving devices 20 of Hayashikura transmit a return signal to the processing device representative of the return electromagnetic wave signal that it received. For example, Hayashikura discloses "a processing section for

determining conditions around the vehicle on the basis of the respective signals received by the individual receiver sections." (Hayashikura at 2:13–16 (EX1002)). The receiving devices 21 send signals, *e.g*., demodulated signal 23a, to a "phase difference detector section 30." (*Id*. Fig. 2 (EX1002)). Hayashikura discloses that the "phase difference detector section 30 constitut[es] a part of the processing device 4." (*Id*. at 3:37–38 (EX1002)). Thus, Hayashikura discloses that each of the plurality of receiving devices transmits to the control module a return signal representative of the return received by that receiving device, as recited in element (f) of claim 21.

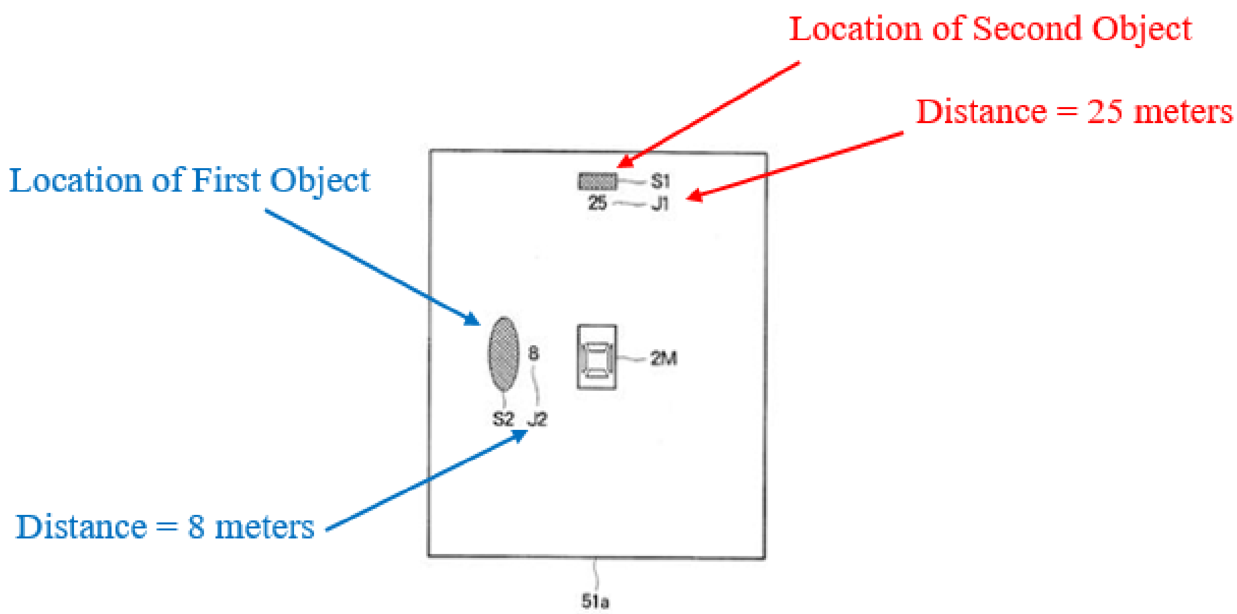
g) "wherein the control module measures the return signals, detects an object as a function of the return signals, calculates a distance to and location of the object and displays the distance to and the location of the object."

58. Hayashikura discloses wherein the processing device 4 measures the return signals, detects an object as a function of the return signals, calculates a distance to and location of the object and displays the distance to and the location of the object. First, Hayashikura discloses to measure the return signals and detect an object as a function of the return signals. Figure 3 of Hayashikura shows an example of the measurement. Figure 3 discloses a "modulating pulse signal 13a" that is used by the transmitter 10 shown in Figure 2. (Hayashikura at 3:55–67 (EX1002)). Figure 3 also shows a "waveform-shaped signal 31a" that is used the

receiver 20 of Figure 2. (*Id*. at 4:9–30 (EX1002)). The transmitter 10 and receiver 20 are part of the same radar device 3.

59. The processing device 4 or control module of Hayashikura, including the phase difference detector section 30, measures a timing difference between the modulating pulse signal 13a and the waveform-shaped signal 31a associated with a radar device 3. (*Id*. at 4:945 (EX1002)). The phase difference detector section 30 forms part of the processing device, as discussed earlier. Using the phase difference detector section 30 of the processing device 4, a time difference is measured between the modulating pulse signal 13a rising to a high level and the waveform-shaped signal 31a rising to a high level, as shown in Fig. 3. (*Id*. at 4:15–30; Fig. 2 (EX1002)). Hayashikura discloses that "the processing device 4 calculates a distance to the object on the basis of the digital data 33b representative of the phase difference (time difference)." (*Id*. at 4:42–45 (EX1002)). By repeating this process through "activating one or more other radar devices 3 oriented in other directions," the processor is able to "determine the presence or absence of an obstacle over the entire range (virtually 360°) around the vehicle," so as to calculate a location of the object(s). (*Id*. at 4:48–57 (EX1002)). The additional embodiment shown in Figs. 6–10 of Hayashikura provides similar teachings with respect to this limitation, in addition to the other limitations in the challenged claims.

60. The processing device 4 of Hayashikura calculates the distance to and the location of the object for display. Fig. 4 of Hayashikura shows the processing device 4 in communication with a display section 5, including the image display device 51. (Hayashikura at 3:24–28; 4:66–67 (EX1002)). Hayashikura discloses that "[t]he processing device 4 in this embodiment displays a mark 2M indicating the user's vehicle on a virtually middle portion of the display screen 51a, and also *marks S1 and S2 indicative of the positions of detected obstacles* along with the *determined distances J1 and J2 to the obstacles*." (*Id*. at 5:7–12 (EX1002)). One of ordinary skill in the art would have understood that the marks S1 and S2 represent the locations of the respective objects. For example, as shown in Figure 5 reproduced below, the mark S1 shows the object as being located to the front of the vehicle and at a distance represented by J1. The Mark S2 shows a different object being located to the left hand side of the vehicle and at a distance represented by J2. (*Id*. at 4:46–56; 5:6–22 (EX1002)). Thus, both the distance and location of the object are calculated and displayed.



(*Id.* Fig. 5 (EX1002) (annotation added)).

61. Hayashikura discloses benefits of detecting object location and distance, such as "assist[ing] the vehicle operator in recognizing and judging the conditions." (*Id.* at 5:16–18 (EX1002)). Hayashikura further discloses that "because the image display can show presence of an obstacle within a dead angle and a distance thereto, it can also be a good safety confirming support when the operator changes a route or lane or puts the vehicle into a garage." (*Id.* at 5:18–22 (EX1002)). Thus, Hayashikura would have taught one of ordinary skill in the art the claimed control module that measures the return signals, detects an object as a function of the return signals, calculates a distance to and location of the object and displays the distance to and the location of the object, as recited in element (g) of claim 21.

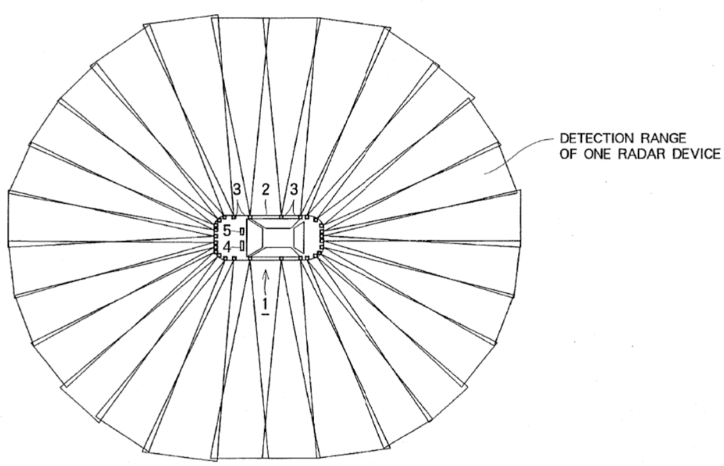
3. Claim 22 is obvious in view of Hayashikura

a) "22. The system of claim 21, wherein the control module fuses data received from the plurality of sensors to detect objects within a 360° view surrounding the vehicle."

62. The processing device 4 of Hayashikura fuses data received from the radar device 3 to detect objects within a 360° view. It's noted that the '803 patent uses the term "360° view" *only* in claims 22 and 28—it is not found anywhere else in the patent. The term was first introduced in dependent claims 41 and 50 added during prosecution, which then issued as dependent claims 22 and 28. (File History, Amendment at 5-6 (12/20/1999) (EX1011)).

63. The system of Hayashikura has a 360° detection range around the vehicle, as show below in Figure 1. (Hayashikura at 3:28–31 (EX1002)).

FIG.1



(*Id.* at Fig. 1 (EX1002)).

64. Hayashikura discloses that "[t]he provision of the plurality of the transmitter and receiver sections on and along the entire periphery of the vehicle

permits detection obstacles or the like over an entire (virtually 360°) range around the vehicle." (*Id*. at 2:29–32 (EX1002)). Hayashikura further discloses that "[i]n this way, the processing device 4 determines presence or absence of an obstacle over the entire range (virtually 360°) around the vehicle and a distance to the obstacle if any…. The processing device 4 updatably stores the data representative of the determined distances in all the directions." (*Id*. at 4:54–65 (EX1002)). One skilled in the art would have been taught that the data of Hayashikura is fused at least by being cumulatively stored and combined to represent object detection in all directions.

65. Further, Hayashikura discloses that "[t]he vehicle-surroundings monitoring section 108 repeats its operation … until the entire (360°) range surroundings are monitored, and then causes an image display device 51 to show the monitored results." (*Id*. at 7:46–52 (EX1002)). One of ordinary skill in the art would have understood that Hayashikura's storing of data followed by providing a single image, representative of objects in all directions, is accomplished by using the data cumulatively as a combination or in a fused manner. Thus, Hayashikura discloses that the control module fuses data received from the plurality of sensors to detect objects within a 360° view surrounding the vehicle, as recited in claim 22.

4. Claim 26 is obvious in view of Hayashikura

a) "26. The system of claim 21, wherein the control module includes a means for detecting a slow moving object."

66. The processing device 4 of Hayashikura teaches a means for detecting a slow moving object. As described above with respect to claim 21, the processing device 4 performs the function of detecting objects. To the extent that any sufficient structure is disclosed in the '803 patent that corresponds to the control module of claim 26, Hayashikura at least teaches similar structure or renders it obvious. (Hayashikura at 3:55-67; 4:47-65; Figure 4 (EX1002)).

67. Hayashikura teaches that the detected objects may be slow moving. For example, Hayashikura discloses that the detected objects may include obstacles encountered when making a lane change or putting the vehicle into a garage. (*Id.* at 5:18-22 (EX1002)). One skilled in the art would have understood that lane changes are often made at slow speeds, for example, when merging into a line of slow-moving traffic, which was a common occurrence before the August 1998 filing date of the '803 patent and is still common. Thus, Hayashikura teaches a control module that includes a means for detecting a slow moving object, as recited in claim 26.

5. Claim 27 is obvious in view of Hayashikura

a) "27. The system of claim 21, wherein the control module includes a means for detecting a stationary object proximate to the vehicle."

68. The processing device 4 of Hayashikura teaches a means for detecting a stationary object proximate the vehicle, for analogous reasons as to why it teaches the means for detecting slow moving objects in claim 26. For example, Hayashikura discloses that the detected objects may include obstacles encountered when putting the vehicle into a garage. (Hayashikura at 5:18-22 (EX1002)). One skilled in the art would have understood that a majority of objects encountered when garaging a vehicle are stationary. It's possible that a slow moving object, such a pet or person, would have been encountered when garaging a vehicle; however, most objects, such as walls and stored items would be stationary. Thus, Hayashikura teaches a control module that includes a means for detecting a stationary object, as recited in claim 27.

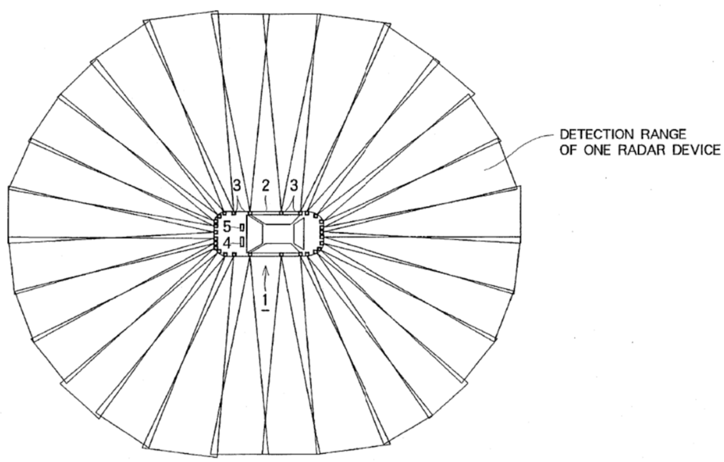
6. Claim 28 is obvious in view of Hayashikura

a) "28. The system of claim 21, wherein the control module fuses data received from the plurality of sensors and provides a single picture of all objects within a 360° view surrounding the vehicle."

69. Claims 21 and 28 are similar. The difference is that claim 28 recites the phrase "and provides a single picture of all" and claim 22 recites "to detect." ('803 patent at 20:15-17; 20:35-38). Hayashikura teaches the features of claim 28.

The system of Hayashikura has a 360° detection range around the vehicle, as show below in Figure 1. (Hayashikura at 3:28–31 (EX1002)). As noted above in Section VII.A.3, with respect to claim 22, Hayashikura teaches that the processing device or control module fuses data received from the plurality of sensors.

FIG.1

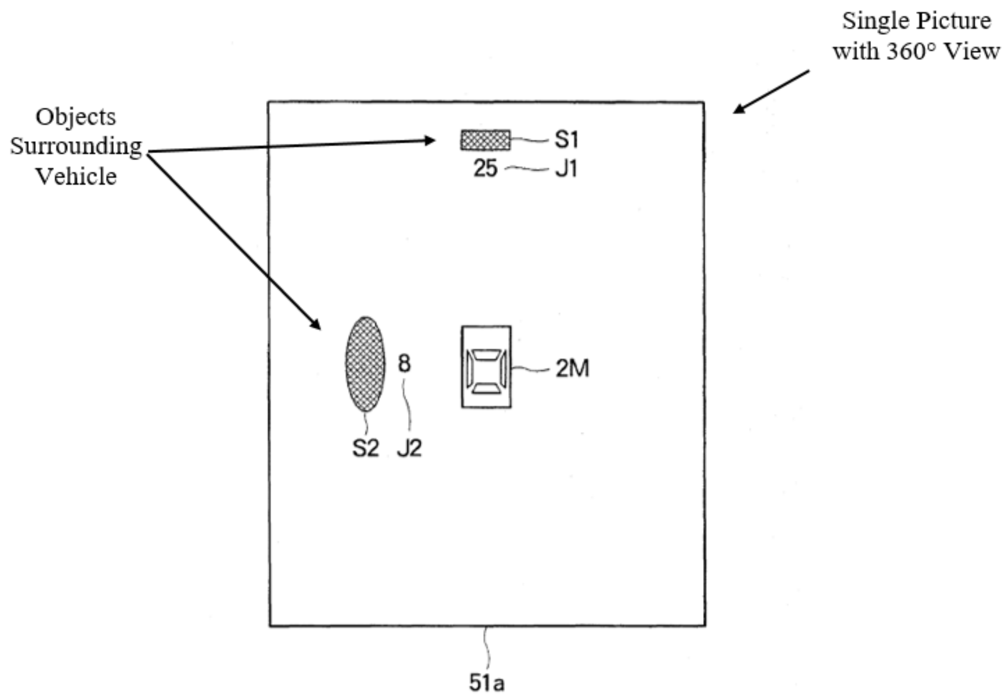


(*Id*. at Fig. 1 (EX1002)).

70. Hayashikura teaches that the processing device 4 provides a single picture of all objects within a 360° view surrounding the vehicle. For example, the processing device 40 of Hayashikura provides a single picture to the display device 51. (*Id*. at 4:66-5:3 (EX1002)). As shown in Figure 5. The processing device 4 causes the display 51 to show a single picture of all objects within a 360° view surrounding the vehicle:

> "[A] mark 2M indicating the user's vehicle on a virtually middle portion of the display screen 51a, and also marks S1 and S2

indicative of the positions of detected obstacles along with the determined distances J1 and J2 to the obstacles."



(*Id* at Fig. 5 (EX1002) (annotation added)). Hayashikura therefore teaches that the control module fuses data received from the plurality of sensors and provides a single picture of all objects within a 360° view surrounding the vehicle, as recited in claim 28.

B. Ground II: Claim 24 is rendered obvious by Hayashikura and Cherry

1. Overview of Cherry

71. Cherry is not of record in the '803 patent. Cherry is directed to an object detection system and method that includes a self-test operation. (Cherry at

Abstract; 1:7–8 (EX1005)). Figure 2, which is illustrated below, shows a block diagram of the system.

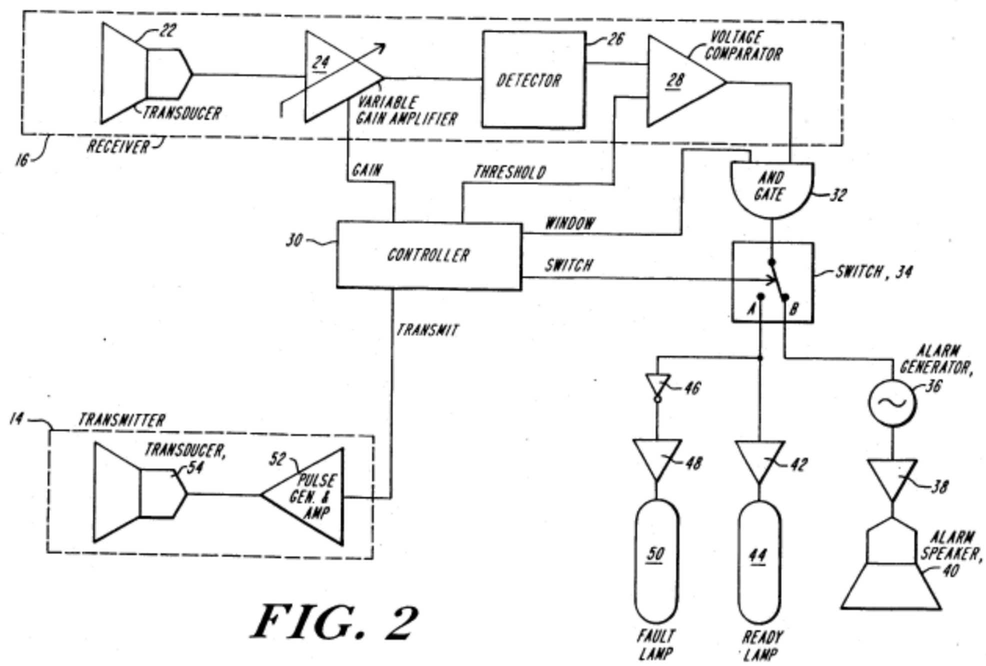


FIG. 2

A transmitter 14 and receiver 16 are each attached to the end portion 12 of a vehicle 10. (*Id*. at 2:34–36 (EX1005)). Transmitter 14 transmits object detection signals, such as ultrasonic waves, that reflect from an object in the path of vehicle 10 and are received by receiver 16. (*Id*. at 2:36–40 (EX1005)).

72. A controller 30, which may be a microprocessor, “coordinates and controls the operation of the transmitter 14 and the receiver 16 to alternate the system between a self test mode and an obstacle detection mode.” (*Id*. at 2:53–56 (EX1005)). In the disclosed self-test operation, controller 30 controls transmitter

14 to emit an object detection signal, such as an ultrasonic pulse signal, infrared signal, or other radiation signal. (*Id*. at 2:60–63 (EX1005)). Controller 30 adjusts receiver gain and threshold so that reflected signals from the ground that are caused by the emitted object detection signal may be detected by receiver 16. (*Id*. at 2:66–3:3 (EX1005)). A determination is thereafter made regarding whether receiver 16 has received pulse reflections within a predetermined verification period. (*Id*. at 3:11–13 (EX1005)). When the system receives a reflection within the verification period, an indication is provided regarding the readiness of the system, and the system moves from the self-test mode into an object detection mode. (*Id*. at 3:26–30; 4:4–6 (EX1005)).

2. Claim 24 is obvious in view of Hayashikura and Cherry

a) "The system of claim 21, wherein the control module includes a built-in-test function which sequentially commands each transmitting device to transmit a signal, detects a return of the signal and sends a signal representative of said return to the control module for system verification."

73. The combination of Hayashikura and Cherry teaches this limitation. Cherry discloses an object detection system for a vehicle that includes a built-in, self-test operation. (Cherry at 1:61–64 (EX1005)). Cherry*'s* built-in-test function commands each transmitting device to transmit a signal, detects a return of the signal and sends a signal representative of the return to the control module for system verification.

74. For example, Figure 2 of Cherry discloses a transmitting device 14 and a receiving device 16. (*Id*. at Figure 2 (EX1005)). A controller 30 commands the transmitting device to transmit a signal. (*Id.* at 2:60–66 ("the controller 30 controls the transmitter 14 to emit an object detection signal….") (EX1005)). The receiving device 16 detects a return of a signal transmitted by the transmitting device to 14. (*Id.* at 2:36–40 (EX1005)). Figure 2 shows communications between the transmitting and receiving devices 14, 16, and the controller 30. (*Id*. at Figure 2; (EX1005)). The controller 30 of Cherry is a "control module."

75. In use, the "controller 30, for example a microprocessor, coordinates and controls the operation of the transmitter 14 and the receiver 16 to alternate the system between a self test mode and an obstacle detection mode." (*Id*. at 2:53–56 (EX1005)). The self-test in Cherry is a "built-in-test function," as claimed because the controller 30 is built into Cherry*'s* system and coordinates the test. (*Id*. at 2:53–56; Figure 2 (EX1005)). During the test, the receiving device 16 of Cherry detects a return of a signal and sends a signal representative of the return signal to the controller, which then makes a determination regarding system verification. (*Id*. at 3:11–13 ("A determination is then made as to whether the receiver 16 has received pulse reflections from the ground within a predetermined verification period (step 304);" 3:42–59; Figure 2 (EX1005)). In particular, Cherry discloses that "[o]nce the receiver receives a signal reflected from the ground surface, an

indication is provided that the system is in a ready or operable state." (*Id*. at 2:2–4 (EX1005)). The controller in Cherry then "adjusts the receiver gain and signal detection threshold so that signals reflected from the ground surface are effectively ignored and only signals reflected from significant objects in the path of the vehicle are detected." (*Id.* at 2:5–9 (EX1005)). FIG. 5 of Cherry illustrates how

> "the monitored zone is increased to a self test zone area 60 during the self test mode so that minor reflections from the ground may be received by the receiver 16, and decreased to an obstacle detection zone area 62 during the obstacle detection mode so that reflections from the ground are effectively ignored by the receiver."

Id. at 4:7–13; Figure 5 (EX1005)).

76. Cherry does not explicitly disclose that the built-in-test function sequentially commands multiple transmitting devices to conduct the test, simply because Cherry*'s* system uses only one transmitter and receiver pair. However, the reason that Cherry performs the self-test is so that "only larger reflected signals from objects or obstacles of interest will be detected" and "small reflected signals from the transmitter pulse, including those from small ground irregularities," will be rejected. (*Id*. at 3:42–51 (EX1005)).

77. Given the similarities in structure, objectives, and operation between Hayashikura and Cherry, one would have been motivated to add the self-test features of Cherry to the object-detecting system of Hayashikura for at least the

following reasons. This combination would have provided the benefits disclosed by Cherry, including the ability to reject signals caused by small ground irregularities, while focusing on objects that are most important to detect.

78. One of ordinary skill in the art would have appreciated that eliminating signals from small ground irregularities, as taught by Cherry, is applicable to systems that include multiple transmitters and receiver pairs, as in Hayashikura. Regardless of the number of transmitters and receivers, the goal is the same in both systems—to detect objects that pose a danger to the vehicle, while not providing false alarms for small ground irregularities that do not. Thus, one of ordinary skill in the art would have been motivated to modify Hayashikura to include the self-test features of Cherry for similar reasons—*i.e.*, to provide a system that focuses on the objects of interest while ignoring small ground irregularities.

79. Further, the technical aspects of Hayashikura support such a modification. Hayashikura discloses that its radar devices 3 may be activated sequentially "so that an electromagnetic wave radiated from the transmitting antenna of one radar device 3 will not be received by the receiving antenna of another radar device 3." (Hayashikura at 4:58–63 (EX1002)). Thus, it naturally follows that since a typical operation of Hayashikura involves subsequently activating the individual radar devices 3 to avoid interference with other radar

devices, the self-test operation would be performed in a similar matter. For example, a first radar device in Hayashikura would perform the test, followed by a second radar device performing the test, etc.

80. Cherry generically discloses using detection signals, and discloses various types, "for example an ultrasonic pulse signal, infrared signal or other like radiation signals." (Cherry at 2:62–63 (EX1005)). Hayashikura discloses using a radar system with electromagnetic waves. (Hayashikura at 1:6–10 (EX1002)). One of ordinary skill in the art would have known how to implement the self-test features of Cherry in Hayashikura, even though Hayashikura uses radar, and it would have taken no great skill to do so. This is because, for example, one of ordinary skill in the art would have known that vehicle object detection systems commonly utilize various sensing technology means, including ultrasonic, infrared, and/or radio frequency electromagnetic sensors (*e.g.*, RADAR), all of which were well known in the industry and deployed in vehicle object detection systems before the priority date of the '803 patent. One of ordinary skill in the art would also have known that incorporating self-test features into an on-board vehicle object detection system was well known in the art at the time of the invention. This incorporation would have been well known because common industry safety practices before the priority date of the '803 patent included integrating self-test routines into vehicle systems and performing such self-test routines during

initialization, vehicle startup, and/or during system operation in order to help ensure that vehicle components operated correctly.

81. Modifying Hayashikura to include the self-test features of Cherry was well within the abilities of one of ordinary skill in the art and would have been accomplished with a reasonable chance of success. Doing so would have required only minor hardware and/or software modifications to the processing device of Hayashikura. One of ordinary skill in the art would have known that modifying Hayashikura to include the self-test features of Cherry was simply a matter of incorporating additional software/firmware functions into Hayashikura's processing device 4 to include the self-test processing routines of Cherry. According to Cherry, "[a] controller 30, for example a microprocessor, coordinates and controls the operation of the transmitter 14 and the receiver 16 to alternate the system between a self test mode and an obstacle detection mode." (Cherry at 2:51-54 (EX1005)). One of ordinary skill in the art would have recognized that incorporating the teachings of Cherry into Hayashikura would have simply included using Cherry's software/firmware with Hayashikura's processing device 4 to control Hayashikura's radar devices 3 in accordance with Cherry's self-test routine. (Hayashikura at Fig. 4 (EX1004)).

82. Other small modifications that would have been needed to implement Cherry's testing functionality in Hayashikura were well known in the art.

Accordingly, the combination of Hayashikura and Cherry teaches the claimed control module that includes a built-in test function which sequentially commands each transmitting device to transmit a signal, detects a return of the signal and sends a signal representative of said return to the control module for system verification, as recited in claim 24.

C. Ground III: Claims 21, 22, and 25-27 are rendered obvious by *JP '265*

3. Overview of *JP '265*

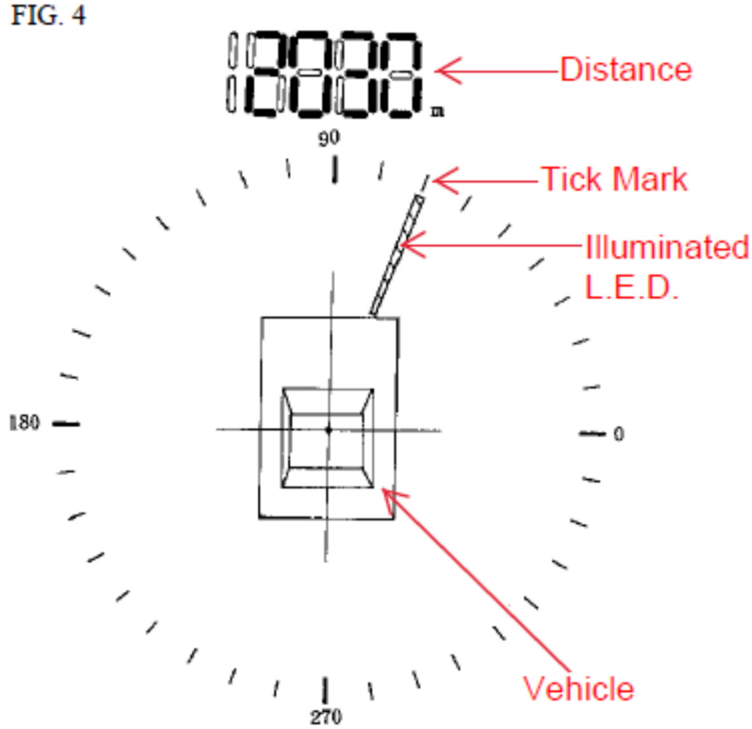
83. *JP '265* is not of record in the '803 patent. *JP '265* is directed to a system for detecting an obstacle in an environment surrounding a vehicle. (*JP '265* at ¶0001 (EX1004)). The system of *JP '265* includes ultrasonic oscillators[1] 4 through 15 attached around the periphery of an automobile 3. (*Id.* at ¶0016 (EX1004)). Three oscillators may be located on each side of automobile 3 "so that there will be no dead angles" around automobile 3. (*Id.* (EX1004)). Oscillators transmit ultrasound into the environment around automobile 3 and receive a return signal of the transmitted ultrasound. (*Id.* at ¶¶0016–0018 (EX1004)). Using the difference in time between transmission and reception of the ultrasound, the distance and direction from automobile 3 to an obstacle is calculated by

[1] *JP '265* also refers to its oscillators as "sonar sensors" throughout its disclosure. *See e.g.*, *JP '265* at ¶¶0016, 0021.

microcomputer 18. (*Id.* at ¶0018 (EX1004)). One of ordinary skill in the art would have understood that the calculated direction is a directional location because it indicates the location at which an object in the environment of automobile 3 is situated, so as to provide a positional relationship between the object and the vehicle. For example, the directional location indicates to which side of the vehicle the object is located.

84. *JP '265* discloses that display panel 21 displays the calculated distance and directional location. (*Id.* at ¶0019 (EX1004)). Figure 4, showing display 21, is reproduced below with annotations:

FIG. 4



85. Display 21 includes a digital display panel that displays the calculated distance to an object. (*Id.* at ¶0049, Fig. 4 (EX1004)). Display panel 21 also

includes angle tick marks indicating directions 360 degrees around an automobile in 10 degree intervals. (*Id.* (EX1004)). Each tick mark has an associated light-emitting diode (L.E.D.). (*Id.* (EX1004)). Display 21 displays the calculated directional location of an object. (*Id.* (EX1004)). For example, when an object is located within a determined safe distance at a determined angle of 72 degrees, the light-emitting diode corresponding to the 70-degree tick mark illuminates. (*Id.* (EX1004)). The directional location of the object is therefore displayed. (*Id.* (EX1004)).

86. While JP '265 and Hayashikura (alone or in combination with Cherry) teach all the elements of the challenged claims, they do so in different ways. For example, while JP '265 and Hayashikura are each generally directed to systems for monitoring vehicle surroundings, each reference performs its object detection and object display in different ways. Moreover, JP '265 is a translated Japanese patent publication, while Hayashikura is an issued US patent. The various grounds in this petition are therefore not redundant. Should the Board find any redundancy in a ground, the Board should still institute this IPR because the redundancy would not "place a significant burden on the Patent Owner and the Board," nor would it "cause unnecessary delays." *See Liberty Mutual Ins. Co. v. Progressive Cas. Ins. Co.*, CBM2012-00003, Paper 7 at 2 (PTAB Oct. 25, 2012).

4. Claim 21 is obvious in view of *JP '265*

a) "A collision avoidance system, which provides object detection around the exterior of a vehicle, comprising:"

87. *JP '265* discloses a system for detecting an obstacle in an environment surrounding a vehicle. (*JP '265* at ¶0001 (EX1004)). The system detects a "distance of the obstacle from the vehicle" and a "direction of the obstacle in relation to the vehicle." (*Id.* (EX1004)). After the distance is calculated, it is compared to a "safe distance." (*Id.* at ¶0048 (EX1004)). The safe distance is the "minimum distance wherein safe travel is possible." (*Id.* at ¶0045 (EX1004)). If the distance to the obstacle is less than the safe distance, the vehicle operator (*e.g.*, driver) is warned by a sound from sound generator 24. (*Id.* at ¶¶0019, 0045, 0048 (EX1004)). Therefore, *JP '265* discloses a collision avoidance system.

88. The system of *JP '265* includes ultrasonic oscillators 4 through 15 "attached around the periphery of the automobile 3." (*Id.* at ¶0016 (EX1004)). Three oscillators may be located on each side of automobile 3. (*Id.* at Fig. 1 (EX1004)). The oscillators "transmit and receive ultrasound" in the environment around automobile 3 to detect the distance and direction to obstacles. (*Id.* at ¶¶0015–0018 (EX1004)). *JP '265* discloses that "the existence of an obstacle to the front, rear, right, or left, and the distance and direction thereto, are detected

automatically…." (*Id.* at ¶0054 (EX1004)). Therefore, the system of *JP '265* provides object detection around the exterior of automobile 3.

89. *JP '265* therefore discloses a collision avoidance system which provides object detection around the exterior of a vehicle, as recited in element (a) of claim 21.

b) "a control module;"

90. *JP '265* discloses a microcomputer 18 that calculates differences in time between transmitted ultrasound signals and reflected, received ultrasound signals. (*JP '265* at ¶0018 (EX1004)). Microcomputer 18 calculates a distance and direction from automobile 3 to an obstacle based on the calculated differences. (*Id.* (EX1004)).[2] Microcomputer 18 determines a control signal from the distance and direction calculation. (*Id.* at ¶0019 (EX1004)). The control signal is used to control automobile 3. (*Id.* (EX1004)). Microcomputer 18 is therefore a control module. Thus, *JP '265* discloses a control module as recited in element (b) of claim 21.

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[2] As noted below with respect to challenged claim 25, the control module of JP '265 also determines whether it can triangulate and calculates an actual perpendicular distance to the object and location of the object with respect to the vehicle.

c) "a plurality of transmitting devices connected to the control module, wherein each of the plurality of transmitting devices transmits a signal;"

91. *JP '265* discloses that oscillators 4 through 15 are attached around the periphery of an automobile 3. (*Id.* at ¶0016 (EX1004)). Three oscillators may be located on each side of automobile 3. (*Id.* (EX1004)). Of the three oscillators on each side, each center oscillator (*e.g.*, oscillators 5, 8, 11, and 14) transmits ultrasound. (*Id.* at ¶¶0016, 0021 (EX1004)). *JP '265* therefore discloses a plurality of transmitting devices, wherein each of the plurality of transmitting devices transmits a signal.

92. Each of oscillators 5, 8, 11, and 14 is connected to microcomputer 18 (the identified control module) via transceiver circuit 17. (*Id.* at ¶¶0016-0018, Fig. 1 (EX1004)). *JP '265* therefore discloses that the plurality of transmitting devices is connected to a control module.

93. Thus, *JP '265* discloses a plurality of transmitting devices connected to the control module, wherein each of the plurality of transmitting devices transmits a signal as recited in element (c) of claim 21.

d) "a plurality of receiving devices connected to the control module,"

94. *JP '265* discloses that oscillators 4, 6, 7, 9, 10, 12, 13, and 15 each receive reflected signals that result from ultrasound transmitted by oscillators 5, 8, 11, and 14. (*JP '265* at ¶¶0016, 0021 (EX1004)). Additionally, while oscillators

5, 8, 11, and 14 are transmitting oscillators, they may also receive reflected signals that result from transmitted ultrasound and act as receiving oscillators. (*Id.* at ¶0016 (EX1004)). Therefore, *JP '265* discloses a plurality of receiving devices.

95. Each of oscillators 4 through 15 (including oscillators 4, 6, 7, 9, 10, 12, 13, and 15) is connected to microcomputer 18 (the identified control module) via transceiver circuit 17. (*Id.* at ¶¶0016-0018, Fig. 1 (EX1004)). Transceiver circuit 17 receives signals from each of oscillators 4 through 15, and sends outputs for each of these oscillators to microcontroller 18 using analog switches. *(Id.* at ¶0018 (EX1004)). For example, "[s]ignals wherein the ultrasound transmission times and reception times are known are sent to the microcomputer 18 from the sonar sensors 4 through 15." *(Id.* at ¶0022 (EX1004)). Microprocessor 18 then determines the distance and direction to an obstacle. *(Id.* (EX1004)). *JP '265* therefore discloses a plurality of receiving devices connected to a control module.

96. Thus, *JP '265* discloses a plurality of receiving devices connected to the control module as recited in element (d) of claim 21.

e) "wherein each of the plurality of receiving devices receives a return representative of one of the plurality of transmitted signals and"

97. *JP '265* discloses that oscillators 4, 6, 7, 9, 10, 12, 13, and 15 receive reflected signals (*i.e.*, return signals) that result from ultrasound transmitted by oscillators 5, 8, 11, and 14. (*JP '265* at ¶¶0016, 0021 (EX1004)). For example,

ultrasound transmitted by front oscillator 5 strikes an object (*e.g.*, a vehicle in front of automobile 3) and is reflected by the object. (*Id.* at ¶0026, Fig. 1 (EX1004)). The reflected signal is a return representative of the transmitted ultrasound from front oscillator 5, and is received at time T_1 by oscillator 4 and time T_2 by oscillator 6 as shown by Figure 2. (*Id.* at Fig. 2 (EX1004)). Similarly, ultrasound transmitted by rear oscillator 11 strikes a rearward object (*e.g.*, a rearward vehicle) and is reflected by the object. (*Id.* at ¶0027, Fig. 1 (EX1004)). The reflected signal is a return representative of the transmitted ultrasound from rear oscillator 11, and is received at time T_4 by oscillator 10 and time T_5 by oscillator 12 as shown in Figure 2. (*Id.* at Fig. 2 (EX1004)). One of ordinary skill in the art would have understood that ultrasound transmitted by oscillators 8 and 14 (*i.e.*, the left and right transmitting oscillators) would be received by oscillators 7, 9, 13, and 15 in the same manner as described above when objects are present in the left and/or right sides of automobile 3. (*Id.* at ¶¶0026, 0027, 0054, Fig. 1 (EX1004)). Therefore, each of oscillators 4, 6, 7, 9, 10, 12, 13, and 15 receives a return signal that is representative of one of the plurality of ultrasound signals transmitted by oscillators 5, 8, 11, and 14.

98. One of ordinary skill in the art would therefore have understood that *JP '265* teaches wherein each of the plurality of receiving devices receives a return

representative of one of the plurality of transmitted signals as recited in element (e) of claim 21.

> ***f) "wherein each of the plurality of receiving devices transmits to the control module a return signal representative of the return received by that receiving device; and"***

99. *JP '265* discloses that ultrasonic transceiver 16, which includes transceiver circuit 17 and microcomputer 18, processes signals from oscillators 4 through 15. *(JP '265* at ¶¶0016, 0017 (EX1004)). Each of the plurality of receiving oscillators 4, 6, 7, 9, 10, 12, 13, and 15 transmits reception times to microcomputer 18 (the identified control module). (*Id.* at ¶¶0021, 0022 (EX1004)). For example, "[s]ignals wherein the ultrasound transmission times and reception times are known are sent to the microcomputer 18 from the sonar sensors 4 through 15." *(Id.* at ¶0022 (EX1004)). Microprocessor 18 then determines the position, distance, and direction to an obstacle. *(Id.* at ¶¶0018, 0022 (EX1004)).

100. For instance, microcomputer 18 (the identified control module) calculates directions and distances to forward and rearward vehicles using the reception times T_1, T_2, T_3, and T_4, as described above, that are determined from ultrasound signals received by front and rear oscillators 4, 6, 10, and 12. *(Id.* at *'265* at ¶0027 (EX1004)).

101. Therefore, *JP '265* discloses that each of the plurality of receiving oscillators 4, 6, 7, 9, 10, 12, 13, and 15 transmits to microcomputer 18 (the

identified control module) a return signal (reception times) representative of the reflected ultrasound return signal received by each of oscillators 4, 6, 7, 9, 10, 12, 13, and 15. *JP ‘265* therefore discloses that each of the plurality of receiving devices transmits to the control module a return signal representative of the return received by that receiving device as recited in element (f) of claim 21.

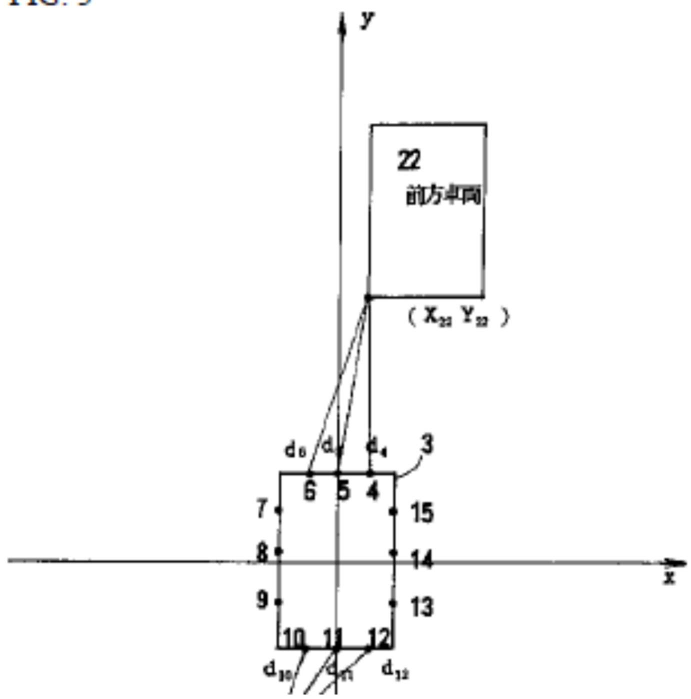
> ***g) “wherein the control module measures the return signals, detects an object as a function of the return signals, calculates a distance to and location of the object and displays the distance to and the location of the object.”***

102. *JP ‘265* discloses that microcomputer 18 (the identified control module) measures the returned reception times (the identified return signals) because microcomputer 18 determines the difference between each reception time and an ultrasound transmission time. *(JP ‘265* at ¶0027 (EX1004)). Microcomputer 18 calculates the distance and direction to an object using the difference between each reception time and an ultrasound transmission time. (*Id.* at ¶¶0019, 0027 (EX1004)). Therefore, microcomputer 18 also detects an object as a function of the returned reception times (the identified return signals). (*Id.* (EX1004)).

103. As discussed, microcomputer 18 calculates the distance to an object, such as a vehicle. (*Id.* (EX1004)). Microcomputer 18 also calculates the location of a vehicle. (*Id.* at ¶¶0028-0033 (EX1004)). For example, a vehicle 22 is located

in front of automobile 3 at a particular spot on the x-y grid, as reflected by reproduced Figure 3 below.

FIG. 3



104. Microcomputer 18 solves the following equations to determine coordinates X_{22} and Y_{22} of vehicle 22:

[0028]

$$(X_4 - X_{22})^2 + (Y_4 - Y_{22})^2 = D_4^2 \quad (1)$$

$$(X_5 - X_{22})^2 + (Y_5 - Y_{22})^2 = D_5^2 \quad (2)$$

[0029]

$$(X_6 - X_{22})^2 + (Y_6 - Y_{22})^2 = D_6^2 \quad (3)$$

$$D_4 + D_5 = (T_1 - T_0)\,V \quad (4)$$

$$D_5 + D_6 = (T_2 - T_0)\,V \quad (5)$$

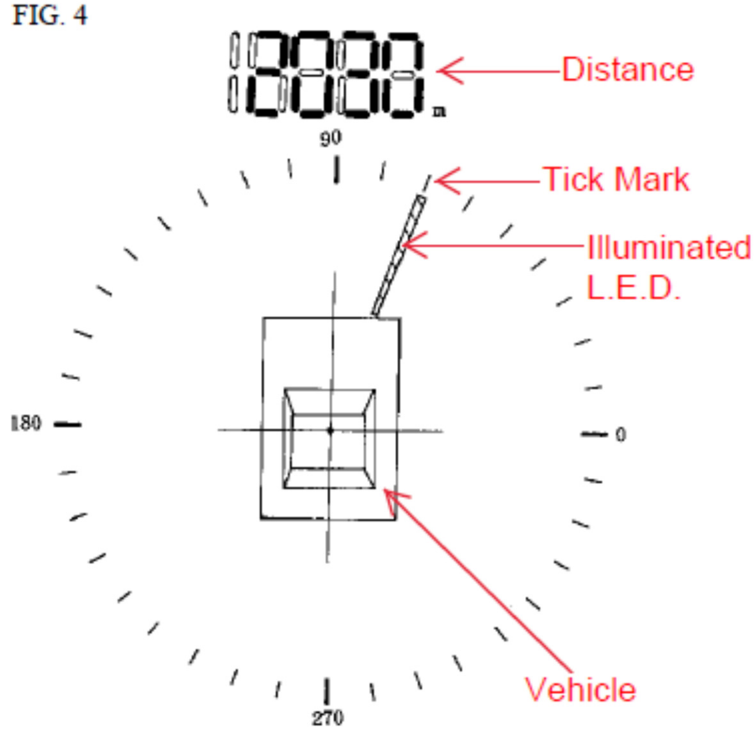
(*Id.* at ¶¶0028-0029, Fig. 3 (EX1004)).

105. By calculating coordinates X_{22} and Y_{22}, *JP '265* provides the calculation of a coordinate location of vehicle 22. Coordinates X_{22} and Y_{22},

however, also provide for the directional location of vehicle 22. Equations (1) through (3), which utilize coordinates X_{22} and Y_{22}, reflect Pythagorean theorem calculations that microcomputer 18 uses to determine distances D4, D5, and D6 to vehicle 22. One of ordinary skill in the art would have understood that microcomputer 18 would use such distances along with cosine, sine, and/or tangent functions to calculate direction. One of ordinary skill in the art would have further understood that the calculated direction is a directional location because it indicates the location at which an object in the environment of automobile 3 is directionally situated. Therefore, *JP '265* discloses that microcomputer 18 (the identified control module) calculates a distance to an object, and both the coordinate and directional locations of an object.

106. *JP '265* further discloses that an output corresponding to the calculation result by microcomputer 18 is displayed on display panel 21. (JP '265 at ¶0019 (EX1004)). Figure 4 showing display 21 is reproduced below with annotations:

FIG. 4



107. Display 21 includes a digital display panel that displays the calculated distance to an object. (*Id.* at ¶0049, Fig. 4 (EX1004)). Display panel 21 also includes "[a]ngle tick marks, indicating directions in 360° around the host vehicle" in 10 degree intervals. (*Id.* at ¶0049, Fig. 4 (EX1004)). Each tick mark has an associated light-emitting diode (L.E.D.). (*Id.* (EX1004)). Display 21 displays the calculated directional location to an object. For example, when an object is located within a determined safe distance at a determined angle of 72 degrees, the light-emitting diode corresponding to the 70-degree tick mark illuminates. (*Id.* at ¶0049, Fig. 4 (EX1004)). Therefore, *JP '265* discloses that both the calculated distance and directional location of an object are displayed as recited in element (g) of claim 21.

108. Additionally, to the extent that the Patent Owner argues or may argue that *JP '265* does not teach element (g) of claim 21 because the above-mentioned coordinate location of an object is not displayed, one of ordinary skill in the art would have found it obvious to provide this coordinate location on the display of *JP '265*. *JP '265* discloses that its system can be "used to supplement the vision of the driver even when a driver is present," and that an object of the invention is "to enable detection of the relative positioning of an individual automobile relative to an obstacle." (*JP '265* at ¶¶0002, 0010 (EX1004)). *JP '265* also discloses that coordinate locations X_{22} and Y_{22} of a vehicle located in front of a driver's vehicle, as well as coordinate locations X_{23} and Y_{23} of a vehicle located behind a driver's vehicle, are calculated. (*Id.* at ¶¶0028–0033, Fig. 3 (EX1004)). Displaying calculated coordinate locations of objects by displaying where objects are located in relation to a driver's vehicle (*e.g.*, by displaying the location in front of or behind a driver's vehicle on the display of JP '265) would have achieved a goal of *JP '265* of "supplement[ing] the vision of the driver" because the driver would then have been alerted to the location of a front or rear vehicle. Such a system would further have provided display of the "relative positioning" of the driver's vehicle relative to obstacles, which would have further helped the driver. One of ordinary skill in the art would have understood that providing such coordinate locations, on the existing display of JP '265, would have aided a driver in

determining where vehicles and obstacles around him/her are located, and how to avoid them.

109. Additionally, providing the calculated object coordinate location on the display of JP ’265 would have had a reasonable chance of success. This is because *JP ‘265* already provides for the calculation of object coordinate locations, and already provides for a display that shows where the driver’s vehicle itself is located. (*JP ‘265* at ¶¶0028-0033, 0049 (EX1004)). Thus, one of ordinary skill in the art would have only needed to modify the system of *JP ‘265* so that the calculated coordinate locations are also displayed. One of ordinary skill in the art would have made such a modification by modifying the existing display panel 21 using routine skill such that the already calculated coordinate locations could be displayed, for example, by adding an array of L.E.D.’s on the display, such that the L.E.D. corresponding to the object’s position is illuminated.

110. Therefore, to the extent that the Patent Owner argues or may argue that *JP ‘265* does not disclose that a calculated coordinate location of an object is displayed, *JP ‘265* teaches displaying the distance and directional location of an object, and further at least teaches that it would have been obvious to display a calculated object coordinate location.

111. One of ordinary skill in the art would have therefore understood that JP ’265 teaches that the control module measures the return signals, detects an

object as a function of the return signals, calculates a distance to and location of the object and displays the distance to and the location of the object, as recited in element (g) of claim 21.

5. Claim 22 is obvious in view of *JP '265*

a) "The system of claim 21, wherein the control module fuses data received from the plurality of sensors to detect objects within a 360° view surrounding the vehicle."

112. The microcomputer 18 (the identified control module) of *JP '265* fuses data received from oscillators 4 through 15 to detect objects within a 360° view.

113. *JP '265* discloses that ultrasonic oscillators 4 through 15 are "attached around the periphery of the automobile 3." (*JP '265* at ¶0016 (EX1004)). *JP '265* also discloses that three oscillators may be provided "on the front, rear, left, and right of the automobile so that there will be no dead angles," and that "[s]ignals wherein the ultrasound transmission times and reception times are known are sent to the microcomputer 18 from the sonar sensors 4 through 15." (*Id.* at ¶¶0016, 0022 (EX1004)). Microcomputer 18 then calculates the distance and direction from automobile 3 to an object using differences between the transmission and reception times. (*Id.* at ¶0016 (EX1004)). After the distance is calculated, it is compared to a "safe distance." (*Id.* at ¶0048 (EX1004)). If the distance to the

obstacle is less than the safe distance, the driver is warned by a sound from sound generator 24. (*Id.* at ¶¶0019, 0045, 0048 (EX1004)).

114. Additionally, display panel 21 includes angle tick marks indicating directions 360 degrees around a vehicle in 10 degree intervals. (*Id.* at ¶0049, Fig. 4 (EX1004)). Each tick mark has an associated light-emitting diode (L.E.D.). (*Id.* (EX1004)). Display 21 displays the calculated directional location of an object. For example, when an object is located within a determined safe distance at a determined angle of 72 degrees, the light-emitting diode corresponding to the 70-degree tick mark illuminates. (*Id*. at ¶0049, Fig. 4 (EX1004)). Therefore, display panel 21 shows a 360-degree view surrounding the vehicle. (*Id.* (EX1004)).

115. Therefore, one of ordinary skill in the art would have understood that microcomputer 18 (the identified control module) receives data from oscillators 4 through 15 to detect objects within a 360 degree view surrounding automobile 3 so that dead angles are eliminated and a driver of automobile 3 is made aware of objects surrounding automobile 3 in 360 degrees.

116. One of ordinary skill in the art would also have understood that microcomputer 18 fuses the data received from oscillators 4 through 15. As discussed, *JP '265* discloses that each of the plurality of receiving oscillators 4, 6, 7, 9, 10, 12, 13, and 15 transmit reception times to microcomputer 18. (*Id*. at ¶¶0021, 0022 (EX1004)). "Signals wherein the ultrasound transmission times and

reception times are known are sent to the microcomputer 18 from the sonar sensors 4 through 15." (*Id.* at ¶¶0022 (EX1004)). Microprocessor 18 then determines the distance and direction to an object. (*Id.* at ¶¶0018, 0022 (EX1004)).

117. For instance, microcomputer 18 (the identified control module) calculates directions and distances to forward and rearward vehicles using the reception times T_1, T_2, T_3, and T_4 that are determined from ultrasound signals received by front and rear oscillators 4, 6, 10, and 12. (*Id.* at ¶0027 (EX1004)). The following equations are satisfied to determine front and rear vehicles:

[0028]

$$(X_4 - X_{22})^2 + (Y_4 - Y_{22})^2 = D_4^2 \qquad (1)$$

$$(X_5 - X_{22})^2 + (Y_5 - Y_{22})^2 = D_5^2 \qquad (2)$$

[0029]

$$(X_6 - X_{22})^2 + (Y_6 - Y_{22})^2 = D_6^2 \qquad (3)$$

$$D_4 + D_5 = (T_1 - T_0) V \qquad (4)$$

$$D_5 + D_6 = (T_2 - T_0) V \qquad (5)$$

[0030]

Similarly, in regards to the position of the rearward vehicle, the following equations are satisfied:

$$(X_{10} - X_{23})^2 + (Y_{10} - Y_{23})^2 = D_{10}^2 \qquad (6)$$

[0031]

$$(X_{11} - X_{23})^2 + (Y_{11} - Y_{23})^2 = D_{11}^2 \qquad (7)$$

$$(X_{12} - X_{23})^2 + (Y_{12} - Y_{23})^2 = D_{12}^2 \qquad (8)$$

[0032]

$$D_{10} + D_{11} = (T_4 - T_0) V \qquad (9)$$

$$D_{11} + D_{12} = (T_5 - T_0) V \qquad (10)$$

(*JP '265* at ¶¶0028-0032 (EX1004)).

118. One of ordinary skill in the art would have understood that microcomputer 18 would similarly calculate directions and distances to vehicles

located to the left and right of automobile 3 using reception times from ultrasound signals received by oscillators 7, 9, 13, and 15 (*i.e.*, the left and right receiving oscillators) and equations like those listed above, but for ultrasound signals received by oscillators 7, 9, 13, and 15.

119. One of ordinary skill in the art would further have understood that microcomputer 18 fuses the received reception times from the plurality of oscillators. Rather than using a single reception time in equations 1 through 10 to determine a distance and location of an object within a 360° view surrounding automobile 3, a combination of multiple reception times (*e.g.*, T1 and T2 for forward vehicles and T4 and T5 for rear vehicles) is used in equations 1 through 10. *(JP '265* at ¶¶0028-0032 (EX1004)). By providing the combination of multiple reception times for use in equations 1 through 10, one of ordinary skill in the art would have recognized that microprocessor 18 fuses the reception times. One of ordinary skill in the art would have further recognized that by using a combination of multiple reception times and the above equations, the distance and location calculations would have had improved accuracy relative to using a single, individual reception time as multiple sensor readings would have been utilized.

120. Therefore, one of ordinary skill in the art would have understood that JP '265 teaches that the control module fuses data received from the plurality of

sensors to detect objects within a 360° view surrounding the vehicle as claimed in element (a) of claim 22.

6. Claim 25 is obvious in view of *JP '265*

a) "The system of claim 21, wherein the control module determines whether it can triangulate and calculates an actual perpendicular distance to the object and location of the object with respect to the vehicle."

121. *JP '265* teaches the features of claim 25. *JP '265* discloses that microcomputer 18 (the identified control module) determines the difference between each oscillator reception time and an ultrasound transmission time, and calculates a distance and direction to a forward obstacle using the difference. *(JP '265* at ¶¶0019, 0027 (EX1004)). A distance d4 (shown below as D4 in equation 1) from front oscillator 4 of automobile 3 to coordinate location (X_{22},Y_{22}) of vehicle 22, as well as coordinate location (X_{22},Y_{22}) itself, are determined by satisfying equations 1 through 5, reflected below. (*Id.* at ¶¶0027-0029, 0033 (EX1004)).

[0028]

$$(X_4 - X_{22})^2 + (Y_4 - Y_{22})^2 = D_4^2 \qquad (1)$$

$$(X_5 - X_{22})^2 + (Y_5 - Y_{22})^2 = D_5^2 \qquad (2)$$

[0029]

$$(X_6 - X_{22})^2 + (Y_6 - Y_{22})^2 = D_6^2 \qquad (3)$$

$$D_4 + D_5 = (T_1 - T_0) V \qquad (4)$$

$$D_5 + D_6 = (T_2 - T_0) V \qquad (5)$$

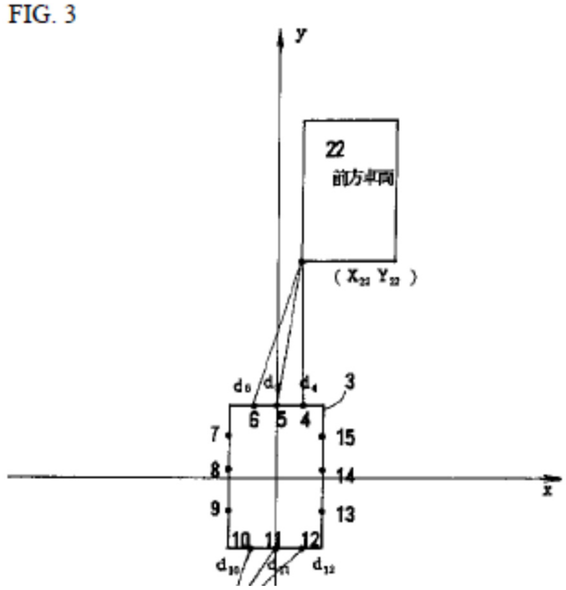
122. One of ordinary skill in the art would have understood that microcomputer 18 uses triangulation to satisfy equations 1 through 5. This is

because equations 1 through 3 use Pythagorean's theorem, which is a known geometric calculation that uses triangulation.

123. One of ordinary skill in the art would have further understood that microcomputer 18 determines whether it can triangulate. For example, for microcomputer 18 to satisfy equations 1 and 2 (and thereby triangulate), microcomputer 18 needs an oscillator reception time (*e.g.*, T_1) and ultrasound transmission time (*e.g.*, T_0) to solve the time difference ($T_1 – T_0$) of equation 4 and use the solved result of equation 4 in equations 1 and 2. (*JP '265* at ¶¶0027-0033 (EX1004)). One of ordinary skill in the art would have therefore understood that microcomputer 18 determines whether it can triangulate when it determines whether it has received necessary reception and transmission time values and is capable of satisfying equations 1 through 2.

124. Additionally, *JP '265* shows distance d4 from front oscillator 4 of automobile 3 to coordinate location (X_{22},Y_{22}) of vehicle 22 in Figure 3, illustrated below.

FIG. 3



125. As noted above, the distance d4 and coordinate location (X_{22},Y_{22}) are determined by microcomputer 18 satisfying equations 1 through 5. (*JP '265* at ¶¶0027-0029 (EX1004)). One of ordinary skill in the art would have understood that the distance d4 (shown as D4 in equation 1) is an actual perpendicular location from automobile 3 to vehicle 22. This is because the distance D4 is satisfied by solving equation 1 (shown above), which reflects a Pythagorean's theorem calculation. When the coordinate location (X_{22},Y_{22}) of vehicle 22 is perpendicular to the location of oscillator 4 (X_4,Y_4), solving for D4 in equation 1 (which reflects the distance between locations (X_4,Y_4) and (X_{22},Y_{22})) renders D4 as a perpendicular distance from automobile 3 to vehicle 22 because D4 must form a right angle with the front of automobile 3 to comply with equation 1. *JP '265* therefore teaches that microcomputer 18 determines an actual perpendicular distance to vehicle 22 with respect to automobile 3.

126. Additionally, since coordinate location (X_{22},Y_{22}) is determined by microcomputer 18 satisfying equations 1 through 5, one of ordinary skill in the art would have understood that microcomputer 18 determines a location of vehicle 22 with respect to automobile 3. (*Id*. at ¶¶0027-0029 (EX1004)).

127. Thus, *JP '265* teaches wherein the control module determines whether it can triangulate and calculates an actual perpendicular distance to the object and location of the object with respect to the vehicle, as recited in claim 25.

7. Claim 26 is obvious in view of *JP '265*

a) "The system of claim 21, wherein the control module includes a means for detecting a slow moving object."

128. *JP '265* teaches the limitations of claim 26. Microcomputer 18 performs the function of detecting objects because it calculates the "distance and direction from the automobile 3 to an obstacle that exists in the surrounding environment." (*JP '265* at ¶0018 (EX1004)). To the extent that any sufficient structure is disclosed in the '803 patent that corresponds to the control module of claim 26, *JP '265* at least teaches a similar structure or renders it obvious. (*Id*. at ¶¶0016-0019; Figure 1 (EX1004)).

129. *JP '265* teaches that the detected objects may be slow moving. For example, *JP '265* discloses that objects are detected because the distance and direction to obstacles (*i.e.*, objects) in the environment around automobile 3 are calculated. (*Id*. at ¶0018 (EX1004)). Obstacles may include, for example, another

automobile. (*Id*. at ¶0002 (EX1004)). One of ordinary skill in the art would have understood that obstacles may also include people who are located around automobile 3.

130. Further, one of ordinary skill in the art would have understood that obstacles around an automobile, such as other automobiles and people, can be slow moving. This is because in various driving environments, surrounding automobiles may be required to drive slowly to abide with traffic laws or avoid other vehicles. Additionally, people usually travel at speeds slower than automobiles, and are often present in automobile surroundings when walking at slow speeds at crosswalks or on sidewalks next to the automobile, for example. In such cases, one of ordinary skill in the art would have understood that when detected by microcomputer 18, these other automobiles and people would have been slow moving objects.

131. Thus, *JP '265* teaches a control module that includes a means for detecting a slow moving object, as recited in claim 26.

8. Claim 27 is obvious in view of *JP '265*

a) "The system of claim 21, wherein the control module includes a means for detecting a stationary object proximate to the vehicle."

132. The microcomputer 18 of *JP '265* teaches a means for detecting a stationary object proximate to the vehicle, for analogous reasons as to why it teaches the means for detecting slow moving objects in claim 26.

133. Furthermore, *JP '265* teaches that the detected objects may be stationary and proximate to a vehicle. For example, *JP '265* discloses that that objects are detected because the distance and direction to obstacles (*i.e.*, objects) in the environment around automobile 3 are calculated. (*JP '265* at ¶0018 (EX1004)). Obstacles may include, for example, a tree by the side of the road, a building, or a billboard. (*Id*. at ¶0002 (EX1004)). One of ordinary skill in the art would have understood that a tree by the side of the road, buildings, and billboards are stationary objects, and when located in an automobile surroundings, are proximate to the automobile.

134. Thus, *JP '265* teaches a control module that includes a means for detecting a stationary object, as recited in claim 27.

D. Ground IV: Claim 24 is rendered obvious by JP ’265 and Cherry

9. Claim 24 is obvious in view of JP ’265 and Cherry

a) “The system of claim 21, wherein the control module includes a built-in-test function which sequentially commands each transmitting device to transmit a signal, detects a return of the signal and sends a signal representative of said return to the control module for system verification.”

135. The combination of JP ’265 and Cherry teaches this limitation. Cherry discloses an object detection system for a vehicle that includes a built-in, self-test operation. (Cherry at 1:61-64 (EX1005)). Cherry*’s* built-in-test function commands each transmitting device to transmit a signal, detects a return of the signal and sends a signal representative of the return to the control module for system verification.

136. For example, Figure 2 of Cherry discloses a transmitting device 14 and a receiving device 16. (*Id*. at Figure 2 (EX1005)). A controller 30 commands the transmitting device to transmit a signal. (*Id.* at 2:60–66 (“the controller 30 controls the transmitter 14 to emit an object detection signal….”) (EX1005)). The receiving device 16 detects a return of a signal transmitted by the transmitting device to 14. (*Id.* at 2:36–40 (EX1005)). Figure 2 shows communications between the transmitting and receiving devices 14, 16, and the controller 30. (*Id*. at Figure 2; (EX1005)). The controller 30 of Cherry is a “control module.”

137. In use, the "controller 30, for example a microprocessor, coordinates and controls the operation of the transmitter 14 and the receiver 16 to alternate the system between a self test mode and an obstacle detection mode." (*Id*. at 2:53–56 (EX1005)). The self-test in Cherry is a "built-in-test function," as claimed because the controller 30 is built into Cherry*'s* system and coordinates the test. (*Id*. at 2:53–56; Figure 2 (EX1005)). During the test, the receiving device 16 of Cherry detects a return of a signal and sends a signal representative of the return signal to the controller, which then makes a determination regarding system verification. (*Id*. at 3:11–13 ("A determination is then made as to whether the receiver 16 has received pulse reflections from the ground within a predetermined verification period (step 304);" 3:42–59; Figure 2 (EX1005)). In particular, Cherry discloses that "[o]nce the receiver receives a signal reflected from the ground surface, an indication is provided that the system is in a ready or operable state." (*Id*. at 2:2–4 (EX1005)). The controller in Cherry then "adjusts the receiver gain and signal detection threshold so that signals reflected from the ground surface are effectively ignored and only signals reflected from significant objects in the path of the vehicle are detected." (*Id.* at 2:5-9 (EX1005)). FIG. 5 of Cherry illustrates how "the monitored zone is increased to a self test zone area 60 during the self test mode so that minor reflections from the ground may be received by the receiver 16, and decreased to an obstacle detection zone area 62 during the obstacle

detection mode so that reflections from the ground are effectively ignored by the receiver." (*Id.* at 4:7–13; Figure 5 (EX1005)).

138. Cherry does not explicitly disclose that the built-in-test function sequentially commands multiple transmitting devices to conduct the test because Cherry*'s* system uses only one transmitter and receiver pair. However, the reason that Cherry performs the self test is so that "only larger reflected signals from objects or obstacles of interest will be detected" and "small reflected signals from the transmitter pulse, including those from small ground irregularities," will be rejected. (*Id*. at 3:42–51 (EX1005)).

139. Given the similarities in structure, objectives, and operation between JP '265 and Cherry, one would have been motivated to include the self-test features of Cherry with the object detecting system of JP '265 for the following reasons. First, this combination would have provided the benefits disclosed by Cherry, including the ability to reject signals caused by small ground irregularities, while focusing on objects that are most important to detect.

140. One of ordinary skill in the art would have appreciated that eliminating signals from small ground irregularities is applicable to systems that include one transmitter and receiver, *and* systems that include multiple transmitters and receivers. The goal is the same in both systems - detect objects that pose danger to the vehicle, while not providing false alarms for small ground

irregularities that do not pose a danger. Thus, one of ordinary skill in the art would have been motivated to modify JP ’265 to include the self-test features of Cherry for similar reasons, for example, to provide a system that focuses on the objects of interest while ignoring small ground irregularities.

141. Further, JP ’265 discloses that transmitting oscillators 5, 8, 11, and 14 need not transmit their pulses simultaneously. *(*JP ’265 at ¶0025 (EX1004)). The timing of when pulses are transmitted by transmitting oscillators 5, 8, 11, and 14 may be different. *(Id.* (EX1004)). One of ordinary skill in the art would have therefore understood that since transmitting oscillators 5, 8, 11, and 14 may transmit pulses at different times that are not simultaneous, transmitting oscillators 5, 8, 11, and 14 may be sequentially activated to send pulses sequentially. One of ordinary skill in the art would have further understood that since the operation of JP ’265 at least suggests sequentially activating transmitting oscillators 5, 8, 11, and 14, incorporating the self-test operation of Cherry would similarly have involved activating transmitting oscillators 5, 8, 11, and 14 sequentially. For example, transmitting oscillator 5 and its corresponding receiving oscillators 4 and 6 would perform the self-test first, followed by transmitting oscillator 8 and its corresponding receiving oscillators 7 and 9, followed by each additional transmitting oscillator and its corresponding receiving oscillators.

142. Cherry discloses to use various types of detection signals, including "an ultrasonic pulse signal, infrared signal or other like radiation signals," for example. (Cherry at 2:62–63 (EX1005)). JP '265 discloses that its transmitting oscillators 5, 8, 11, and 14 are ultrasonic transmitters that transmit ultrasonic pulses. *(*JP '265 at ¶0025 (EX1004)). Therefore, one of ordinary skill in the art would have understood how to implement the self-test process of Cherry in the system of JP '265 because both utilize ultrasonic pulses. Moreover, modifying JP '265 to include the self-test features of Cherry was well within the abilities of one of ordinary skill in the art and would have been accomplished with a reasonable chance of success. Doing so would have required only minor hardware and/or software modifications to microcomputer 18 of JP '265 because both Cherry and JP '265 already utilize ultrasonic pulses.

143. One of ordinary skill in the art would have known that the process of modifying *JP '265* to include the self-test features of Cherry was simply a matter of incorporating Cherry*'s* software/firmware functions into *JP '265's* microcomputer 18. According to Cherry, "[a] controller 30, for example a microprocessor, coordinates and controls the operation of the transmitter 14 and the receiver 16 to alternate the system between a self test mode and an obstacle detection mode." (Cherry at 2:51-54 (EX1005)). One of ordinary skill in the art would have recognized that adding Cherry*'s* software/firmware to microcomputer

18 would have controlled *JP '265's* oscillators so that they are operated in accordance with Cherry*'s* self-test routine. Other small modifications that would have been needed to implement Cherry*'s* testing functionality in JP '265 would have been well known in the art.

144. Accordingly, the combination of JP '265 and Cherry teaches the claimed control module that includes a built-in-test function which sequentially commands each transmitting device to transmit a signal, detects a return of the signal and sends a signal representative of said return to the control module for system verification, as recited in claim 24.

VII. AVAILABILITY FOR CROSS-EXAMINATION

145. In signing this declaration, I recognize that the declaration will be filed as evidence in a contested case before the Patent Trial and Appeal Board of the United States Patent and Trademark Office. I also recognize that I may be subject to cross examination in the case and that cross examination will take place within the United States. If cross examination is required of me, I will appear for cross examination within the United States during the time allotted for cross examination.

VIII. RIGHT TO SUPPLEMENT

146. I reserve the right to supplement my opinions in the future to respond to any arguments that the Patent Owner raises and to take into account new information as it becomes available to me.

IX. JURAT

147. I declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code.

Dated: May 3, 2017

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Summary

Automotive Electronics Engineer, Consultant, Expert. Also a Car Guy/Racer, Technology Angel Investor, and Musician. I have more than 40 years involved with hands-on design, development, testing, manufacturing, and technical marketing of Automotive Electronics Components & Systems for both OEM and Aftermarket. Over this period, I have worked on nearly every electronic system used in vehicles. Also have experience with Consumer Electronics Products, Medical Devices, Musical Effects, Voice Recognition/Dialogue, and Automotive Cybersecurity testing and solutions.

Employment/Contractor Experiences

M.H. KITCHEN - 1986 - Present (www.tech4cars.com)

Owner/Principal of consulting practice specializing in Vehicle Electronics, Consumer Electronics, Medical Devices, and more. Have fun and make a living applying my years of technology experience to hardware and software design, manufacturing guidance, technical marketing, business development, intellectual property, and forensic investigative services for clients. See Employment/ Forensic/Consulting experience highlights below.

VISUAL THREAT - 2015 - Present (www.visualthreat.com)

Director, Business Development, Advisor to Company: Retained as consultant for this startup business developing Cyber Security solutions for Connected Vehicles. Work with design teams in Silicon Valley, and Shanghai China to define, develop, and deploy a security framework consisting of a proprietary smart firewall, wirelessly connected to a Cloud Platform and Portal to monitor, learn, analyze, all in-vehicle network traffic to automatically detect anomalous activity. Security policies can be modified and deployed Over-The-Air in real-time to identify and stop any unauthorized intrusions. Company also provides Penetration Testing devices and services for vehicles, systems, and modules, and analyzes mobile apps for vulnerabilities. Working with vehicle OEMs, Tier 1/2/3 Vendors, Fleets, and Testing Services providers. Actively serve on the SAE J3061 Cybersecurity committee.

SPEAK WITH ME - 2007 - Present (www.speakwithme.com)

Investor/Shareholder/Contractor Consultant: Advise this Silicon Valley startup, developing an advanced software platform for natural-language, dialogue management, combining voice recognition and other modalities in a seamless, highly accurate and responsive, scalable hybrid (client/server) User Interface applicable for Autos, SmartPhones, and other Consumer Electronics. This solution employs advanced Deep Learning, Neural Network technology to recognize conversational speech, and emotional expressivity. Consult and assist management on automotive, consumer and business strategy matters. Company currently engaged with a high-end auto manufacturer for an upcoming deployment of this advanced technology. Company also in active discussions with several other auto manufacturers, and customers.

SAFETYMATE INC. - 2004 - 2009 (www.dcsafety.com)

Investor/Shareholder/Contractor Consultant Served as Director of Product Development for this award-winning, start-up Medical Device/Software firm. Directed development, tooling, and manufacturing of hardware, software, and other intellectual property for interactive, multi-lingual, life-saving emergency information products for medical emergencies. SafetyMate acquired in 2015 by DC Safety. Act as consultant/advisor to DC Safety (www.dcsafety.com).

QUANTIC INDUSTRIES INC. - 1993 - 1997 (www.psemc.com)

Part Owner/Employee /Vice President, Automotive Marketing - While consulting for this electronics/pyrotechnics firm, participated in a management LBO of this privately-held Aerospace/ Defense firm, and directed Engineering and Marketing to focus on Automotive energetic devices as used in Airbag, and Seatbelt Pretensioner products. Successfully built the automotive business and sold company as two separate entities to both Nippon Kayaku, and Pacific Scientific in 2001.

ZEMCO GROUP INC - 1981 - 1986 (www.dunyoung.com)

Employee /Vice President , Marketing & Vice President, Product Development.. Helped take this aftermarket trip computer pioneer, started by a former Mattel toy designer, from retail accessories to OEM Automotive supplier. Company developed, and manufactured cruise controls, trip computers, security systems, compasses, and many other automotive electronic devices. Company ultimately acquired by shareholder LITEON, and is now DunYoung/LITEON Automotive Corp.

INTEL CORP - 1980 - 1981 (www.intel.com)

Employee /Director, Automotive Marketing: Specifically recruited to direct this renowned semiconductor manufacturer's marketing efforts in penetrating the automotive electronics O.E.M market with standard and custom microprocessors, and memory devices. Key member of custom 8061 engine control processor development team (for Ford EEC-IV). Successfully repaired a key business relationship with Delco Electronics (now Delphi).

NATIONAL SEMICONDUCTOR INC. - 1978 - 1980 (www.ti.com)

Employee /Director, Automotive Marketing: Helped take this semiconductor manufacturer's market share in automotive from 0 to #2 in just two years with a wide range of semiconductor products, including analog, digital, custom ASIC, memory, I/O, opto-electronics, micro-controllers, and other devices.   National acquired in 2011 by Texas Instruments.

MOTOROLA INC. 1973 - 1978 (www.conti-online.com)

Employee Automotive Products Division: Product Marketing Manager, and Design/Project Engineer. Provided technical marketing support for underhood automotive electronic products, including advanced engine controls (Ford EEC-III). Designed and developed Aftermarket and OEM automotive electronic ignition systems, and diagnostic test equipment. Got to meet and work directly with Bob Galvin and Elmer Wavering, industry pioneers. Motorola's Automotive business segment was acquired by Continental in 2006.

Education/Qualifications

Bachelor of Science in Electrical Engineering - University of Kentucky, 1973

Associate Degree in Electronic Engineering Technology- University of Cincinnati, 1971

also 44 hours completed toward Masters of Business Administration - Northern Illinois University, 1977

also 12 hours completed toward Masters of Science in Electrical Engineering- University of Kentucky, 1973

Post Graduate Courses:

Society of Automotive Engineers, Airbag TOPTEC, 1992

Member, Society of Automotive Engineers (SAE) - Lifetime Member

Member, Society of Automotive Engineers Cyber Security SAE J3061 Committee & Cyber Security Testing Sub Committee, Member Tire Pressure Monitoring Standards Committee SAE J2657

Bondurant School of High Performance Driving, 1984, 1985, 1986

Jim Russell School of Motor Racing, 1985

3-time Racing Champion, USRRC Seniors Tour, Under 2.0 litre GT Class 1994, 1995, 1996

Performance Driving Instructor - Ferrari Club of America, Shelby American Automobile Club

Expert/Forensic Highlights

- Expert retained by Plaintiff Counsel for patent/IP matter involving design features in Automotive rear seat video entertainment products. Serve as expert for both infringement/non-infringement, and validity/invalidity in this matter involving cross complaints between the parties. Current case.

- Expert for Plaintiff Counsel in case involving popular Electric Luxury Vehicle. Retained to investigate alleged faults related to the battery charging process, and claims that vehicle's usable range falls well below manufacturer's stated levels. Current case.

- Automotive Technology Expert advising a large Global Auto Manufacturer in their negotiation to acquire a large portfolio of patents from a Technology Supplier and a Non Practicing Entity. Engaged to help assess those patents applicable to Mobile and Vehicle technology applications. Completed patent technical assessment and received the following feedback. "The client was really happy with the final report and also your comments. R&D units have made comment that your comments were insightful and easy to understand."

- Expert for Plaintiff Counsel in fatality SUA event. Performed forensic vehicle inspection. Uncovered anomalies in EDR data. Case underwent change of counsel and ended.

- Expert for Defense Counsel in fatality rollover accident involving multiple events, including potential SUA of Plaintiff vehicle. Performed forensic analysis of Plaintiff vehicle components/systems. Deposed and prepared for trial. Case settled just prior to trial.

- Expert for Defense Counsel representing automotive component supplier in patent/IP matter regarding Automotive GPS system design features. Conducted research and identified prior art examples for counsel. Parties settled prior to trial.

- Expert for Plaintiff Counsel in case involving personal injury related to faults in the electronically controlled transmission shifter design and operation in popular luxury vehicles. Conducted forensic investigation, research of vehicle systems, testing, review of exemplar hardware and software, and recommendation of simple and cost-effective solutions to eliminate existing system hazards/deficiencies. Parties reached settlement.
- Expert for Plaintiff Counsel in Federal class action, and other venues regarding wrongful death, injury, and damages involving alleged Sudden Unintended Acceleration (SUA) in popular vehicles, including hybrid vehicles. Conducted forensic investigation, research, exemplar testing, and expert reporting on electronic throttle control systems, cruise controls, data recorders and more. Designed and built a custom 128 channel vehicle data acquisition system to monitor the vehicle ECU and systems to aid in this investigation. Deposed by opposing counsel. Retained in over 20 individual cases where settlements were reached.
- Expert for Defense Counsel representing a large luxury automobile manufacturer in patent litigation involving voice controlled media player features. Contributed to claim construction and definition phase of litigation. Case dismissed after favorable claim construction ruling.
- Expert in Federal copyright dispute involving artists royalty payments for the current and future delivery of media content to vehicles via Satellite Radio and Integrated Internet Connectivity in vehicles. Researched and forecasted trends in technology integration in future OEM vehicles as independent resource for another testifying expert.
- Expert for Defendant Counsel for auto dealer defendant in lawsuit alleging pre-sale faults in vehicle involving airbags. Conducted research, forensic investigation, and reporting. Defendant won dismissal based on my expert report.
- Expert for Plaintiff Counsel in unintended airbag deployment involving injury. Conducted forensic investigation and report confirming unintended inadvertent deployment. Parties settled case prior to trial.
- Expert for Defense Counsel representing several auto manufacturers and their suppliers as defendants in patent litigation for alleged infringement involving telematics products and features. Case involved non-infringement analysis, prior art research, and reporting. Case dropped after favorable claims construction ruling.
- Expert for Defense Counsel representing a specialized vehicle manufacturer/converter of accessible vans for handicap access in patent litigation involving automated control system and features for doors and ramps used in wheelchair access van conversions. Expert research and reporting for both non-infringement, and validity. Cross-complaints involved with both parties. Deposed by opposing counsel. Parties reached settlement just prior to trial.
- Expert for Defense Counsel for auto dealer defendant in fatality accident case in which vehicle's side airbags did not deploy. Investigated airbag sensors for proper installation as directed by the vehicle manufacturer's technical service bulletin. Determined that sensors had been properly installed as directed. Client won dismissal from case.
- Expert for Defense Counsel representing a major auto manufacturer defendant in patent litigation involving Tire Pressure Monitoring systems. Researched and identified prior art to subject patent. Case dropped after initial reporting.
- Expert for Defense Counsel representing a large luxury vehicle manufacturer in a patent/IP matter involving Adaptive Cruise Controls. Conducted document review, vehicle testing, and expert report on non-infringement. Client won summary judgment after initial expert reporting.

- Expert for Defense Counsel representing a regional water utility company defendant in wrongful death case due to a drowning near an irrigation pumping station in a river. Work included forensic investigation, research, reporting, deposition, and testimony at trial. Client won jury trial case.

- Expert for Defense Counsel in murder trial involving automotive electronics. Researched and reported on the effects of water and decreasing voltage over time on automatic vehicle occupant restraint system in submerged vehicle. Work included forensic research, testing and demonstration of exemplars, technical reporting, deposition and testimony at jury trial. The defendant, a law enforcement officer, won acquittal.

Technical Due Diligence

- In 2009, was retained by an international investor group including a large Chinese auto manufacturer and U.S. Investment Banking Group to research and provide technical due diligence on potential North American automotive electronic system and component supplier acquisition candidates.

- In 2002, was retained by Blackstone Group (www.blackstone.com) to perform technical due diligence during their $4.7 Billion acquisition of TRW Automotive (www.trw.com), which was the largest private equity purchase of that year.

- In 2000, was retained by Magneti Marelli (www.magnetimarelli.com) to research and identify potential acquisition candidates in the areas of Fuel Injection/Engine Control ECUs, Interior and Exterior Lighting Modules, Instrument Panel/Navigation products, and Suspension modules.

- In 1989, was retained by LITEON Group's Automotive Division (www.dunyoung.com) to conduct research and technical due diligence for a potential acquisition of a North American automotive electronics components supplier.

- In 1987, was hired by Thomson CSF (now Thales Group, www.thalesgroup.com) to identify, research, and report on an initial list of 100 firms involved with advanced automotive electronic technologies as potential acquisition candidates. This list was then jointly pared to 20, and then 4, which Thomson engaged in acquisition discussions.

Consulting Project Highlights

- Consulting for diagnostic tool designer/manufacturer. Assisting this vendor of specialized automotive electronic/diagnostic tools in the development and support for advanced wiring harness adapters, adapter cables, and specialized electronic electronic diagnostic equipment products for vehicles and markets. (strategictq.com)

- Retained by haptics technology developer and licensor, Immersion Corp (www.immersion.com), to conduct a global market research assessment of the market for haptics applications within vehicles, and worked with their team to focus on specific applications to develop new business. Immersion developed the technology behind BMW's, programmable iDrive knob, and has also developed touch-feedback for touchscreen applications.

- Hired by vision technology start-up, Canesta Corp.,(acquired by Microsoft, http://en.wikipedia.org/wiki/Canesta) to review their in-house design of a multi-technology vision sensor system targeted at automotive applications such as occupant detection, blind-spot assist, and more. Reviewed and revised their hardware designs to meet automotive environments, and assisted in providing ruggedized prototypes for vehicle testing.

- Worked with electric and PHEV vehicle charging equipment start-up Coulomb Technologies (www.chargepoiont.com) to provide engineering services involving the communication between Coulomb's proprietary charging station network, and on-board vehicle CAN networks, to enable advanced user features. Also, assisted this firm with business development efforts with a major Tier-1 supplier in Detroit.

- Consulted for Silicon Valley startup, Unistar Technology during the development of a patented Automatic Sun Visor system. This innovative product utilized a sensor measuring the angle of the sunlight as compared to the driver's position to keep a small, moving visor that travelled around the headliner between the driver's eyes and the bright sun. A prototype was developed for a concept vehicle for Magna Corp. (see video at https://www.dropbox.com/s/h5t2hb8yj3xhg8z/Unistar%20AutoVisor.mp4?dl=0).

- Engaged by Bay Area startup Joalto Design to redesign and build a ruggedized wireless electronic control system for an innovative, patented rotary drop car door design (see https://www.youtube.com/watch?v=4wniuMn-JVU). Our design was used in the production of multiple operational displays and prototype vehicles. Joalto Design later became JATECH LLC and relocated to the Detroit area.

- Retained by wiring harness and electronics supplier, Yazaki Corp. (www.yazaki.com), to study and forecast the emerging global market for hybrid, PHEV, electric, and fuel-cell vehicles, with an emphasis on the technical requirements for DC-to-DC converters, and other specialized electronics these vehicles may require.

- Contracted by GPS pioneer, Trimble Navigation (www.trimble.com), for multiple assignments. First, to research, assess, and propose how Trimble should approach the "12 Volt Aftermarket" with vehicle tracking products targeted for aftersale distribution, fleet users, and value-added distributors. Second, to conduct an engineering assessment of their product design for potential OEM applications. And third, as a contract engineering resource to design, develop and transfer to off-shore manufacturing, an integrated module enabling their stand-alone Trimtrac product to be permanently installed in a vehicle.

- Contracted by Trimble Navigation customer, Numerex Corp. (www.numerex.com), to design and source a custom vehicle interface module for the Trimble Trimtrac incorporating proprietary features for Numerex.

- Engaged by LITEON Automotive Corp. as consultant, managing the U.S. Technical and Businesss Liaison with customer Rosen Products for the off-shore contract manufacture of rear seat video entertainment systems for the automotive OEM and Aftermarket, and for custom police car video systems for Rosen. Involved with system design for Automotive requirements, ease of manufacturing, and to meet performance and cost objectives.

- Engaged by Alps Automotive (www.alpsautomotive.com) for multiple assignments. Contracted to design a stand-alone, self-compensating, flux-gate compass engine meant for use as an external sensor for multiple applications, including vehicle navigation, industrial controls, mobile antenna positioning, and more. This included development of proprietary, patented features assigned to Alps, and support during the patent process. Also, researched, and specified a family of on-board vehicle control modules communicating over CAN as a line of standard products.

Advisor Roles

- Advisor to SpeakWithMe (www.speakwithme.com), a startup platform/services provider which adds a Dialogue Manager, and User Interface Modality management to applications where voice is an important input to other user commands, gestures, or inputs. Company has Client, Server, and Hybrid Client/Server solutions for Consumer, Automotive, and other markets/applications.

- Advisor to SeeControl Inc. (www.seecontrol.com), a start-up software platform provider of Machine-to-Machine (M2M) applications used for asset tracking, remote control and reporting, and business integration of widespread resources, assets, and personnel. SeeControl acquired by Autodesk (http://autodeskfusionconnect.com) in 2015.

- Advisor to VisualThreat (www.visualthreat.com), a startup developing security applications, cloud services, and a CAN Bus firewall for mobile devices and connected vehicles to circumvent/prevent vehicle "hacking" intrusions. Allows manufacturers/owners/users to be able to identify and track any unauthorized "data leaks" from their mobile devices and/or connected vehicles, and to minimize risk of wireless remote hacking into vehicle systems. Company also provides Penetration Testing services for vehicles, systems, modules, and apps.

Publications/Articles/Events

- Speaker at Western Automotive Journalists (WAJ) event October, 2016 at the Silicon Valley Computer Museum. The presentation titled, "Do You Trust Your Vehicle's Software?", addressed Safety and Cybersecurity issues for connected and autonomous vehicles.

- Speaker at Silicon Valley Auto Tech Council (www.autotechcouncil.com) event, "Connected Vehicle Security", identifying connected vehicle vulnerabilities, and presenting startup Visual Threat and their connected vehicle security solution consisting of a CAN bus firewall, Secure Cloud Storage element, and companion mobile app. December 12, 2014

- Speaker for Auto Hack Silicon Valley Meetup, "Autonomous Vehicles, What Could Possibly Go Wrong?", May 7, 2014.

- Moderator for Panel Discussion for Silicon Valley Auto Tech Council event, "Autonomous Vehicle - Panel: Under the Hood", April 11, 2014.

- Speaker for American Bar Association Webcast Meetup, "Autonomous Vehicles, What Could Possibly Go Wrong?, Jan 22, 2014.

- Speaker at "Sports and Lifestyle and Auto Technologies" event, for Thomas Weisel Partners.

- Telematics Update - Authored article for Telematics Update 2005 conference, "Conference Report – Navigation 2005 Navigation on the Move!"

- Telematics Update - Authored article for Telematics Update 2004 covering Navigation conference, San Jose, CA.

- Hosted Panel Discussion for Telematics Update Navigation 2004 Event on User Interfaces for Navigation/Telematics devices.

- Hosted Panel Discussion for Telematics Update Las Vegas 2005 Event on Storage Technologies for Telematics devices, FLASH vs. Auto-Grade Disk Drives.

- Between 2000 - 2005, retained by consulting firm, Prismark Partners LLC (www.prismark.com) to research and author a comprehensive annual review of the market and developments in Automotive Electronics (including semiconductors), for their annual "Electronics Industry Report" publication, a "coffee table" type book provided by Prismark to their clients and Fortune 100 CEOs.

- Architect, researcher, and co-author of an extensive multi-client study of the Automotive Electronics Market between 1988-1995, for Dataquest Inc. This was the first such study to create a multi-level, searchable forecast database by vehicle type, platform, make & model, forecasting to the individual electronic module level used on each vehicle, and further to the individual type of integrated circuits and components used in each module. This project eventually spun out of Dataquest to become Tier One, an independent automotive data research firm.