

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

TESLA, INC.,

Petitioner

v.

CHARGELOGIC LLC,

Patent Owner

Inter Partes Review Case No. IPR2026-00379

U.S. Patent No. 11,508,996

DECLARATION OF SCOTT ANDREWS

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CLAIM LISTING

Claim Designation	Claim Language
Claim 1[Pre]	A vehicle alignment system for an inductive vehicular battery charger having a first core movable with respect to a second core to charge a battery of a vehicle, the vehicle alignment system comprising:
Claim 1[a]	a controller; and
Claim 1[b]	a display mounted within the vehicle, oriented for view by a user seated in the vehicle, and coupled to the controller;
Claim 1[c]	wherein the controller is configured to:
Claim 1[c(i)]	detect a first positional relationship between the first core and the second core at a first time,
Claim 1[c(ii)]	detect a misalignment of the first core with respect to the second core based at least in part on the first positional relationship between the fir[st] core and the second core,
Claim 1[c(iii)]	in response to detecting the misalignment, disable at least one user control on the display usable to control the inductive charging of the battery,
Claim 1[c(iv)]	detect a second positional relationship between the first core and the second core at a second time occurring after movement of the vehicle,
Claim 1[c(v)]	detect an alignment of the first core with respect to the second core within a threshold based at least in part on the second positional relationship between the first core and the second core,
Claim 1[c(vi)]	in response to detecting the alignment, enable the user control on the display, and
Claim 1[c(vii)]	in response to receiving a selection of the user control, initiate inductive charging via the first core and the second core.
Claim 2	The vehicle alignment system of claim 1, wherein the second core is part of a pad over which the first core is movable.
Claim 3	The vehicle alignment system of claim 1, wherein the controller is configured to detect the first positional relationship between the first core and the second core based at least in part on detection of a magnetic field.

Claim Designation	Claim Language
Claim 4	The vehicle alignment system of claim 1, wherein the controller is further configured to, in response to detecting the misalignment, generate an indicator for display on the display, the indicator indicating a direction of movement of the vehicle for improved alignment of the first core with respect to the second core.
Claim 5	The vehicle alignment system of claim 4, wherein the indicator comprises an arrow indicating the direction of movement.
Claim 6	The vehicle alignment system of claim 4, wherein the controller is configured to generate the indicator in a position relative to a graphical representation of at least part of the vehicle displayed on the display.
Claim 7[Pre]	A method of charging a battery of a vehicle, the method comprising:
Claim 7[a]	detecting a positional relationship between a first core on the vehicle and a second core in a location exterior to the vehicle, the first and second cores enabling induction charging of the battery when sufficiently aligned with respect to one another;
Claim 7[b]	detecting a misalignment of the first core with respect to the second core based at least in part on the positional relationship between the first core and the second core; and
Claim 7[c]	in response detecting the misalignment of the first core with respect to the second core, disabling a user control displayed on a display for controlling the induction charging of the battery.
Claim 8	The method of claim 7, further comprising, in response to detecting the misalignment of the first core with respect to the second core, generating an indicator for display on the display, the indicator indicating a direction of movement of the vehicle for improved alignment of the first core with respect to the second core.
Claim 9	The method of claim 8, wherein the indicator comprises an arrow indicating the direction of movement.

Claim Designation	Claim Language
Claim 10	The method of claim 8, wherein the indicator is displayed in a position relative to a graphical representation of at least part of the vehicle displayed on the display.
Claim 11	The method of claim 7, wherein the second core is part of a pad over which the first core is movable.
Claim 12[Pre]	The method of claim 7, wherein the positional relationship is a first positional relationship and further comprising:
Claim 12[a]	detecting a second positional relationship between the first core on the vehicle and the second core after detecting the first positional relationship,
Claim 12[b]	detecting an alignment of the first core with respect to the second core based within a predetermined threshold at least in part on the second positional relationship, and
Claim 12[c]	in response detecting the alignment misalignment of the first core with respect to the second core, enabling the user control.
Claim 13	The method of claim 12, further comprising, in response to receiving a selection of the user control, initiating induction charging via the first core and the second core.
Claim 14	The method of claim 7, wherein the display is mounted within the vehicle.
Claim 15[Pre]	A method of charging a battery of a vehicle, the method comprising:
Claim 15[a]	detecting a positional relationship between a first core on the vehicle and a second core in a location exterior to the vehicle, the first and second cores enabling induction charging of the battery when sufficiently aligned with respect to one another;
Claim 15[b]	detecting an alignment of the first core with respect to the second core within a predetermined threshold based at least in part on the positional relationship between the first core and the second core; and

Claim Designation	Claim Language
Claim 15[c]	in response detecting the alignment of the first core with respect to the second core, enabling a user control displayed on a display for controlling the induction charging of the battery.
Claim 16[Pre]	The method of claim 15, wherein the positional relationship is a first positional relationship and further comprising:
Claim 16[a]	detecting a second positional relationship between the first core on the vehicle and the second core before detecting the second positional relationship;
Claim 16[b]	detecting a misalignment of the first core with respect to the second core based at least in part on the second positional relationship between the first core and the second core; and
Claim 16[c]	in response detecting the misalignment of the first core with respect to the second core, disabling the user control displayed on a display for controlling the induction charging of the battery.
Claim 17	The method of claim 16, further comprising providing information indicative of the second positional relationship to a user seated within the vehicle.
Claim 18	The method of claim 16, further comprising providing information indicative of the misalignment to a user seated within the vehicle.
Claim 19	The method of claim 16, further comprising providing information indicative of changes of position of the vehicle with respect to the second core to a user seated within the vehicle.
Claim 20	The method of claim 15, further comprising initiating induction charging via the first core and the second core in response to receiving a selection of the user control.

I, Scott Andrews, declare as follows:

I. INTRODUCTION

1. I have been retained by counsel for Petitioner as a technical expert in the above-captioned case. Specifically, I have been asked to render certain opinions regarding the IPR petition with respect to U.S. Patent No. 11,508,996 (“the ’996 Patent”). I understand that the Challenged Claims are 1-20, and my opinions are limited to those claims. A true and correct copy of my Curriculum Vitae, which provides further details about my background and experience, is appended to this Declaration.

A. Educational Background and Professional Experience

2. My current curriculum vitae is attached as Exhibit A, which includes a detailed listing of my education, work experience, honors, awards, professional associations, publications, and a list of my expert consulting activities during the past five years in which I have testified as an expert at deposition or trial.

3. I have over 30 years of professional experience in the field of electronics, mobile information technology, and communication systems. Further, I have authored numerous published technical papers and am a named inventor on 13 U.S. and foreign patents.

4. I received a Bachelor of Science degree in Electrical Engineering from University of California, Irvine in 1977 and a Master of Science degree in Electronic Engineering from Stanford University in 1982.

5. From 1977 to 1979, I worked at Ford Aerospace where I designed, tested and delivered microwave radar receiver systems. From 1979 to 1983, I worked at Teledyne Microwave, where I developed high reliability microwave components and developed CAD tools. From 1983 to 1996, I worked at TRW, Inc., having held various positions. From 1983 to 1985, I was a Member of the technical staff and a Department Manager in the Space Electronics sector. Between 1985 and 1990 I was a project manager working on various communications systems projects including the US DoD Advanced Research Projects Administration (ARPA) MIMIC Program. Between 1990 and 1993 I was the Manager of MMIC (monolithic-microwave-integrated-circuit) Products Organization. In this role, I developed business strategy and managed customer and R&D programs. During this time, I also developed the first single chip 94 GHz Radar, used for automotive cruise control and anti-collision systems. In 1993, I transferred to the TRW Automotive Electronics Group, and managed about 30 engineers in the Systems Engineering and Advanced Product Development organization. In this role, I managed advanced development programs such as electronic and electrohydraulic steering systems, automotive radar, adaptive cruise control, occupant sensing, automatic crash notification systems, in-vehicle

information systems, vehicle user interfaces, and other emerging transportation products.

6. I was employed as a Project General Manager in the Electronics Division of Toyota Motor Corporation at Toyota headquarters in Toyota City, Japan from April 1996 to around April 2000. In this position, I was responsible for leading the development of vehicle telematics systems, infotainment systems, including onboard and off-board navigation systems, traffic information systems, vehicle communications systems, safety applications, and automated vehicle control systems. This work also included advanced parking management systems wherein parking lot sensors would be used to identify open parking places that could then be communicated to drivers via the connected vehicle information system.

7. I am currently a consultant for Cogenia Partners, LLC, focusing on systems engineering, business development and technical strategy supporting automotive and information technology. I have been in this position since 2001. In one of my active engagements, I serve as the technical lead on a project funded by the National Highway Traffic Safety Administration (NHTSA) to develop requirements for connected vehicle safety systems in preparation for NHTSA regulations governing such systems. I also serve as a technical consultant on multiple projects sponsored by the Federal Highway Administration (FHWA) related to connected vehicle technology research. One project on which I was the chief systems

engineer was a truck parking information and reservation system. In this system, truck drivers were provided information on available parking at truck stops along the road ahead of their current location. The system would identify their hours of service, and recommend where they should stop to rest based on parking availability. The system included various techniques for sensing open truck parking places (including ultrasonic (sonar), infrared, and camera sensors), and allowed the driver to also potentially reserve a space. This project also explored mechanisms for truck electrification which is a technique for providing electric power to parked trucks to minimize the use of diesel fuel while parked and idling.

8. In 2003, working with two colleagues, I designed a prototype electric vehicle with the aim of providing a high-performance vehicle with extensive electronic features such as electronically controlled steering, suspension, in vehicle information systems and such. As part of this development effort, I also developed a patent related to how information in a highly integrated vehicle would be shared among the various electronic control units. This invention is described, in, among various other patents, U.S. Patent 7,802,263. Many of the features envisioned for this vehicle are now found in commercially available electric vehicles. As a result of this activity, I have a deep understanding of the architecture of electric vehicles, the limitations and characteristics of the powertrain and energy sources, and the various considerations associated with charging these vehicles.

9. I also worked on a user interface for a Ford EV concept car called the EVent. In this system I used a laptop computer screen in place of the instrument cluster of the car, and used a small touch pad located on the center console. The screens for the display included four soft button areas that corresponded to the four corners of the touch pad. Touching a corner of the touch pad then activated that button on the screen. This allowed the driver to activate different features, such as the audio system, the navigation system, the charge status, the HVAC systems, etc. without taking eyes off the road. I was subsequently awarded U.S. Patent number 5,864,105, titled Method and Apparatus for Controlling an Adjustable Device, based on the concept of the touch pad being used as a physical (shape) metaphor for the thing being controlled.

10. In the various positions mentioned above, I was responsible for research and development projects relating to numerous mobile and vehicle information systems, hybrid vehicles systems, vehicle networks, user interface systems, sensory systems, communications systems, control systems and safety systems, and had the opportunity to collaborate with numerous researchers and suppliers that are involved in the field of automotive control systems. I therefore believe that I have a detailed understanding of the state of the art during the relevant period, as well as a sound basis for opining how persons of skill in the art at that time would understand the technical issues in this case.

II. MATERIALS CONSIDERED

11. In forming my opinions, I have relied on my own knowledge and experience, including my education, training, and work experience in the field of electrical engineering, my experience in working with others in this field, and my experience in the design, development, and operation of relevant systems.

12. In developing my opinions, I have considered the following materials:

Exhibit	Description
1001	U.S. Patent No. 11,508,996 (the “’996 Patent”)
1002	File History of the ’996 Patent (the “’996 File History”)
1004	Japanese Application Publication 2006-74868 to Izuno et al. (“Izuno”)
1005	Japanese Application Publication H09-182212 to Minoshima et al. (“Minoshima”)
1006	U.S. Patent No. 5,701,222 to Canedy (“Canedy”)
1007	U.S. Patent Application Pub. No. 2002/0105549 to Yokota (“Yokota”)
1008	U.S. Patent No. 5,669,470 to Ross (“Ross”)
1009	U.S. Patent No. 5,821,731 to Kuki et al. (“Kuki”)
1010	U.S. Patent No. 6,657,555 to Shimizu et al. (“Shimizu”)
1011	Willett Kempton and Jasna Tomić. <i>Vehicle-to-grid power fundamentals: Calculating capacity and net revenue</i> . Journal of Power Sources. 2005. 144. pp. 268–279 (“Kempton”)
1012	Chan, C.C., <i>The State of the Art of Electric and Hybrid Vehicles</i> , February 2002, Vol. 90, No. 2, IEEE (“Chan”)
1013	<i>Electric Vehicle Battery Systems</i> , Sandeep Dhameja, Newnes, 2002 (“Sandeep”)
1014	Weed, R. <i>Electric Vehicles: Copper Applications in Electrical</i> . February 1998. (“Weed”)
1015	Mahmood, Nasrul Humaimi, et al. <i>Cableless battery charger using induction technique for electric vehicles</i> . Proceedings. Student Conference on Research and Development, 2003. SCORED 2003. IEEE, 2003. (“Mahmood”)

1016	Laouamer, R., et al. <i>A multi-resonant converter for non-contact charging with electromagnetic coupling</i> . Proceedings of the IECON'97 23rd International Conference on Industrial Electronics, Control, and Instrumentation. Vol. 2. IEEE, 1997. (“Laouamer”)
1017	Covic, Grant A., et al. <i>A three-phase inductive power transfer system for roadway-powered vehicles</i> . IEEE transactions on industrial electronics 54.6 (2007). (“Covic”)
1018	Esser, Albert. <i>Contactless charging and communication system for electric vehicles</i> . Conference Record of the 1993 IEEE Industry Applications Conference Twenty-Eighth IAS Annual Meeting. IEEE, 1993. (“Esser”)
1019	U.S. Patent No. 5,595,271 to Tseng (“Tseng”)
1020	Juby, Lee. <i>Inductive Coupling Mechanisms for Charging Electric Vehicles</i> . The University of Manchester (United Kingdom), 1998. (“Juby”)
1021	Kurs, Andre, et al. <i>Wireless power transfer via strongly coupled magnetic resonances</i> . Science 317.5834 (2007): 83-86. (“Kurs”)
1022	U.S. Patent No. 5,498,948 to Bruni et al. (“Bruni”)
1023	U.S. Patent No. 5,617,003 to Odachi et al. (“Odachi”)
1024	U.S. Patent No. 5,646,500 to Wilson (“Wilson”)
1025	U.S. Patent No. 5,703,461 to Minoshima et al. (“Minoshima-461”)
1026	U.S. Patent No. 7,084,859 to Pryor (“Pryor”)
1027	U.S. Patent No. 2,309,941 to Drummond (“Drummond”)
1028	U.S. Patent Publication No. 2003/0230443 to Cramer et al. (“Cramer”)
1029	U.S. Patent Application Pub. No. 2008/0221756 to Plishner (“Plishner”)
1030	U.S. Patent Application Pub. No. 2009/0040068 to Oyobe et al. (“Oyobe”)
1031	Brooks, Gage, <i>Integration of Electric Drive Vehicles with the Electric Power Grid – a New Value Stream</i> , EVS 18 Berlin, 2001 (“Brooks”)
1032	U.S. Patent Publication No. 2008/0312782 to Berdichevsky et al. (“Berdichevsky”)
1033	U.S. Patent No. 5,487,002 to Diller et al. (“Diller”)
1034	U.S. Patent No. 8,290,649 to Iwashita et al. (“Iwashita”)
1035	U.S. Patent Application Pub. No. 2010/0045239 to Oki (“Oki”)
1036	U.S. Patent Application Pub. No. 2009/0011616 to Patwardhan (“Patwardhan”)
1037	U.S. Patent No. 6,157,162 to Hayashi et al. (“Hayashi”)

1038	U.S. Patent Application Pub. No. 2003/0004617 to Kimura et al. (“Kimura”)
1039	U.S. Patent Application Pub. No. 2006/0164222 to Nou (“Nou”)
1040	U.S. Patent No. 9,170,585 to Flick (“Flick”)
1041	Suryavanshi, P. V., V. K. Sharma, and Rakhi Sharma. <i>Advance Computer Communication Systems in Hybrid Vehicles</i> . 2006 IEEE Conference on Electric and Hybrid Vehicles. IEEE, 2006. (“Suryavanshi”)
1042	U.S. Patent No. 5,773,962 to Nor (“Nor”)
1043	U.S. Patent No. 5,508,594 to Underwood et al. (“Underwood”)
1044	U.S. Patent NO. 6,181,996 to Chou et al. (“Chou”)
1045	PCT Application Pub. No. WO 2006/124130 to Hanssen et al. (“Hanssen”)
1046	U.S. Patent No. 6,577,928 to Obradovich (“Obradovich”)
1047	Schilit, Bill, Norman Adams, and Roy Want. <i>Context-aware computing applications</i> . 1994 first workshop on mobile computing systems and applications. IEEE, 1994. (“Schilit”)
1048	Sharma, Hemant, Roger Kuvedu-Libla, and A. K. Ramani. <i>ConFra: A context aware human machine interface framework for in-vehicle infotainment applications</i> . Proceedings of the International MultiConference of Engineers and Computer Scientists. Vol. 1. 2008. (“Sharma”)
1049	U.S. Patent Application Pub. No. 2008/0211652 to Cope et al. (“Cope”)
1050	U.S. Patent No. 6,718,260 to Kadi et al. (“Kadi”)
1051	U.S. Patent No. 5,982,368 to Toffolo et al. (“Toffolo”)
1052	U.S. Patent Application Pub. No. 2007/0002032 to Powers et al. (“Powers”)
1053	U.S. Patent No. 6,266,589 to Boies et al. (“Boies”)
1054	U.S. Patent No. 7,240,323 to Desai et al. (“Desai”)
1055	Hayes, John G., et al. <i>Wide-load-range resonant converter supplying the SAE J-1773 electric vehicle inductive charging interface</i> . IEEE Transactions on Industry Applications 35.4 (2002): 884-895. (“Hayes”)
1056	Schultz, Aaron M. <i>Digital control of contactless battery charging system</i> . Diss. Massachusetts Institute of Technology, 1995. (“Schultz”)
1057	U.S. Patent Application Pub. No. 2006/0061324 to Oglesbee (“Oglesbee”)

1058	PCT Application Pub. No. WO 2008/140333 to Boys et al. (“Boys”)
1059	Chan, Marco SW, K. T. Chau, and C. C. Chan. <i>Modeling of electric vehicle chargers</i> . IECON'98. Proceedings of the 24th Annual Conference of the IEEE Industrial Electronics Society (Cat. No. 98CH36200). Vol. 1. IEEE, 1998. (“Chan-Modeling”)
1060	U.S. Patent No. 6,032,110 to Ishihara et al. (“Ishihara”)
1061	U.S. Patent No. 6,002,332 to King (“King”)
1062	U.S. Patent No. 8,352,177 to Akita et al. (“Akita”)
1063	Ortega, Jesse, et al. <i>An interactive, reconfigurable display system for automotive instrumentation</i> . No. 860173. SAE Technical Paper, 1986 (“Ortega”)

13. I have considered these materials from the viewpoint of a POSITA as of the priority date of the '996 Patent. For the purposes of this declaration, the priority date of the '996 Patent is August 18, 2008, as I discuss below. *See* Section IV below. I note that my opinions provided in this Declaration are made from the perspective of a POSITA as of this priority date of the '996 Patent unless expressly stated otherwise. To the extent that I use any verb tense in this Declaration that is present tense (e.g., “a POSITA would understand” instead of “a POSITA would have understood”), such verb tense should be understood to be my opinion as of the '996 Patent's priority date (again, unless expressly stated otherwise). I merely use the present verb tense for ease of reading.

III. OVERVIEW AND LEGAL STANDARDS

14. In formulating my opinions, I have been instructed to apply certain legal standards. I am not a lawyer. I do not offer any testimony regarding what the

law is. Instead, the following sections summarize the law as I have been instructed to apply it in formulating and rendering my opinions found later in this declaration. I understand that, in an *inter partes* review (“IPR”) proceeding, patent claims may be deemed unpatentable if it is shown that they are anticipated or rendered obvious in view of the prior art. I understand that prior art in an IPR review is limited to patents or printed publications that predate the priority date of the patent at issue. I understand that questions of claim clarity (definiteness) and enablement cannot be considered as a ground for considering the patentability of a claim in these proceedings.

A. Person of Ordinary Skill in the Art

15. I understand that the '996 Patent, the record of the proceedings at the Patent Office (which I understand is called the “File History” or “Prosecution History”), and the teachings of the prior art are evaluated from the perspective of a person of ordinary skill in the art (“POSITA”). I understand that the factors considered in determining the ordinary level of skill in the art may include: (i) the levels of education of the inventor; (ii) the types of problems encountered in the art; (iii) prior art solutions to those problems; (iv) the rapidity with which innovations are made; (v) the sophistication of the technology; and (vi) the educational level of persons working in the field.

16. I understand that a person of ordinary skill in the art is not a specific real individual, but rather a hypothetical individual having the qualities reflected by the factors above. The hypothetical person is presumed to have the same level of skill as the typical practitioner of the art and is presumed to have knowledge of all prior art in the relevant field. I understand that the inventor's actual knowledge or lack of knowledge of prior art reference is irrelevant to the obviousness determination.

B. Obviousness

17. I understand that a claim may be invalid under 35 U.S.C. § 103(a) if the subject matter described by the claim as a whole would have been "obvious" to a POSITA in view of a single or combination of prior art references at the time the claimed invention was made. I further understand that a POSITA is assumed to know and to have all relevant prior art in the field of endeavor covered by the patent-in-suit and all analogous prior art. I understand that obviousness in an IPR review proceeding is evaluated using a preponderance of the evidence standard, which means that the claims must be more likely obvious than nonobvious.

18. I also understand that an obviousness determination includes the consideration of various factors including: (1) the scope and content of the prior art, (2) the differences between the prior art and the claim at issue, and (3) the level of ordinary skill in the pertinent art. I understand that secondary considerations of non-

obviousness such as commercial success, long-felt but unresolved needs, failure of others, and so forth may be assessed as well. I have been informed that an obviousness analysis must consider the full scope of the claims to avoid impermissibly using hindsight to invalidate a patent.

19. In considering whether certain prior art renders a particular patent claim obvious, I have been informed that I can consider the scope and content of the prior art, including the fact that a POSITA would regularly look to the disclosures in patents, trade publications, journal articles, conference papers, industry standards, product literature and documentation, texts describing competitive technologies, requests for comment published by standard setting organizations, and materials from industry conferences, as examples.

20. I have been informed that for a prior art reference to be proper for use in an obviousness analysis, the reference must be “analogous art” to the claimed invention. A reference is analogous art if: (1) the reference is from the same field of endeavor as the claimed invention (even if it addresses a different problem); or (2) the reference is reasonably pertinent to the problem faced by the inventor (even if it is not in the same field of endeavor as the claimed invention). For a reference to be “reasonably pertinent” to the problem, it must logically have commended itself to an inventor’s attention in considering the problem. In determining whether a reference is reasonably pertinent, one should consider the problem faced by the

inventor, as reflected either explicitly or implicitly, in the specification. I believe that the documents I considered in forming my opinions in this IPR are well within the range of documents a POSITA would have consulted to address the type of problems described in the Challenged Claims.

21. I have been informed that to establish that a claimed invention was obvious based on a combination of prior art elements, an articulation of the reason(s) why a claimed invention would have been obvious must be provided. Specifically, I have been informed that the prior art, either as a single reference or a combination of multiple items of prior art, renders a patent claim obvious when there was an apparent reason for a POSITA, at the time of the invention, to combine or modify the prior art. Rationales for combining or modifying the prior art include, but are not limited to, any of the following: (A) combining prior art methods according to known methods to yield predictable results; (B) substituting one known element for another to obtain predictable results; (C) using a known technique to improve a similar device in the same way; (D) applying a known technique to a known device ready for improvement to yield predictable results; (E) trying a finite number of identified, predictable potential solutions, with a reasonable expectation of success; (F) identifying that known work in one field of endeavor may prompt variations of it for use in either the same field or a different one based on design incentives or other market forces if the variations are predictable to one of ordinary skill in the art;

or (G) identifying an explicit teaching, suggestion, or motivation in the prior art that would have led one of ordinary skill to modify the prior art reference or to combine the prior art references to arrive at the claimed invention.

22. I have also been informed that where there is a motivation to combine, claims may be rejected as obvious provided a POSITA would have had a reasonable expectation of success regarding the proposed combination. I have also been informed that common sense may be considered. Common sense teaches that familiar items may have obvious uses beyond their primary purposes. I have been informed that if the combination was obvious to try (regardless of whether it was actually tried) or leads to anticipated success, then it is likely the result of ordinary skill and common sense rather than non-obvious innovation.

23. I have been informed that the existence of an explicit teaching, suggestion, or motivation to combine known elements of the prior art is a sufficient, but not a necessary, condition to a finding of obviousness. In determining whether the subject matter of a patent claim is obvious, neither the particular motivation nor the avowed purpose described in the patent-in-suit controls. I have been further informed that the obviousness analysis may consider the effects of demands known to the technological community or present in the marketplace and the background knowledge possessed by a POSITA. These issues may be considered to determine

whether there was an apparent reason to combine the known elements in the fashion claimed by the patent.

24. I have been informed that it is improper to combine references where the references teach away from their combination. A reference may be said to teach away when a POSITA, upon reading the reference, would be discouraged from following the path set out in the reference, or would be led in a direction divergent from the path that was taken by the patent applicant. I have also been informed that a reference does not teach away if it merely expresses a general preference for an alternative invention but does not criticize, discredit, or otherwise discourage investigation into the invention claimed.

25. I am informed that even if a case of obviousness is established, the final determination of obviousness must also consider “secondary considerations” if presented. Secondary considerations include: (a) commercial success of a product due to the merits of the claimed invention; (b) a long-felt, but unsatisfied need for the invention; (c) failure of others to find the solution provided by the claimed invention; (d) deliberate copying of the invention by others; (e) unexpected results achieved by the invention; (f) praise of the invention by others skilled in the art; (g) lack of independent simultaneous invention within a comparatively short space of time; and (h) teaching away from the invention in the prior art.

26. I have been further informed that secondary considerations evidence is only relevant if the offering party establishes a connection, or nexus, between the evidence and the claimed invention. The nexus cannot be based on prior art features. The establishment of a nexus is a question of fact. While I understand that Patent Owner here has not offered any secondary considerations at this time, I will supplement my opinions should Patent Owner raise secondary considerations during the course of this proceeding.

C. Claim Construction

27. I understand that the claim terms in an IPR proceeding are construed according to their plain and ordinary meaning as understood in light of the claim language, the patent's description, and the prosecution history viewed from the perspective of a POSITA. I further understand that where a patent defines claim language, the definition of the patent controls, even if there are other definitions that might be understood by those working in the art.

IV. LEVEL OF A PERSON OF ORDINARY SKILL

28. Based on my review and analysis of the '996 Patent, the cited prior art, and the ordinary skill factors described in this section, a POSITA at the time of the '996 Patent would have been knowledgeable regarding the field of automotive systems, including electric vehicle battery charging systems. In my experience working in this field, most workers of ordinary skill in the art as of the earliest

possible priority date of August 18, 2008, would have had at least a bachelor's degree in electrical or mechanical engineering, or a similar technical field and at least two years of experience involving automotive systems, including electric vehicle battery charging systems. Additional industry experience or technical training may offset less formal education, while advanced degrees or additional formal education may offset lesser levels of industry experience. When I refer to the understanding of a POSITA, I am referring to the understanding of such a person as of August 18, 2008.

29. As of August 18, 2008, I had more than ordinary skill in the art. I am, however, familiar with the skills and knowledge possessed by those I would have considered to be of ordinary skill in the art as of that date. For example, I worked at Toyota Motor Corporation from 1996 to 2000, where I conceptualized and developed new technology products and services for Toyota's future passenger vehicles. Such technology products included a heavy emphasis on vehicle electronic systems, vehicle information systems and vehicle and mobile device based user interface systems. I also designed a novel hybrid electric vehicle that used a dynamically charged electric powertrain system in conjunction with a conventional internal combustion engine to create a very high-performance vehicle.

30. My opinions provided in this declaration would not change in view of minor modifications to this level of ordinary skill.

V. OVERVIEW OF THE '996 PATENT

A. Summary

31. The '996 Patent is directed to an electrical charging system for charging electric vehicles, including performing alignment of inductive charging cores (one in a vehicle, another in a charger) for inductively charging the vehicle's battery. EX1001, generally 33:19-34:63. The vehicle includes a display and a controller that detects a positional relationship between the two cores including detecting misalignment/alignment of the cores. EX1001, 34:43-63. When core alignment is detected, the controller enables a user control on the display to charge the vehicle upon user selection. *Id.*

1. Field of Endeavor

32. I have been informed that the field of endeavor of the claimed invention can be determined by reference to explanations of the invention's subject matter in the patent application, including the embodiments, function, and structure of the claimed invention.

33. The '996 Patent relates to electric vehicle battery charging systems. EX1001, Abstract, 33:19-42. The '996 Patent is directed to detecting alignment or misalignment of inductive charging cores and enabling or disabling user controls on a display. EX1001, 33:19-34:63.

34. For these reasons, a POSITA would understand that the field of endeavor of the '996 Patent includes managing vehicle systems, such as electric vehicle (EV) charging, and EV control interfaces.

2. *Problems Solved by the Inventor*

35. I have been informed that a prior art reference is “reasonably pertinent” if a POSITA would have consulted it and applied its teachings when faced with the problems that the inventor was trying to solve. As such, I have been asked to analyze the '996 Patent and determine the problems that the inventors were trying to solve.

36. The '996 Patent describes assisting a driver in parking a vehicle at a particular position. EX1001, 34:20-35:3. In particular, the '996 Patent describes parking the vehicle in a position where the charging core in a vehicle and the charging core in a charging apparatus are aligned so inductive charging can take place. *Id.*

37. The '996 Patent describes using a controller/processor in a vehicle to perform processing operations. EX1001, 34:20-63. For example, the '996 Patent describes the controller receiving signals from sensors and performing a “conventional triangulation algorithm” to display directions to a user for how to position the vehicle to achieve alignment. *Id.*

38. The '996 Patent describes enabling and disabling functions on a display based on various conditions. EX1001, 34:59-63. For example, the '996 Patent

describes enabling a “START CHARGE” when the vehicle is not properly aligned, and enabling a “START CHARGE” control on a display when alignment has been achieved. *Id.*

39. The ’996 Patent describes notifying a user about information related to the vehicle using a vehicle display. EX1001, 34:20-63. For example, the ’996 Patent describes providing positioning information to a user for positioning the vehicle to achieve alignment of the charging cores. *Id.*

40. The ’996 Patent describes using a particular charging device such as a charging pad to charge an electric vehicle. EX1001, 33:19-34:19, 34:64-35:3.

41. The ’996 Patent describes using sensors to assist a user in parking a vehicle at a particular position. EX1001, 33:48-34:28, 34:64-35:3. For example, the ’996 patent describes using sensors operating on well-known principles and using a “conventional triangulation algorithm” for determining positioning. *Id.*

B. Prosecution History

42. The ’996 Patent was filed as U.S. Patent Application Number 17/188,269. I have reviewed the prosecution history for the ’996 Patent (“the ’996 File History”). During prosecution, the Examiner issued a first action Notice of Allowance on September 29, 2022, where the Examiner stated that:

“the prior art of record does not suggest or disclose the claimed combination of elements or steps as recited, most particularly the claimed, ‘detecting a positional relationship between a first core on the

vehicle and a second core in a location exterior to the vehicle, the first and second cores enabling induction charging of the battery when sufficiently aligned with respect to one another; detecting an alignment of the first core with respect to the second core within a predetermined threshold based at least in part on the positional relationship between the first core and the second core; and in response detecting the alignment of the first core with respect to the second core, enabling a user control displayed on a display for controlling the induction charging of the battery.”

EX1002, 303-312.

43. The Examiner noted that US 5,462,439 to Keith and US 5,461,298 to Lara both “fail to disclose in response to the alignment/misalignment disabling/enabling a user control on a display for controlling the induction charging of the battery as claimed.” EX1002, 310-311. The Examiner noted that US 2009/0047991 “fails to disclose detecting alignment/misalignment of first and second cores allowing induction charging and enabling/disabling a user control based on the detection.” EX1002, 310-311.

VI. OVERVIEW OF THE TECHNOLOGY

44. I was asked to briefly summarize the background of the prior art from the standpoint of a person having ordinary skill in the art prior to August 18, 2008. As explained below, the charging of electric-powered vehicles described in the '996 Patent was based on well-known intelligent charging systems and technologies used

for vehicles with electric drive systems. All the functionalities encompassed by the Challenged Claims were thus well-known and conventional prior to the invention of the '996 Patent.

A. Electric Vehicles

45. Electric vehicles (EV) “use an electric motor to provide all or part of the mechanical drive power.” EX1011-Kempton, 2 Section 3. “EVs may include battery electric vehicles (BEVs), hybrid electric vehicles (HEVs), and fuel-cell electric vehicles (FCEVs).” EX1012-Chan, 1, Section I. The “EV was invented in 1834” and “[b]y the mid-1970s, oil shortages led to aggressive development of EV programs[,]” with EVs being leased and sold in the USA starting in 1996. EX1012-Chan, 2, Section III.A; EX1013-Sandeep, 4; *see also*, EX1012-Chan, 9 at Table 2. Thus, electric vehicles, such as hybrid vehicles and fully electric vehicles, were readily available and well-known prior to the '996 Patent.

B. Inductive Charging Systems

46. Electric vehicles were known to require some form of charging to maintain the electric power source. EX1008-Ross, 2:4-9. For this reason, charging infrastructures for EVs were developed and in use before the '996 Patent. EX1014-Weed, 3 (describing how “both conductive and inductive charging are commercially available for EV’s” by 1998). Electromagnetic induction “is the production of an electromotive force in a conductor as a result of a changing magnetic field about the

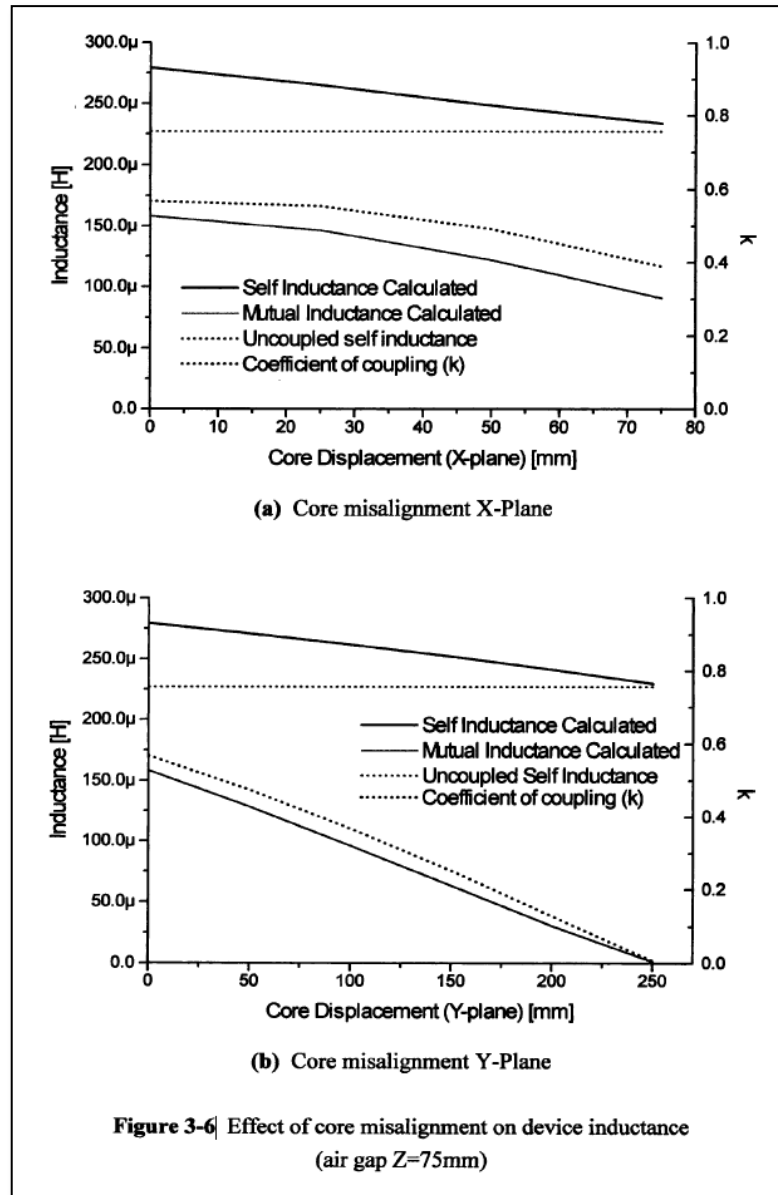
conductor.” EX1015-Mahmood, 1. When applied to electric vehicles, inductive charging “is a method for magnetic-transfer of power which offers several advantages for fully automatic electrical vehicle (EV) charging stations[.]” EX1016-Laouamer, 1.

47. Reflecting these advantages, inductive power transfer (IPT) systems for roadway vehicle applications “have been proposed for more than two decades[.]” EX1017-Covic,1. At least as early as 1993, laboratory studies have explored efficient contactless charging systems for vehicles. EX1018-Esser, Abstract. Researchers subsequently recognized that such contactless charging systems were well suited for “shopping complex’s car park and other places which require a big space of parking lots.” EX1015-Mahmood, 1. In particular, Mahmood explains that “[w]e can build a parking lot with the primary coil embedded in a parking lot, which provide magnetic field as a medium of energy transfer to charge the electric vehicle’s battery.” EX1015-Mahmood, 1.

1. Charging Coil Alignment

48. Contactless inductive charging systems require that the primary and secondary coils are “sufficiently close to each other” to “improve[] power transmission efficiency.” EX1009-Kuki, 5:1-3. When discussing the inductive charge coupling between an electric vehicle and a power-providing roadway, Tseng explains that “[p]erhaps the most crucial problem associated with efficient coupling

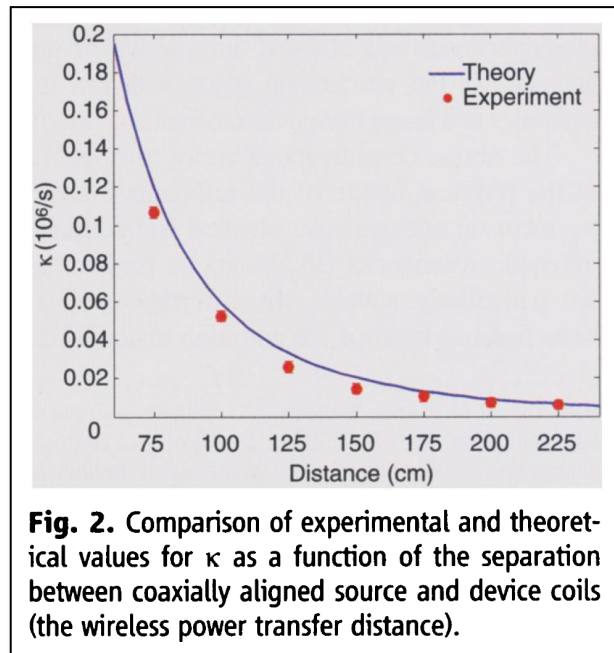
has to do with insuring the alignment between the roadway and vehicle counterparts or the inductive charge system, it should be obvious that the vehicle strays too far from a preferred path, power transfer will diminish.” EX1019-Tseng, 1:59-2:1. Specifically, coil misalignment was found to reduce the induced and terminal voltages of the secondary coil while increasing magnetic flux leakage, leading to lower peak secondary voltage and reduced secondary resonant frequency. EX1020-Juby, 60-61. Juby further explains that systems with small air gap couplers “require very accurate parking and any misalignment results in a significant loss of power transfer capability.” EX1020-Juby, 32-33. As the device misaligns, “[t]he mutual inductance will decrease and tend towards zero.” EX1020-Juby, 46, Fig. 3-6. As the magnetic flux leakage increases and the magnetizing inductance decreases, “this causes a reduction in the power transfer capability” and the “coupling factor (k) decreases.” EX1020-Juby, 69, 87.



EX1020-Juby, Fig. 3-6 (illustrating the decrease in inductance and coupling coefficient (k) with an increase in core misalignment in the x and y-planes for a given air gap).

49. In addition to coil misalignment, an increase in the separation distance between the coils further causes a decrease in the induction coupling efficiency.

EX1021-Kurs, 3 (“When the distance D between the centers of the coils is much larger than their characteristic size, [coupling coefficient] κ scales with the D^{-3} dependence characteristic of dipole-dipole coupling.”), Fig. 2 (illustrating the decrease in coupling coefficient κ as coil separation distance increases).



EX1021-Kurs, Fig. 2.

50. Prior to the '996 Patent, it was well known that inductive charging systems could employ a variety of techniques to align a vehicle with the charging coil. For example, Bruni teaches a method whereby “[t]he self-aligning inductive charging system 10 is designed to automatically mate the charge probe 12 to the charge port 15.” EX1022-Bruni, 2:51-53. Similarly, Odachi teaches a method of charging an electric vehicle through inductive coupling whereby the “primary inductive device is provided on a movable arm of a ground charger unit and the

secondary inductive device is mounted on the bottom of the vehicle adjacent its rear.” EX1023-Odachi, Abstract. Wilson further teaches an inductive charging system whereby a charge probe is automatically aligned with the charge port of a vehicle by using photoelectric detectors to detect a light source at the vehicle’s charge port. EX1024-Wilson, Abstract, 1:42-2:5. Similarly, Minoshima-461 teaches an inductive charging system whereby a charging coil is automatically moved along the extension of a wheel stop until it reaches a position immediately below the vehicle-side coil, wherein a photoelectric or magnetic sensor is used for the detection and alignment. EX1025-Minoshima-461, 6:49-61.

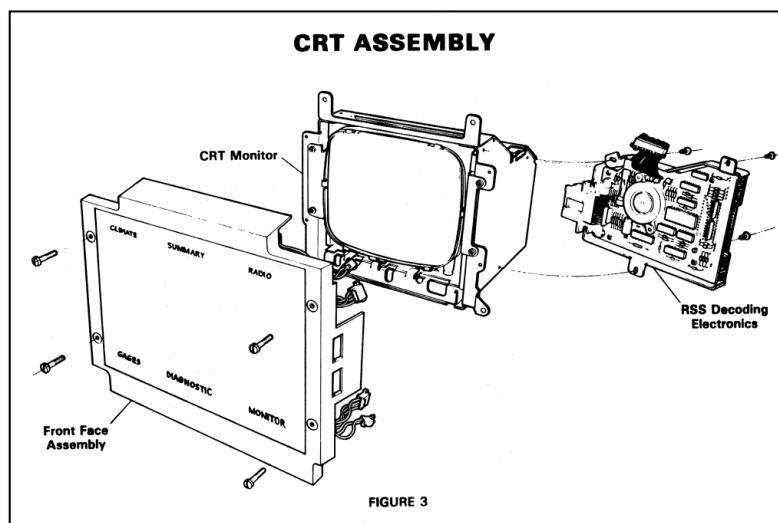
51. Thus, the importance of proper coil alignment in inductive charging systems, and methods for aligning the vehicle with the external charging coil were well-known prior to the ’996 Patent.

C. Electric Vehicle Hardware

1. Vehicle Displays

52. Displays and interfaces, including GUIs (graphical user interfaces) provided on displays, were known, and their inclusion in vehicles was also known prior to the ’996 Patent. For example, vehicles were known to have “a basic vehicle dashboard” comprising “tactile displays/and or touch screens 10-14” which “can be used for the basic control functions of the vehicle.” EX1026-Pryor, 2:38, 13:19-21.

53. Instrument panels to display vehicle-related information to the user have been employed in vehicles well before the '996 Patent. *See, e.g.*, EX1027-Drummond, 2:26-30 (describing “instrument panel 10” found “on the dashboard of the automobile immediately in front of the driver so that it will attract his attention without any effort on his part” in 1943). An on-board vehicle display was known to be beneficial “for displaying information for the driver[,]” as vehicle displays “improve[d] occupant safety, environmental friendliness, ergonomics, and compatibility to modify, add, or upgrade vehicle features.” EX1028-Cramer, [0307]. In 1987, General Motors released the Graphical Control Center which used a cathode ray tube (CRT) screen fitted with a touch sensitive overlay to both display vehicle information, and to allow the driver to control various features. EX1063-Ortega, Abstract, Figs. 1, 3. The structure of this screen is shown below.



EX1063-Ortega, Fig. 3.

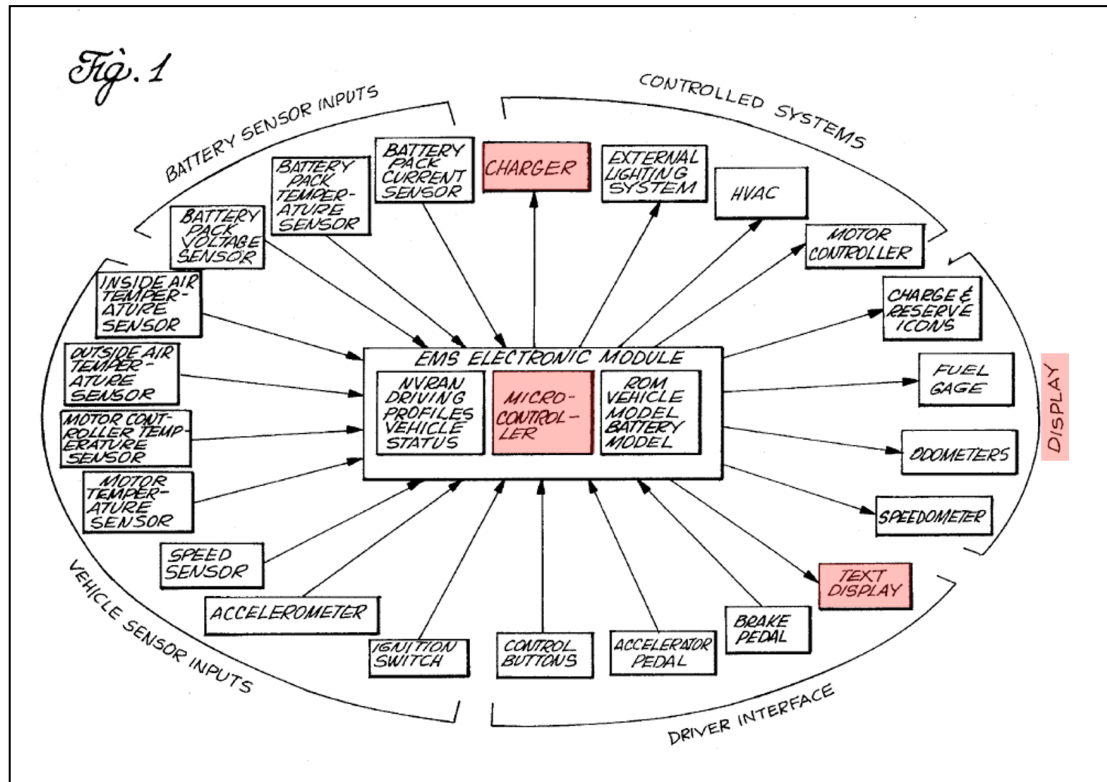
54. It was well-known that electric vehicles employing inductive charging may direct the driver using the vehicle display to align the vehicle with the external charging coil. Such a system may provide “visual clues to align and locate the vehicle relative to the plug[,]” such as using “a horizontal column of light-emitting diodes” to “indicate whether the vehicle receptacle is left or right of the plug, and whether by a lot or a little[.]” EX1029-Plishner, [0052]. When parking near an external charging probe, the display may also provide “an auxiliary line, frame and the like for assisting and controlling the parking[,]” such that guidance lines are “superimposed on the actual image taken by [a] back monitor camera[.]” EX1030-Oyobe, [0072].

55. Thus, utilizing visual displays in electric vehicles to indicate to a driver how to better align the vehicle with an external charging device was well-known prior to the '996 Patent.

2. *Controllers*

56. Managing EV charging within the vehicle itself was known, as infrastructure for “measuring and keeping track of the vehicle-to-grid services” should be “on the vehicle side.” EX1031-Brooks, 7-8, Section 4.3, 4.5. Thus, EVs were known to include a “vehicle communication interface that is capable of communicating predetermined instructions from the user to the electric vehicle regarding the battery and charging thereof.” EX1032-Berdichevsky, [0008].

57. Some EV systems had a processor on-board the vehicle for controlling charging of the batteries among other vehicle functions; for instance, Diller describes an EV with a singular processor where “[t]he energy management system electronic module 10 incorporates a micro-controller 12 as a calculation engine and means for controlling the various systems of the electric vehicle” wherein “an Intel Model 196KR processor is employed.” EX1033-Diller, 3:29-33. Further, this “energy management system through its microcontroller [*sic*] provides active control of vehicle systems including the charging system for the battery pack, internal and external lighting systems, heating, ventilating and air conditioning systems.” *Id.*, 2:53-58. Diller’s on-board micro-controller 12 and its control of various vehicle systems, including battery charging and the vehicle display, is shown below:

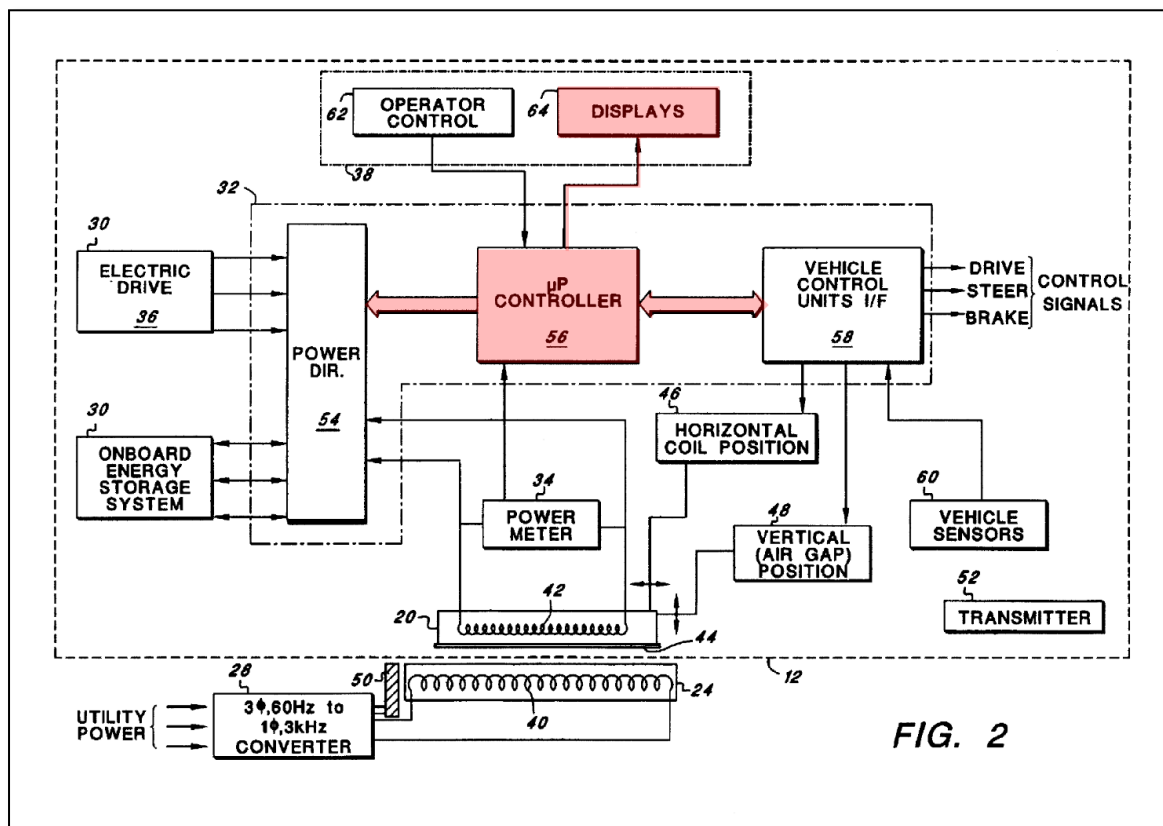


EX1033-Diller, Fig. 1 (annotated)¹, 3:26-29 (“Fig. 1 shows the relationship of the energy management system (EMS) to the various sensor inputs, controlled system outputs, driver interface and display for the vehicle.”).

58. Ross describes a roadway-powered EV that includes a “microprocessor controller 56, which is realized using a conventional processor-based system” as part of an on-board “power control unit 32.” EX1008-Ross, 8:14-20 (describing the power control unit 32 on-board the vehicle directing charge to the “energy storage system”), 11:37-51, 16:47-50. The microprocessor controller 56 controls charging

¹ All emphases and annotations are added unless noted otherwise.

by “directing the power to and from the energy storage system,” among other vehicle functions (e.g., “monitoring onboard vehicle sensors 60” and “receiving appropriate commands from the operator control devices 38”). *Id.*, 11:58-67 (describing many “tasks” carried out by the microprocessor “are the same as carried out with the operation of any EV”). Ross’s on-board microprocessor 56 and its regulation of various vehicle components, including display 64, is shown below:



EX1008-Ross, Fig. 2 (annotated).

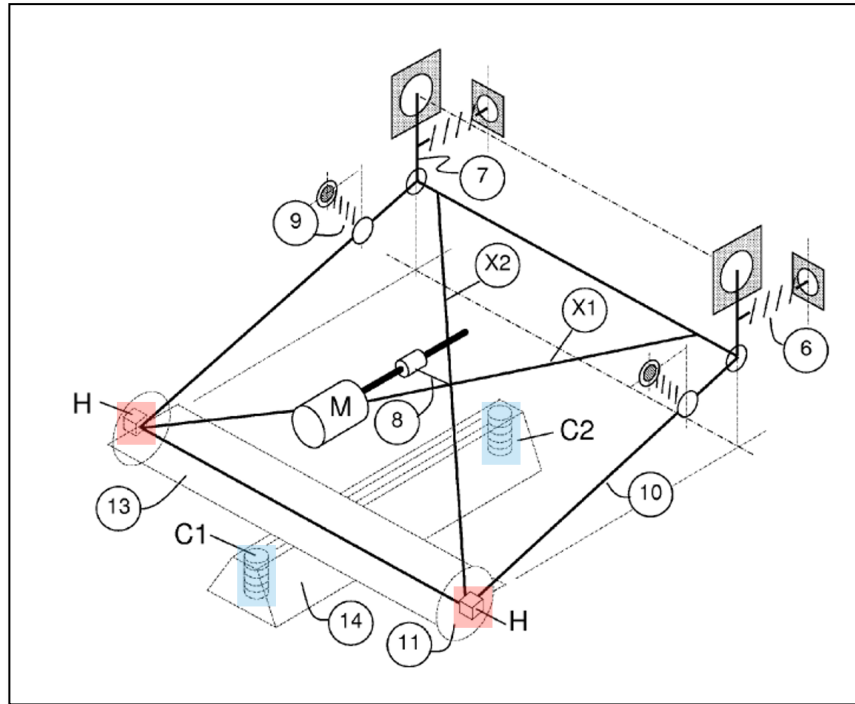
59. The control unit that comprises a microprocessor may also include an electronic control unit (ECU) for managing the battery charging. *Iwashita*, 4:41-47. The ECU may monitor the state of charge of the battery based on sensor signals.

EX1034-Iwashita, 4:48-60 (“The current sensor 33 is connected to the battery ECU 32 and provides a detection signal in accordance with the value of current flowing through the high-voltage power supply circuit 29 to the battery ECU 32.”). Using the current and voltage detected by a current and voltage sensor, respectively, the battery ECU may estimate the state-of-charge (SOC) of the vehicle’s power storage devices. EX1035-Oki, [0044]. After the battery ECU has estimated the SOC, “battery ECU starts charging electric power storage devices 6-1, 6-2 from external power supply 34” and continues to update the SOC during charging. EX1035-Oki, [0046]-[0047]. The battery ECU may also monitor whether a command has been issued to begin charging. EX1035-Oki, [0064]-[0065].

60. Thus, the use of controllers in electric vehicles to monitor and control the charging process was well-known prior to the ’996 Patent.

3. *Sensors*

61. To assist in aligning the primary and secondary coils, the positional relationship may be detected using magnetic-field sensors. EX1025-Minoshima-461, 6:42-61 (describing the use of magnetic sensors to detect the position of the vehicle-side coil when aligning the external charging coil); EX1036-Patwardhan, [0047] (describing magnetometers onboard a vehicle for sensing the magnetic field of energized coils to assist in charging alignment), Fig.7;



EX1036-Patwardhan, Fig. 7 (annotated to show the magnetometers H (red) onboard the vehicle for detecting the magnetic field from energized coils C1/C2 (blue) for proper charging alignment).

62. In the context of electric vehicle battery charging systems, proximity sensors were commonly used to detect the relative position and spacing between a vehicle-side charging coil and external charging infrastructure. EX1037-Hayashi, 4:9-12. (“An ultrasonic sensor 42 for detecting a distance from a receiving coupler 118 of the electric vehicle 10 along the Z-axis is mounted on the base 32 of the battery charging robot 30.”).

63. The use of vehicle proximity sensors connected to a controller to detect obstacles during parking was also commonly employed. EX1038-Kimura, [0034]

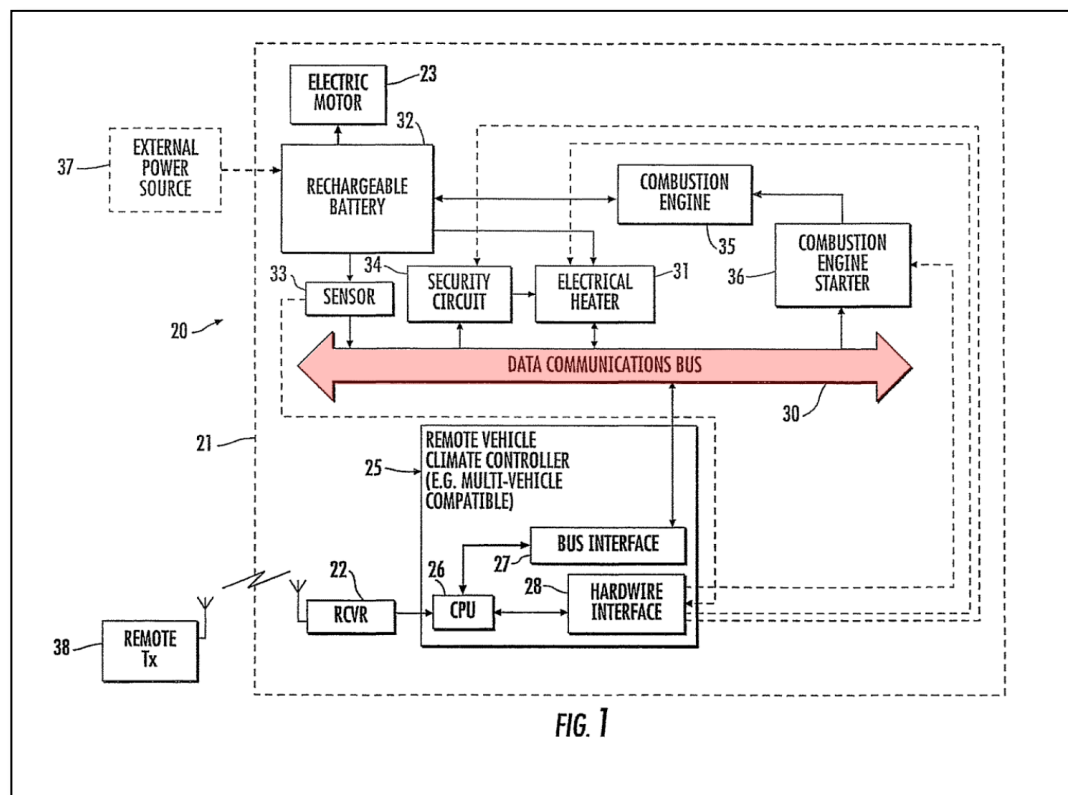
(“the controller 1 is connected with an ultrasonic sensor 7 serving as a first distance sensor for measuring a distance to an obstacle on a side of the vehicle and a wheel speed sensor 8 serving as a second distance sensor for measuring a moving distance of the vehicle.”); EX1039-Nou, Abstract (“a sensor unit having a plurality of sensors for measuring distance from other vehicles; a system controlling unit for receiving measurements signals from the sensors, calculating distances from other vehicles”).

64. Thus, the use of sensors to assist in the alignment of a vehicle with a charging coil in a parking space was well-known prior to the '996 Patent.

4. *Communication Bus*

65. Electric vehicles utilize communication buses to connect hardware components to various controllers. EX1040-Flick, 45-48 (“[a] data communications bus may extend throughout the hybrid vehicle”), 9:7-11 (“[t]he data communications bus 60 may extend through at least one of the engine compartment, the passenger compartment, and the trunk of the hybrid vehicle 51”), Fig. 1. Communication buses may include a Controller Area Network (CAN) bus or additional buses for smaller sub-networks. EX1041-Suryavanshi, 2 (“[i]n addition to CAN networks, many electric vehicles use additional buses for smaller sub-networks within the vehicle”). In electric vehicles with battery management systems, it is common that “the main control module will further connect to the vehicle communications bus over which it provides control, monitoring, and feedback communications to and from a driver

controller[.]” EX1042-Nor, 4:35-40. Nor further explains that “[e]ach of the battery monitoring modules include serial communications bus means as well, and data acquisition circuitry which comprises cell or battery voltage monitoring means for each cell or battery module with which it is associated.” EX1042-Nor, 4:20-24. Generally, “the vehicle communication bus serves as a communication pathway for interfacing various vehicle sensors and controllers to the chassis controller [] and the motor controller [.]” EX1043-Underwood, 6:1-6. Signals received over the vehicle communication bus include “battery current sensor” information, “charging commands[.]” and “state-of-charge value[s].” EX1043-Underwood, 6:33-42.



EX1040-Flick, Fig. 1 (annotated to show the data communications bus (red)).

66. Communication buses are further utilized to couple the control units to an in-vehicle display. EX1006-Canedy, 4:6-12 (“the microprocessor 100 controls a display 110 having a seven segment display array 115, via control bus 111”). Electronic control units typically interface with visual displays and sensors via a communication bus such as a SAE J1850 bus or a CAN-bus. EX1044-Chou, 3:1-13 (“a vehicle 100 having at least one sensor (e.g. sensor circuit) and more preferably a plurality of sensors located at different positions in the vehicle [], an electronic control unit (ECU) 140 [] for controlling sensor circuits, a vehicle communication bus 105 for carrying data and control signals to the ECU 140, an ECU 160 interfaced with the bus 105, and at least one interface device...including, for example, any one or more of a visual display 170”), 3:58-63 (“the car bus, such as a Society of Automotive Engineers (SAE) J1850 communication bus, or a Controller Area Network (CAN)”). The display of an electric vehicle may “receive[] information from the advanced battery” and “includes means for communication with the vehicle’s communication bus[.]” EX1045-Hanssen, 12:5-7, 5:7-13.

67. Thus, communication buses were known to couple controllers to electric vehicle hardware, including displays, prior to the ’996 Patent.

D. Vehicle User Interfaces

68. Vehicles were known to include a “multifunction display interface 102b [that] is installed on the dashboard” which “provides the user with graphic

display and control of selected functions using well-known touch screen technology” including “navigation, phone, radio and climate control[.]” EX1046-Obradovich, 6:20-24. Vehicles used “programmable forms” of “touch screens and displays employing tactile physical selection or adjustment means.” EX1026-Pryor, Abstract. For example, a driver may use a “[t]ouch screen 301 located on a vehicle dashboard 302” for controlling various vehicle functions. EX1026-Pryor, 14:5, 39:1-2; *see also*, *Id.*, Fig. 13B.

1. Context-Aware Computing

69. Context-aware computing “adapts according to the location of use, the collection of nearby people, hosts, and accessible devices, as well as to changes to such things over time.” EX1047-Schilit, 1. A context-aware system “can examine the computing environment and react to changes to the environment.” *Id.* In vehicle systems, “[c]ontext is any measurable and relevant information that can be used to characterize the situation of an entity (e.g. driver).” EX1048-Sharma, 2. Because drivers operate in “highly dynamic environments or contexts[.]” context such as “task at hand, location, user preferences and device capabilities [.]” are used to “deliver relevant information to the user.” EX1048-Sharma, 2.

70. On vehicle displays, certain information may be displayed more prominently depending on operating conditions, for example, a fuel gauge when fuel is low or a tachometer when the vehicle exceeds recommended RPMs. EX1049-

Cope, [0015]. A dynamic vehicle display may also display certain menu items when the vehicle is stationary, and another set of menu items when the vehicle is moving. EX1050-Kadi, 1:40-60 (“The menu has a first configuration when...the motor vehicle is stationary. The menu has a second configuration when...the motor vehicle is moving”). Additionally, the vehicle display may dynamically update based on the geographic heading of the vehicle. EX1051-Toffolo, 1:44-58 (“based upon information from the navigation system regarding the geographical heading of the vehicle, the display selects one of the second icons indicating the current vehicle heading and displays it in the second display area.”), 4:18-23 (“The display system 20 of the present invention can provide a high resolution, reconfigurable display 30, displaying high resolution, reconfigurable information based upon information from the navigation system 24.”).

71. It was also well-known that features and functions on a vehicle display may be made inaccessible based on certain “lockout criterion.” EX1052-Powers, [0006]. For example, the display may be temporarily disabled if the vehicle speed is above a certain threshold, and the “predicted eyes-off-road-time exceeds driver workload (DW) criterion.” EX1052-Powers, [0022]. By temporarily disabling the display under certain conditions, the unsafe overuse of the display while driving may be prevented. EX1052-Powers, [0004]. Similarly, Boies teaches a system whereby the state of various functionalities of a vehicle display is determined by the vehicle

speed. EX1053-Boies, 1:27-52 (“vehicle speed data is supplied to a rules based system which applies rules that determine the state of various electronic devices at a given speed.”). When a vehicle is traveling above a certain speed, the system may disable the album cover graphic, disable the menu-selection system for tuning stations, and turn off the on-screen buttons for music balance and tone. EX1053-Boies, 3:41-4:3.

72. Graphical user interfaces (GUIs) commonly used visual indicators to inform users whether a particular function or selection was currently available or executable. Indeed, it was well known that unavailable menu items in a GUI may be greyed out to communicate to the user that the selection cannot be executed. EX1054-Desai, 13:56-14:7 (“If this software operation determines that the user-selected object is, in fact, available, then all of its respective menu items in its popup menu may not be greyed-out on the screen and thus all menu items will be made accessible to the user. Alternatively, some of the menu items may be greyed-out making those inaccessible by the user, where the remaining menu items which are not greyed-out are then accessible by the user.”).

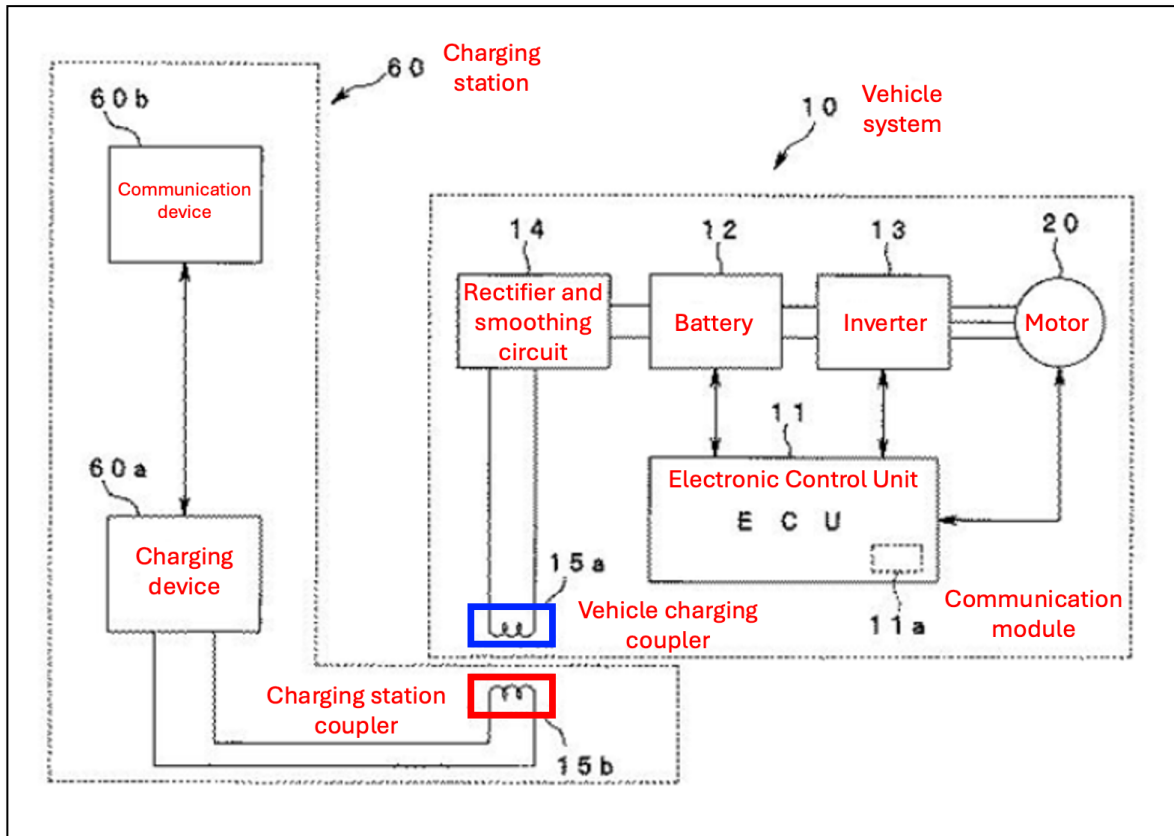
73. Thus, vehicle user interfaces utilizing context-aware computing to enable and disable certain functions based on user inputs, vehicle data, and environmental information was well-known prior to the '996 Patent.

VII. SUMMARY OF THE PRIOR ART REFERENCES

A. Izuno

74. I have been instructed by counsel that Izuno is prior art to the challenged patent.

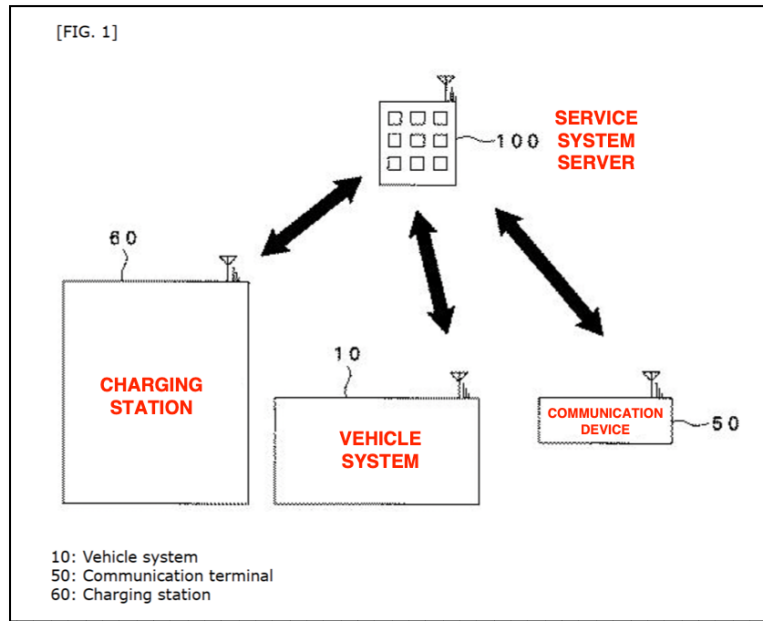
75. Izuno teaches an electric vehicle including a controller, where the vehicle includes a coupler 15a that receives power from coupler 15b located in a parking space. EX1004-Izuno, [0019]-[0020] (“When a vehicle with a charging coupler 15a mounted on its underside is parked in a predetermined charging parking space at a charging station 60, the vehicle charging coupler 15a and the charging coupler 15b located in the charging parking space are positioned opposite each other, enabling contact-free charging of the battery 12 via electromagnetic induction.”), [0037] (“[T]he system checks whether the vehicle has been parked at the predetermined position in the charging parking space[.]”).



EX1004-Izuno, Fig. 2.²

76. In connection with Figure 1 below, Izuno describes the major elements of the system as the vehicle system 10, a communications terminal 50, a charging station 60, server, and a service system server 100. EX1004-Izuno, [0012].

² All annotations and emphases are added unless otherwise noted.



EX1004-Izuno, Fig. 1.

77. Izuno's vehicle system 10 includes electronic control unit (ECU) 11 "which includes a microcomputer." EX1004-Izuno, [0015]. Izuno teaches ECU 11 "is a control device that primarily controls the motor 20 via the inverter 13 and manages the battery 12." EX1004-Izuno, [0016].

78. Izuno's vehicle includes a *display mounted within the vehicle*. Izuno's communication terminal 50 installed in vehicle system 10 of vehicle is mapped as a *display* below. For example, Izuno teaches "in this battery charging system, the vehicle system 10, the communication terminal 50, and the charging station 60 are all connected to the service system server 100 via a communication network." EX1004-Izuno, [0012]. Izuno further teaches that communication terminal 50 may be a "a display device or audio device installed in the vehicle system 10 of the user's

vehicle...allowing information from the service system server 100 to be automatically confirmed via display or audio.” EX1004-Izuno, [0014]. Further, Izuno teaches the user selects charging modes using communication terminal 50, which may be a vehicle display. EX1004-Izuno, [0027], [0014].

79. Izuno is analogous to the claimed invention of the '996 Patent because Izuno is from the same field of endeavor: electric vehicle battery charging systems. *Compare* EX1004-Izuno, Title, Abstract, [0001], [0008]-[0012], [0018]-[0020], [0027]-[0039], Figs. 1-5, *with* EX1001, Title, Abstract, 33:19-42.

80. Izuno is also reasonably pertinent to particular problems with which the inventor of the '996 Patent was involved: (1) assisting a driver in parking a vehicle at a particular position, optionally including repositioning a vehicle; *compare* EX1004-Izuno, [0020], [0030], [0039], *with* EX1001, 34:20-35:3; (2) using a controller/processor in a vehicle to perform processing operations; *compare* EX1004-Izuno, [0015], [0018], [0022], Fig. 2, *with* EX1001, 34:20-63; and (3) notifying a user about information related to the vehicle using a vehicle display; *compare* EX1004-Izuno, [0014], [0025], *with* EX1001, 34:20-63.

B. Minoshima

81. I have been instructed by counsel that Minoshima is prior art to the challenged patent.

82. Minoshima teaches using proximity sensors to detect a position of the vehicle to determine if the parking orientation is correct to allow for charging to begin. EX1005-Minoshima, [0047]. Minoshima teaches two embodiments regarding the location of proximity sensors: one where proximity sensors are in ground-level charging device 9, and another where proximity sensors are part of electric vehicle 1. EX1005-Minoshima, [0059] (teaching proximity sensors 17 (“detectors”) are in the electric vehicle and detected component 16 is in ground-level charging station 9).

83. Minoshima teaches a detecting means, including proximity sensors 17, in the vehicle detect the vehicle’s deviation in the width and longitudinal directions relative to a predetermined distance from the ground-level charging device (*positional relationship*). EX1005-Minoshima, [0009], [0021]-[0024], [0039], [0047]-[0049], [0058] (“three or more detectors, such as proximity sensors, may be provided”), [0065] (“[T]he widthwise misalignment detecting means comprises at least two proximity sensors that detect when the vehicle has approached within a predetermined distance of a predetermined reference position, using two different locations on the vehicle as detection targets. As a result, the system can detect not only widthwise misalignment but also improper angled parking.”). The proximity sensors 17 may consist of optical, magnetic or ultrasonic sensors. EX1005-Minoshima, [0059].

84. If the detecting means, including the proximity sensors, determine the vehicle is not parked in a predetermined position to allow charging, the driver is notified to reposition the vehicle before charging is enabled. EX1005-Minoshima, Abstract (“Parking Position NG”), [0011] (“[I]f the parking orientation of the vehicle is unsuitable for charging, information indicating that the parking orientation is unsuitable is provided to the driver via the notifying means, prompting the driver to reposition the vehicle.”), [0039], [0048], [0063]. Specifically, a controller, in conjunction with the proximity sensors, determines that the vehicle is “within a permissible misalignment range” and “ready for charging.” EX1005-Minoshima, [0035].

85. Minoshima is analogous to the claimed invention of the ’996 Patent because Minoshima is from the same field of endeavor: electric vehicle battery charging systems. *Compare* EX1005-Minoshima, Title, Abstract, [0001]-[0008], [0016]-[0046], Figs. 1-5, 8, *with* EX1001, Title, Abstract, 33:19-42.

86. Minoshima is also reasonably pertinent to particular problems with which the inventor of the ’996 Patent was involved: (1) assisting a driver in parking a vehicle at a particular position, optionally including repositioning a vehicle; *compare* EX1005-Minoshima, [0009], [0022], [0059], [0065], Figs. 1-3, *with* EX1001, 34:20-35:3; (2) notifying a user about information related to the vehicle using a vehicle display; *compare* EX1005-Minoshima, [0053]-[0054], Fig. 7, *with*

EX1001, 34:20-63; and (3) using sensors to assist a user in parking a vehicle at a particular position; *compare* EX1005-Minoshima, Abstract, [0022], [0047], [0059], [0065], Figs. 1-3, *with* EX1001, 33:48-34:28, 34:64-35:3.

C. Canedy

87. I have been instructed by counsel that Canedy is prior art to the challenged patent.

88. Canedy teaches a vehicle with a microprocessor coupled to proximity sensors and a display. Specifically, Canedy teaches a vehicle including microprocessor 100 and proximity sensors, comprising two pairs of optical sensors (optical transmitter 20 and optical detector 22 on the left side of vehicle spoiler 16; optical transmitter 24 and optical detector 26 on the right side of vehicle spoiler 16), communicating via bus 121. EX1006-Canedy, 3:58-65 (“A microprocessor 100 is used to control the detection process. Bus [121]³ are used to control the two pairs of optical sensor units.”), 3:7-47 (generally teaching each pair of optical sensors), Fig. 2. Microprocessor 100 processes data from the proximity sensors regarding the proximity of an object in front of a vehicle when being parked. EX1006-Canedy,

³ Canedy has a typographical error where “bus 120” should be “bus 121,” as depicted in Fig. 2 “bus 121.” EX1006-Canedy, 3:58-62, 4:19-21, Fig. 2. Element 120 properly refers to “LEFT indicator 120” of display 114. *Id.*

90. Canedy teaches display 104 includes lights 106 and 107 related to proximity sensors at the front of the vehicle that detect an object's proximity to the vehicle's front. EX1006-Canedy, 3:66-4:16. The sensor information is provided to the display from proximity sensors via microprocessor 100 and buses 121, 103, 111. EX1006-Canedy, 3:66-4:16, Fig. 2. Microprocessor 100 also controls display 114, which displays a distance to the detected object in inches based on data from proximity sensors. EX1006-Canedy, 4:24-33.

91. Canedy is analogous to the claimed invention of the '996 Patent because Canedy is reasonably pertinent to particular problems with which the inventor of the '996 Patent was involved: (1) using a controller/processor in a vehicle to perform processing operations; *compare* EX1006-Canedy, 3:66-4:16, 4:34-51, 5:7-23 Fig. 2, *with* EX1001, 34:20-63; (2) notifying a user about information related to the vehicle using a vehicle display; *compare* EX1006-Canedy, 3:65-4:23, Fig. 2, *with* EX1001, 34:20-63; and (3) using sensors to assist a user in parking a vehicle at a particular position; *compare* EX1006-Canedy, 3:8-34, 4:34-5:6, Fig. 1, *with* EX1001, 33:48-34:28, 34:64-35:3.

D. Yokota

92. I have been instructed by counsel that Yokota is prior art to the challenged patent.

93. Yokota teaches a system and method for executing a function corresponding to a selected menu item displayed on a screen. Yokota teaches a navigation device for use in a vehicle. EX1007-Yokota, [0004], [0014], [0058]-[0059]. Specifically, Yokota teaches determining whether a function corresponding to a menu item displayed on the screen can be executed, and when it is determined that the function cannot be executed, disabling the menu item corresponding to that function (*disabling at least one user control on the display*). EX1007-Yokota, [0030] (“The menu item displaying method includes...determining whether a function corresponding to a menu item displayed on the screen can be executed, and when it is determined that the function cannot be executed in the determining step, disabling the menu item corresponding to the function from being selected.”). Yokota teaches that the menu item is not selectable and instead the menu skips over the disabled option. EX1007-Yokota, [0071] (“When the user attempts to select the shaded menu item 51 by causing the menu bar to move thereto, since the menu bar skips over it, the menu item 51 cannot be selected (step 105).”), [0032]-[0034], [0084]-[0085].

94. Yokota teaches that if a function cannot be executed, the menu item associated with that function is shaded (e.g., grayed out) to indicate to a user that the function is disabled, and a user cannot select the disabled function. EX1007-Yokota, [0052], [0063]. Additionally, Yokota teaches displaying a reason for why the menu item is disabled. EX1007-Yokota, [0030], [0052]-[0053], [0063], [0084]-[0088].

95. Yokota also includes a central processing unit CPU 17 (*controller*) and memory for enabling/disabling controls on the display. EX1007-Yokota, [0060], [0069], [0072], [0075]-[0077], [0083]-[0084] (“when a desired menu item is selected (step 306), the CPU 17 executes the function corresponding to the selected menu item (step 307).”).

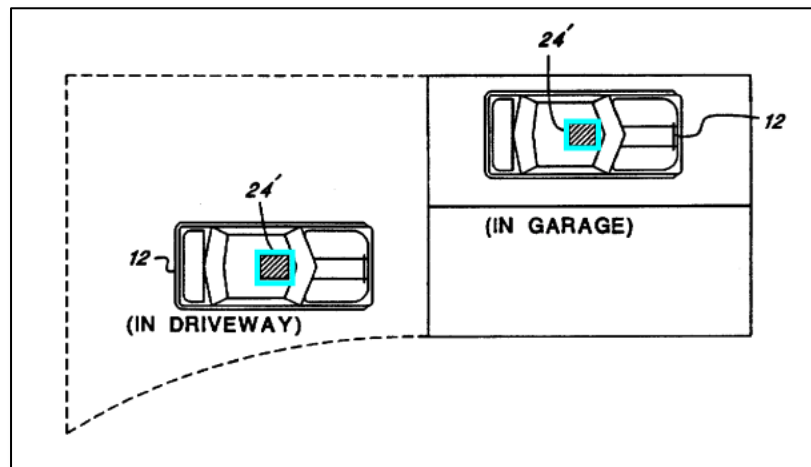
96. Yokota is analogous to the claimed invention of the '996 Patent because Yokota is reasonably pertinent to particular problems with which the inventor of the '996 Patent was involved: (1) using a controller/processor in a vehicle to perform processing operations; *compare* EX1007-Yokota, [0060], [0069], [0072], [0075], [0083], Fig. 2, *with* EX1001, 34:20-63; (2) enabling and disabling functions on a display based on various conditions; *compare* EX1007-Yokota, [0030], [0032]-[0034], [0052], [0063], [0071], [0084]-[0085], *with* EX1001, 34:59-63; and (3) notifying a user about information related to the vehicle using a vehicle display; *compare* EX1007-Yokota, [0030], [0032]-[0034], [0052], [0063], [0071], [0084]-[0085], *with* EX1001, 34:20-63.

E. Ross

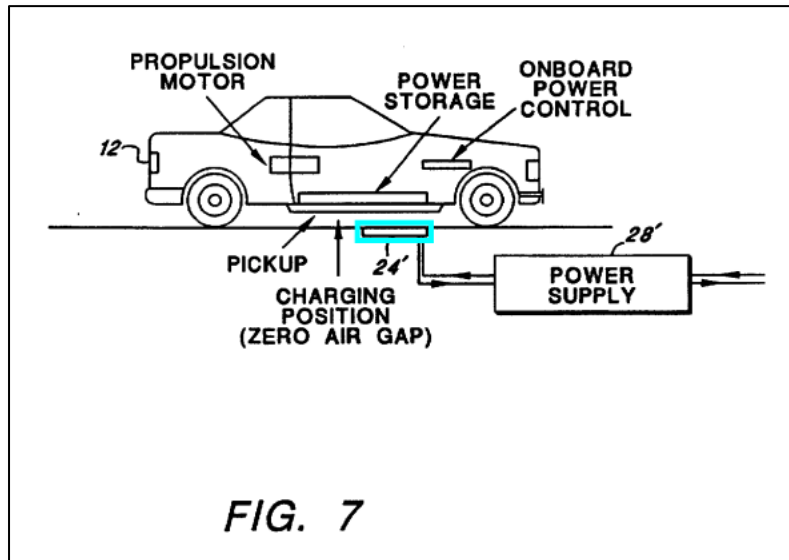
97. I have been instructed by counsel that Ross is prior art to the challenged patent.

98. Ross teaches a charging system for an electric vehicle that utilizes charging pad 24 to inductively charge an electric vehicle's battery. EX1008-Ross,

18:1-10, 17:7-13, 9:11-43. Specifically, Ross teaches charging pad 24 is “approximately 1 meter square and 3 cm thick” and “is installed on the surface of a driveway or garage floor.” EX1008-Ross, 18:1-10. Ross teaches “pad 24’ is used for an overnight recharging of the energy storage system 30” of the electric vehicle.” *Id.* Ross’s Fig. 7 below depicts charging pad 24 and vehicles located in a driveway or garage:



EX1008-Ross, Fig. 7 (excerpt). Charging pad 24 is located beneath a vehicle to perform inductive charging:



EX1008-Ross, Fig. 7 (excerpt).

99. Ross is analogous to the claimed invention of the '996 Patent because Ross is from the same field of endeavor: electric vehicle battery charging systems. *Compare* EX1008-Ross, Abstract, 1:5-12, 2:4-53, 3:31-51, 4:37-47, 13:47-14:21, 16:23-63, 17:13-18:27, Figs. 1-2, 4-7, *with* EX1001, Title, Abstract, 33:19-42.

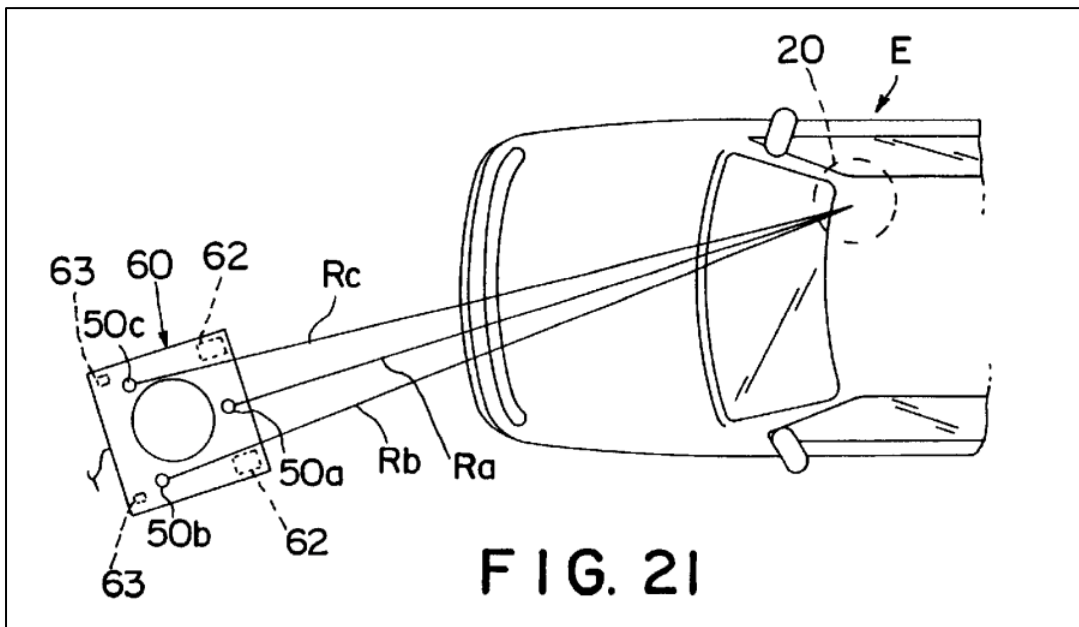
100. Ross is also reasonably pertinent to particular problems with which the inventor of the '996 Patent was involved: (1) assisting a driver in parking a vehicle at a particular position, optionally including repositioning a vehicle; *compare* EX1008-Ross, 6:12-23, 9:44-10:5, 12:33-62, 13:5-14, 15:56-16:12, 20:17-28, Fig. 7, *with* EX1001, 34:20-35:3; (2) using a controller/processor in a vehicle to perform processing operations; *compare* EX1008-Ross, Abstract, 11:50-12:32, 13:27-31, 14:22-40, Fig. 2, *with* EX1001, 34:20-63; (3) notifying a user about information related to the vehicle using a vehicle display; *compare* EX1008-Ross, 12:1-9, Fig.

2, *with* EX1001, 34:20-63; and (4) using a particular charging device such as a charging pad to charge an electric vehicle; *compare* EX1008-Ross, 17:7-13, 17:40-51, 18:1-10, *with* EX1001, 33:19-34:19, 34:64-35:3.

F. Kuki

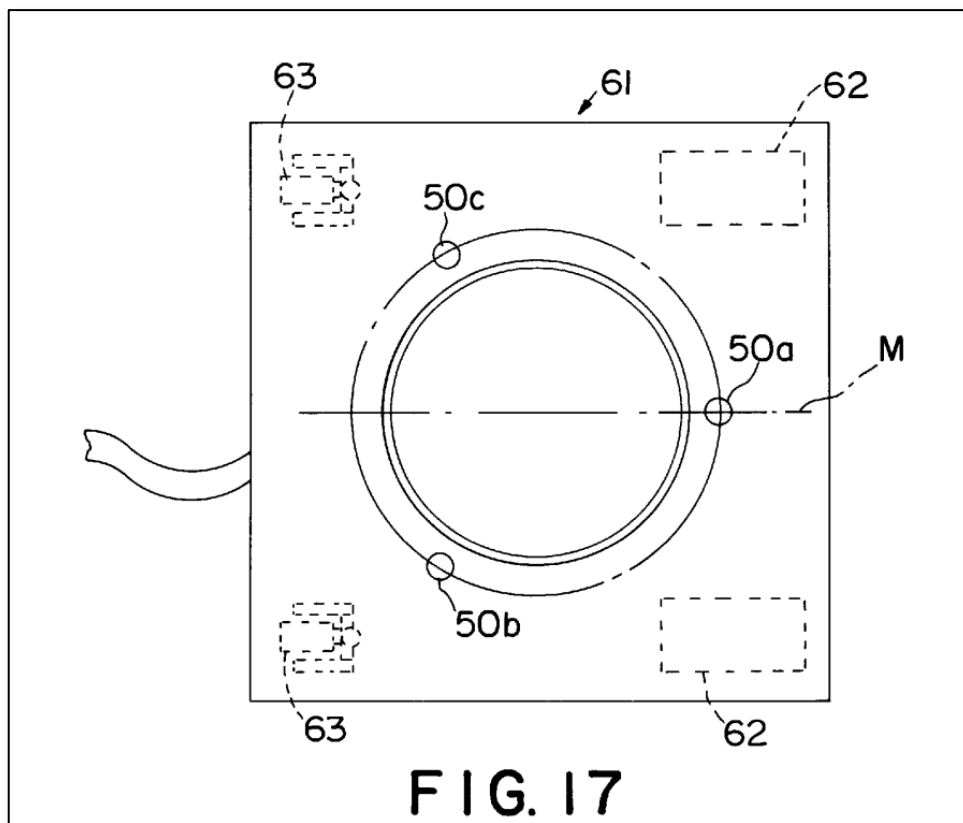
101. I have been instructed by counsel that Kuki is prior art to the challenged patent.

102. Kuki teaches an inductive charging system for a vehicle where three magnetic sensors (50a-c) are utilized for determining when the core in the vehicle and core in the charger are aligned. EX1009-Kuki, 10:19-34, 10:65-11:24, 12:39-51, Figs. 17, 21. In one embodiment, Kuki teaches arranging the sensors in a triangle formation, allowing for magnetic field strength to be detected in both the X- and Y-axis directions. *Id.* That is, when the magnetic field detected by each sensor is equal, the two cores are aligned. *Id.*; Kuki's Fig. 21 depicts sensors 50a-c and a vehicle with a core to be charged inductively:



EX1009-Kuki, Fig. 21. Fig. 17 below depicts a zoomed in view of magnetic sensors

50a-c:



EX1009-Kuki, Fig. 17.

103. Kuki is analogous to the claimed invention of the '996 Patent because Kuki is from the same field of endeavor: electric vehicle battery charging systems. *Compare* EX1009-Kuki, Title, Abstract, 1:7-11, 1:44-6:44, 8:41-52, 11:29-49; 12:60-13:10, 15:42-16:40, 17:10-26, 23:14-25:22, Figs. 1-47, Figs. 54-56, *with* EX1001, Title, Abstract, 33:19-42.

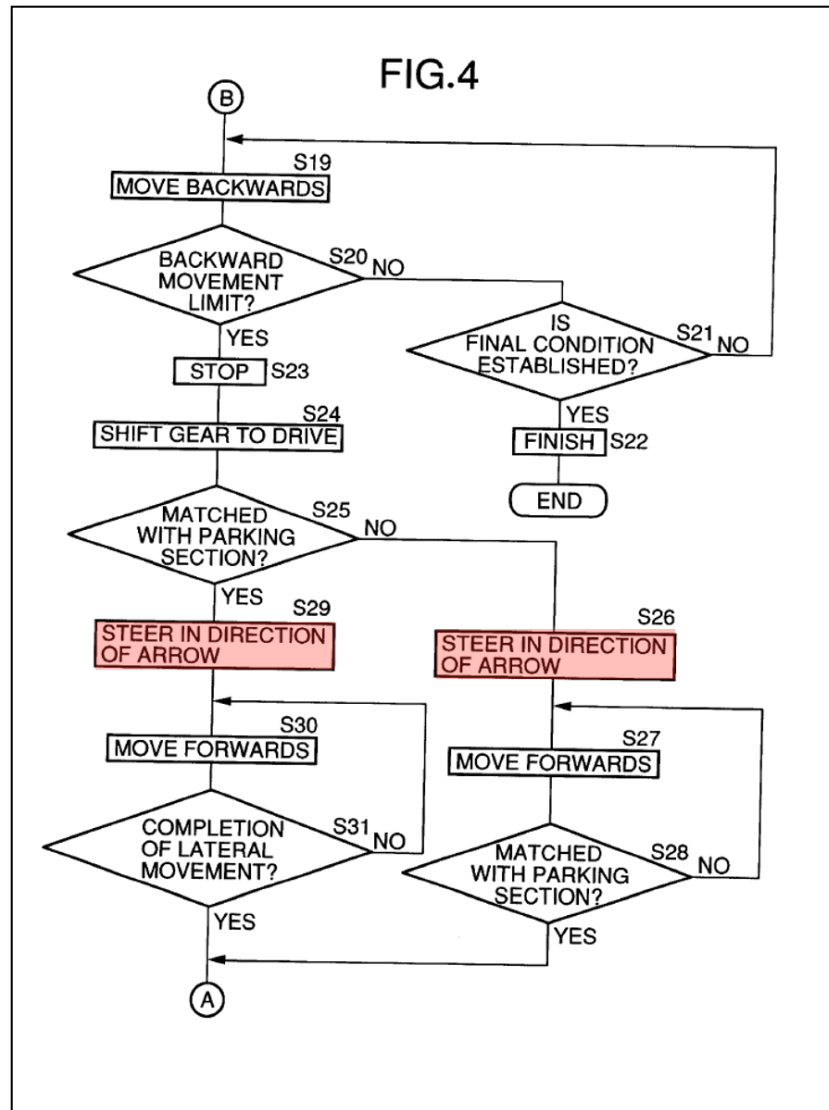
104. Kuki is also reasonably pertinent to particular problems with which the inventor of the '996 Patent was involved: (1) assisting a driver in parking a vehicle at a particular position, optionally including repositioning a vehicle; *compare* EX1009-Kuki, Abstract, 4:24-61, 5:4-7, 8:64-9:3, 9:24-39, 10:49-60, 11:41-12:3, 13:3-10, 15:44-16:12, 16:41-57, 17:27-18:50, Figs. 1, 37-38, 49-51, *with* EX1001, 34:20-35:3; and (2) using sensors to assist a user in parking a vehicle at a particular position; *compare* EX1009-Kuki, 10:19-34, 10:65-11:24, 12:39-51, Figs. 17, 21, *with* EX1001, 33:48-34:28, 34:64-35:3.

G. Shimizu

105. I have been instructed by counsel that Shimizu is prior art to the challenged patent.

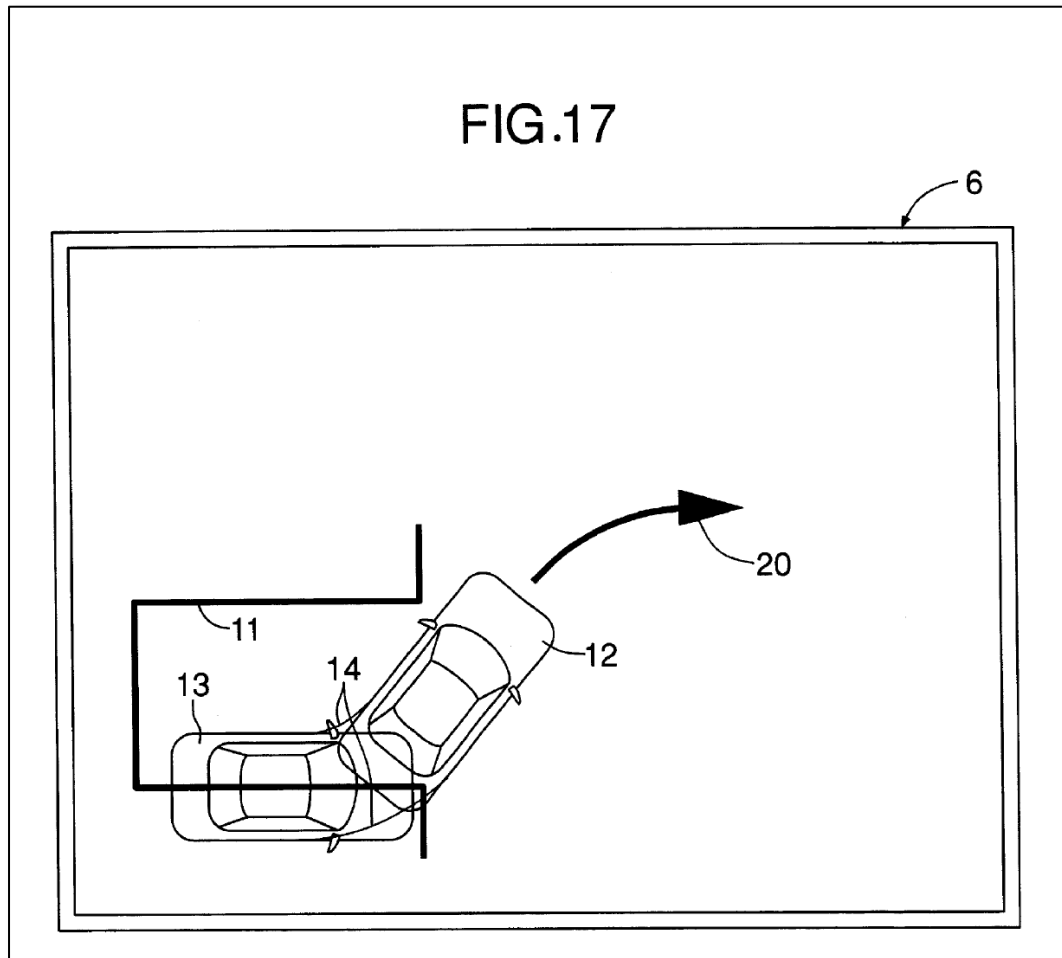
106. Shimizu teaches a system for aiding a driver in parking a vehicle where the vehicle includes a display for displaying parking-aiding information including a target parking position and a vehicle position. EX1010-Shimizu, Abstract, 5:7-13,

5:41-48, 13:1-43. Shimizu's Fig. 4 below depicts a flowchart including a driver steering in the direction of an arrow on display 6 to properly park the vehicle in the target parking space:



EX1010-Shimizu, Fig. 4 (annotated).

107. Specifically, Shimizu teaches displaying a vehicle and indicator (e.g., arrow) on a display where the arrow is in relation to a graphical representation of the vehicle to aid the driver in positioning the vehicle within the target parking space:



EX1010-Shimizu, Fig. 17, *see also id.*, Figs. 18-19.

108. Shimizu is analogous to the claimed invention of the '996 Patent because Shimizu is reasonably pertinent to particular problems with which the inventor of the '996 Patent was involved: (1) assisting a driver in parking a vehicle at a particular position, optionally including repositioning a vehicle; *compare*

EX1010-Shimizu, Title, Abstract, 1:6-8, 1:36-4:23, 5:13-7:8, 9:34-13:43, Figs. 1, 5-21, *with* EX1001, 34:20-35:3; (2) using a controller/processor in a vehicle to perform processing operations; *compare* EX1010-Shimizu, 5:6-12, Fig. 1, *with* EX1001, 34:20-63; (3) notifying a user about information related to the vehicle using a vehicle display; *compare* EX1010-Shimizu, Abstract, 1:46-2:49, 3:45-59, 4:1-36, Figs. 1-2, 7-19, *with* EX1001, 34:20-63; and (4) using sensors to assist a user in parking a vehicle at a particular position; *compare* EX1010-Shimizu, 5:6-140, 6:35-40, 7:10-14, 7:48-8:23, Figs. 1-2, *with* EX1001, 33:48-34:28, 34:64-35:3.

VIII. GROUNDS OF UNPATENTABILITY

Proposed Grounds of Unpatentability of the '996 Patent	Exhibits
<u>Ground 1:</u> Claim 1 is obvious under §103(a) over Izuno, Minoshima, Canedy, and Yokota	EX1004-Izuno EX1005-Minoshima EX1006-Canedy EX1007-Yokota
<u>Ground 2:</u> Claims 7, 12-20 are obvious under §103(a) over Izuno, Minoshima, and Yokota	EX1004-Izuno EX1005-Minoshima EX1007-Yokota
<u>Ground 3:</u> Claim 2 is obvious under §103(a) in view of Izuno, Minoshima, Canedy, Yokota, and Ross	EX1004-Izuno EX1005-Minoshima EX1006-Canedy EX1007-Yokota EX1008-Ross
<u>Ground 4:</u> Claim 3 is obvious under §103(a) in view of Izuno, Minoshima, Canedy, Yokota, and Kuki	EX1004-Izuno EX1005-Minoshima EX1006-Canedy EX1007-Yokota EX1009-Kuki
<u>Ground 5:</u> Claims 4-6 are obvious under §103(a) in view of Izuno, Minoshima, Canedy, Yokota, and Shimizu	EX1004-Izuno EX1005-Minoshima

	EX1006-Canedy EX1007-Yokota EX1010-Shimizu
Ground 6: Claims 8-10 are obvious under §103(a) in view of Izuno, Minoshima, Yokota, and Shimizu	EX1004-Izuno EX1005-Minoshima EX1007-Yokota EX1010-Shimizu
Ground 7: Claim 11 is obvious under §103(a) in view of Izuno, Minoshima, Yokota, and Ross	EX1004-Izuno EX1005-Minoshima EX1007-Yokota EX1008-Ross

IX. OVERVIEW OF THE IZUNO-MINOSHIMA-CANEDY-YOKOTA COMBINATION

109. Izuno alone teaches an electric vehicle, aligning charging coils (one in the vehicle and another connected to a charging station) to charge the vehicle's battery, and a user initiating the charging by selecting a user control on a display in the vehicle. Izuno also teaches allowing charging when the cores are aligned and disallowing charging when the cores are misaligned.

110. As to the additional recited limitations, such concepts were well known in the prior art, and it would have been obvious to incorporate these implementation details in Izuno, as detailed in the Grounds below. For example, Minoshima teaches using proximity sensors in an electric vehicle to detect alignment/misalignment based on a threshold and, if misaligned, providing feedback to a driver on a display for the driver to reposition the vehicle to enable inductive charging. Canedy teaches a vehicle with a microprocessor, display, and proximity sensors connected via a bus, where the microprocessor in the vehicle performs processing related to the proximity

sensors and display. And Yokota teaches a vehicle where certain functionalities are disabled and cannot be selected on a display (or executed) when certain conditions are not met. Conversely, when the conditions are met, the functionalities are enabled/selectable for a user on the display. This concept was simply an application of human-computer interaction/context-based menu programming principles that were well known in the prior art.

111. Thus, Minoshima, Canedy, and Yokota are merely included to provide well-known implementation details not expressly described in Izuno. Together, the Izuno-Minoshima-Canedy-Yokota combination renders Claim 1 obvious.

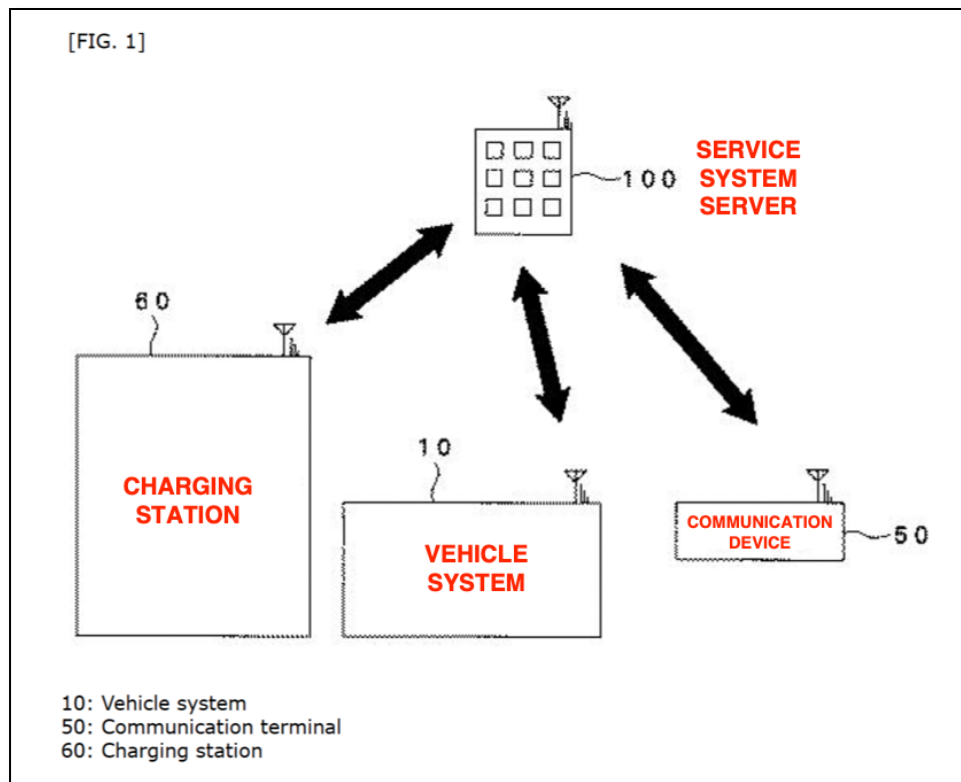
X. OPINIONS REGARDING GROUND 1: OBVIOUSNESS OF CLAIM 1

A. Claim 1 Is Obvious Over Izuno in Combination with Minoshima, Canedy, and Yokota

1. Claim 1[Pre]: “A vehicle alignment system for an inductive vehicular battery charger having a first core movable with respect to a second core to charge a battery of a vehicle, the vehicle alignment system comprising:”

112. To the extent the preamble is limiting, Izuno teaches an electric vehicle battery charging system comprising contactless charging using electromagnetic induction where two couplers (*first and second cores*) are aligned to charge a vehicle's battery. Izuno's system and method includes vehicle system 10 of the electric vehicle including a *first core*, charging station 60 including a *second core* located in a parking space for transferring energy to the *first core* in the vehicle, and

service system server 100 for performing scheduling and other operations, all of which are coupled via a communication network. EX1004-Izuno, [0012], [0014], [0021]. Collectively, vehicle system 10, charging station 60, and service system server 100 are *an inductive vehicular battery charger*. The vehicle (including vehicle system 10), charging station 60, and service system server 100 work together to provide inductive vehicular battery charging when a vehicle is parked in the correct position. EX1004-Izuno, [0012], [0018]. I have added labels to Figure 1 below to illustrate the components of Izuno's vehicle charging system.



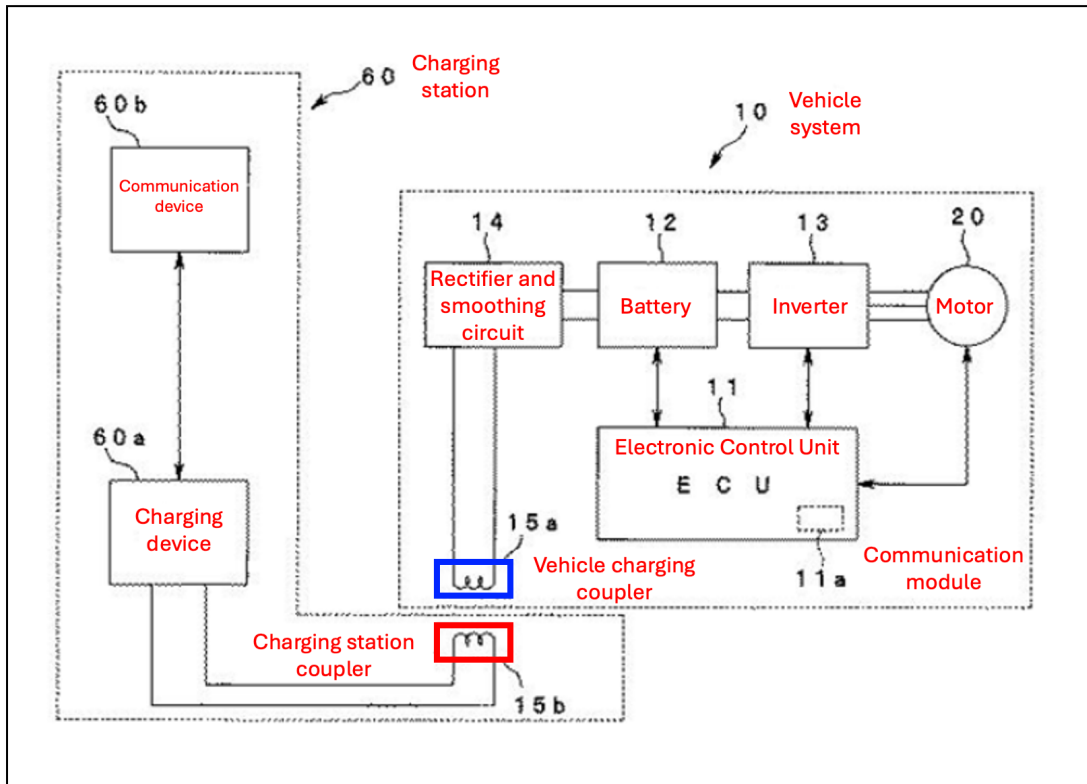
EX1004-Izuno, Fig. 2 (annotated with text labels).

113. Izuno teaches vehicle system 10 includes charging coupler 15a (*first core*) arranged on the underside of a vehicle and coupler 15b (*second core*) installed in a parking space of charging station 60. EX1004-Izuno, [0015] (“charging coupler 15b in the charging station 60”), [0019]-[0020] (“Charging unit 60a first converts the commercial AC power...into DC power, then...converts it into high-frequency AC power to charge the vehicle battery 12 via the charging coupler 15b...and the vehicle charging coupler 15a.”), [0037] (“charging of the vehicle battery 12 begins by contact-free electromagnetic induction via the charging coupler 15b...and the vehicle charging coupler 15a.”).

114. Izuno teaches inductive charging of the vehicle battery is enabled only after the vehicle is parked in a predetermined position in a charging space and charging coupler 15a of vehicle 1 is “positioned opposite” charging coupler 15b. EX1004-Izuno, [0019]-[0020] (“When a vehicle with a charging coupler 15a mounted on its underside is parked in a predetermined charging parking space at a charging station 60, the vehicle charging coupler 15a and the charging coupler 15b located in the charging parking space are positioned opposite each other, enabling contact-free charging of the battery 12 via electromagnetic induction.”), [0037] (“[T]he system checks whether the vehicle has been parked at the predetermined position in the charging parking space[.]”).

115. Because Izuno's charging coupler 15a is installed on the vehicle while charging coupler 15b is in the parking space at charging station 60, charging coupler 15a (*first core*) is movable with respect to charging coupler 15b (*second core*) to facilitate charging when the vehicle is parked in a predetermined position (i.e., when the couplers are aligned). EX1004-Izuno, [0019]-[0020], [0012], [0030]. Conversely, Izuno teaches charging is not enabled "if the vehicle is not parked in the predetermined position." EX1004-Izuno, [0030]. As such, Izuno describes that charging can only be performed when the vehicle is in the predetermined position because if the coupler in the vehicle and coupler in the charging station are not aligned, the charging process ends. EX1004-Izuno, [0020], [0030], [0037], Fig. 2. In Izuno, the user is thus informed by the presence or lack thereof, of correct alignment of the vehicle relative to the charging system, because charging is able to be performed or not. Thus, Izuno teaches a *vehicle alignment system for an inductive vehicular battery charger*.

116. Izuno's Fig. 2 below depicts charging coupler 15a (*first core*) arranged on the underside of a vehicle and coupler 15b (*second core*) installed in a parking space of charging station 60:



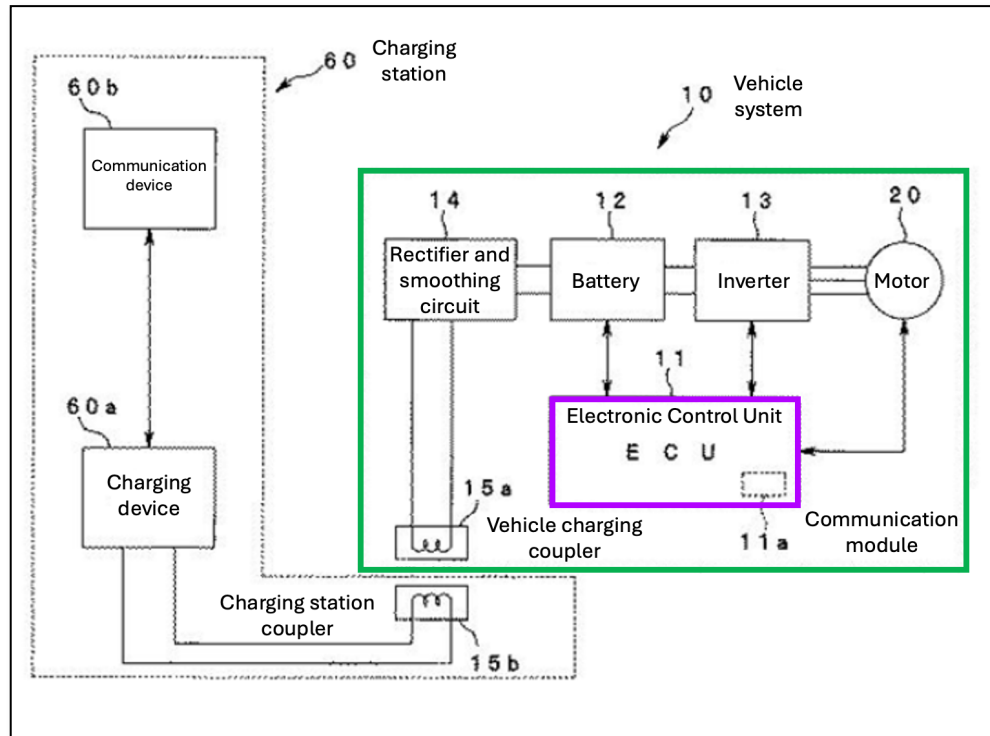
EX1004-Izuno, Fig. 2 (annotated with red/blue boxes and text labels).

117. This system, however, does not provide any specific guidance to the user to help them determine how to move the vehicle when it is not aligned, so that charging can begin. As described below in Claims 1(c)(i)-(ii), and (iv)-(v), it would have been obvious to a POSITA and a POSITA would have been motivated to modify Izuno to utilize Minoshima's vehicle alignment technique including using proximity sensors to detect when a vehicle is parked correctly, thus ensuring Izuno's couplers 15a and 15b are properly aligned before initiating charging. *See* Claims 1(c)(i)-(ii), and (iv)-(v).

2. Claim 1[a]: “a controller; and”

a) Izuno’s Teachings

118. A POSITA would have understood that Izuno teaches *a controller*. Izuno’s vehicle system 10 includes electronic control unit (ECU) 11 “which includes a microcomputer.” EX1004-Izuno, [0015]. ECU 11 “is a control device that primarily controls the motor 20 via the inverter 13 and manages the battery 12.” EX1004-Izuno, [0016]. Izuno teaches that ECU 11 “oversees the entire system” and may be a single unit or multiple units “connected via a communication line, such as a CAN (Controller Area Network), to enable bidirectional communication, thereby allowing the units to exchange control information and sensing data related to the operational status of the controlled objects.” EX1004-Izuno, [0016]. Fig. 2 depicts ECU 11 of vehicle system 10 of the vehicle:



EX1004-Izuno, Fig. 2 (annotated with green/purple boxes and text labels). A vehicular Electronic Control Unit (ECU) is a *controller* at least because the ECU controls various operations of the vehicle. As I opined above, ECUs were commonly utilized components in vehicles for performing processing tasks and controlling components of the vehicle. See my discussion above at Section VI.C.2.

119. As mapped below, Izuno's ECU (*controller*) alone or as modified by Minoshima, Canedy, and/or Yokota is configured to perform the claimed functions. See Claim 1(c)(i)-1(c)(vii).

3. ***Claim 1[b]: "a display mounted within the vehicle, oriented for view by a user seated in the vehicle, and coupled to the controller;"***

a) '996 Patent's Description of a Display

120. The '996 Patent describes a display as “an LCD display 32, although any other type of display can be used as desired.” EX1001, 8:18-20, 34:29-37 (describing a touchscreen or another display in a vehicle console).

b) Izuno's Display

121. Izuno's vehicle includes a *display mounted within the vehicle*. Izuno teaches that communication terminal 50 may be “a display device or audio device installed in the vehicle system 10 of the user's vehicle...allowing information from the service system server 100 to be automatically confirmed via display or audio.” EX1004-Izuno, [0014]. Izuno teaches “in this battery charging system, the vehicle system 10, the communication terminal 50, and the charging station 60 are all connected to the service system server 100 via a communication network.” EX1004-Izuno, [0012]. Further, Izuno teaches the user selects charging modes using communication terminal 50. EX1004-Izuno, [0027], [0014]. Therefore, a POSITA would have understood from Izuno that in at least one embodiment, communication terminal 50 is a *display* installed in vehicle system 10.

122. Izuno's display is *oriented for view by a user seated in the vehicle* including because communication terminal 50 (*display*) provides specific information to “users of electric vehicles[.]” EX1005-Izuno, [0005]. A POSITA would have understood that this information would have been useful to a driver

while seated in the vehicle by updating the driver on numerous aspects of the vehicle, including battery charge level and time remaining until full charge (when the vehicle is charging). Izuno teaches examples of information provided to a user via communication terminal 50 (*display*) include “battery charge level, charge status, time remaining until full charge, remaining capacity, and estimated driving range, and to confirm this information via display or audio output.” EX1004-Izuno, [0013]. Izuno’s information is oriented for view by a user seated in the vehicle because Izuno’s display is part of the vehicle and this information (e.g., driving range remaining, battery charge level) is pertinent to a user, particularly a driver, within the vehicle for viewing. Indeed, in order for the user to be able to view the presented information and provide input, it must be oriented to them in some fashion. A POSITA would have understood that an important aspect of Izuno’s display is providing information to a human driver to be viewable, and the display is therefore *oriented for view by a user seated in the vehicle*.

123. Izuno teaches the display is *coupled to the controller*. ECU 11 and communication terminal 50 are both part of vehicle system 10 of the user’s vehicle. EX1004-Izuno, [0013]-[0015]. Izuno teaches ECU 11 may be “a single unit that oversees the entire system” of vehicle 1, including the vehicle display. EX1004-Izuno, [0017]. A POSITA would have understood that Izuno’s teaching of the ECU overseeing/controlling the “entire system” would have included the display because

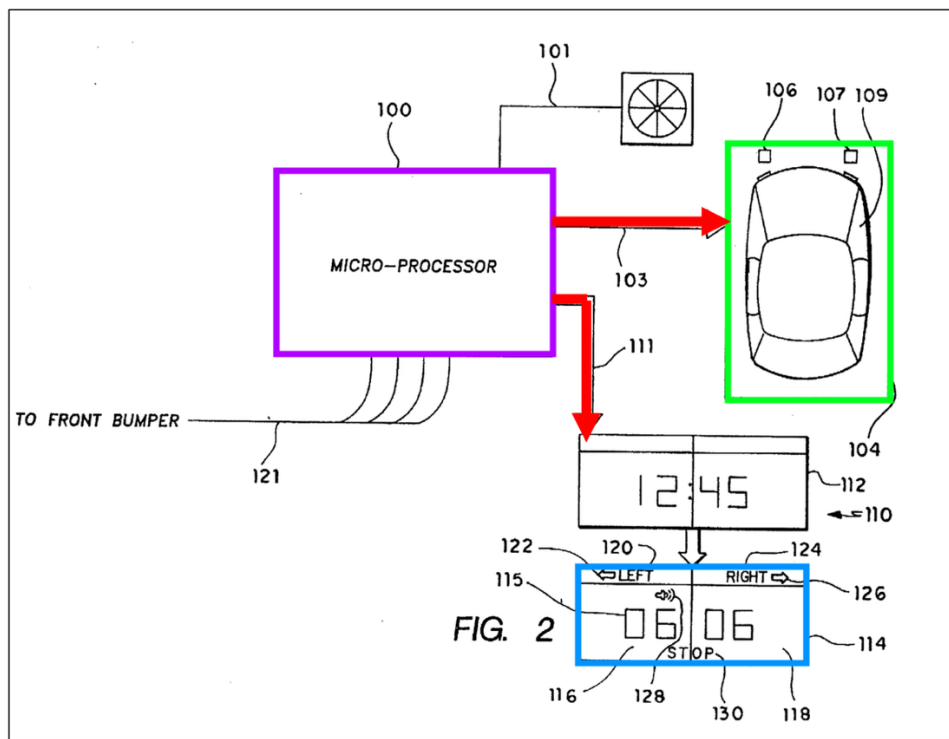
the display is a component installed in the vehicle. Further, a display in the vehicle (e.g., communication terminal 50 installed in vehicle system 10) is an output device for outputting information to a user, and the display would have been controlled by a processor/controller such as ECU 11, as this was known in the prior art. EX1008-Ross, 11:50-12:9 (“the most significant tasks carried out under control of the controller 56 relate to...receiving appropriate commands from the operator control devices 38...[t]he operator control devices 38 include...vehicle displays 64.”), Fig. 2; *see also* Section VI.C. Therefore, a POSITA would have understood that Izuno’s ECU 11 and display are directly coupled with one another such as via a bus, as this was a common method for connecting components within a vehicle.

124. Izuno teaches ECU 11 (*controller*) provides information to service system server 100 via communication module 11a in the vehicle including “battery status.” EX1004-Izuno, [0022], [0018] (“transmits battery information, such as the voltage and remaining capacity of the battery 12 as well as fault information, to the service system server 100.”). Service system server 100 “calculates the amount of charge required to reach full charge, the charging time, and the estimated driving range both currently and after charging, and transmits this charging information to the user’s communication terminal 50 or the vehicle system 10.” EX1004-Izuno, [0022]. Thus, Izuno’s ECU 11 and display are coupled such that the display presents information originally provided by ECU 11 via service system server 100.

Therefore, even if it is argued that ECU 11 and the display are not directly coupled via a bus, for example, the ECU and display are at a minimum indirectly coupled. This is because signals from the ECU are sent to server 100 (e.g., related to battery information) and returned to the display. EX1004-Izuno, [0022].

c) Canedy's Display

125. To the extent it is argued that Izuno's display is not explicitly *coupled to the controller* and/or not *oriented for view by a user seated in the vehicle*, Canedy teaches this. Canedy's Fig. 2 teaches "electronic circuitry" for a vehicle including microprocessor 100 and display 104, which are electronically coupled via bus 103, and microprocessor 100 and display 112/114 coupled by bus 111:



EX1006-Canedy, Fig. 2, 3:66-4:33, 2:63-65 (“FIG. 2 is a block diagram of the electronic circuitry of the present invention.”). Display 104 includes lights 106 and 107 related to proximity sensors at the front of the vehicle that detect an object’s proximity to the vehicle’s front. EX1006-Canedy, 3:66-4:16. The sensor information is provided to the display from proximity sensors via microprocessor 100 and buses 121, 103, 111. EX1006-Canedy, 3:66-4:16, Fig. 2. Microprocessor 100 also controls display 114, which displays a distance to the detected object in inches based on data from proximity sensors. EX1006-Canedy, 4:24-33. Thus, the display is coupled to the microprocessor (*controller*) via a bus such as bus 103 coupling microprocessor 100 and display 104, as well as bus 111 coupling microprocessor 100 to displays 110 and 114. Indeed, Canedy teaches the microprocessor controls lights on display 104 based on proximity sensor information, and display 110 changes to display 114 when the microprocessor determines from proximity sensors that the vehicle is 18 inches (in one example) from an object. EX1006-Canedy, 3:58-4:33.

126. Further, Canedy’s display is oriented for view by a user seated in the vehicle. Canedy’s information on proximity of objects detected in front of a vehicle is presented to a user to aid the user when parking a vehicle. EX1006-Canedy, 2:15-31, 2:39-50, 3:66-4:33, 5:26-30. Thus, Canedy’s display is *oriented for view by a user seated in the vehicle*, such as during parking the vehicle. For example, Canedy expressly teaches that its invention is “for indicating the distance from a cars bumper

or spoiler to a solid object, such as a curb or divider, while parking the car.” EX1006-Canedy, 1:6-9, 2:28-31 (“The principles of the instant invention could also be applied to the side of the car, for parallel parking, to control accurately distance from the curb.”). Thus, the information would have been useful to a driver and the display would have been oriented for view by the driver seated in the vehicle to assist the driver in parking.

d) Motivation to Combine Izuno and Canedy

127. A POSITA would have been motivated and found it obvious to modify Izuno’s display to be coupled to ECU 11 to output information to the display to a user seated in the vehicle. This modification would have been a commonly used and understood method for providing information to a driver of a vehicle. This use of a known technique would have improved Izuno’s vehicle in the same way as Canedy’s vehicle. For example, Canedy’s vehicle provides information to a driver for properly parking the vehicle in a given location. Izuno’s system would have benefited from providing information to the driver to likewise properly park the vehicle so the couplers are aligned and charging can begin, as well as to provide information including battery-related information to the driver. As an example, providing information regarding amount of battery left would have benefited Izuno so the driver would know when the vehicle needs to be charged again.

128. Canedy provides implementation details such as a bus coupling the display and controller, which a POSITA would have looked to when modifying Izuno. As I noted above, using a bus to couple components in a vehicle was a common technique. Thus, a POSITA would have been motivated to utilize Canedy's teachings to implement features such as a display in a standard and straightforward way in Izuno's vehicle. Furthermore, directly coupling the display to the controller via a communication bus would increase data transfer reliability and speed. Coupling a controller such as Izuno's ECU to a display would have advantageously allowed the ECU to output information for viewing by the user (e.g., related to charging, sensor data, proximity). Presenting such information to the user while seated in the vehicle would have assisted the user in parking the vehicle, thereby improving accuracy and efficiency of parking in a predetermined position. Because this information is related to vehicle operations and is pertinent to a driver of a vehicle, providing this information while the vehicle is in operation and being driven/parked would have been advantageous. For example, it was well known that pertinent information in a vehicle would be conveyed to a driver while the vehicle is stopped or being driven. EX1005-Minoshima, [0066] ("the notifying means can reliably convey information to the driver. For example, if an alert is displayed visually, the information is guaranteed to appear within the driver's field of view regardless of the vehicle's orientation when stopped.").

129. Combining these prior art elements according to known methods would have yielded the predictable results of a controller coupled to a display and a display oriented for view by a user seated in the vehicle. Indeed, this modification would have been straightforward and well-understood, including because vehicles with displays coupled to processors were known in the prior art, such as Canedy. EX1006-Canedy, 3:66-4:12, Fig. 2; EX1033-Diller, 3:26-29, Fig. 1; EX1008-Ross, 13:36-44, Fig. 2.

130. A POSITA would have had a reasonable expectation of success when modifying Izuno. Connecting components in vehicles, such as a controller and display, via buses was well known in the prior art. *See* Section VI.C.4. To the extent a hardware modification would have been required, a POSITA would have known how to locate off-the-shelf vehicle components and would have known either how to install such components or locate a technician to perform the installation. I note that a POSITA would not have had to bodily incorporate Canedy's bus into Izuno's vehicle. To the extent any hardware modifications would have been required, a POSITA would have been able to select from commercially available products. Additionally, or alternatively, a POSITA would have simply selected from known, commercially available products including circuitry such as Canedy's. In this way, a POSITA would also have been able to simply select a commercially available product.

131. A POSITA would have had a reasonable expectation of success because orienting the display for a user seated in the vehicle was also known. Indeed, one of the main purposes of a display is to provide visual output to a user, making orienting the display towards a driver so the driver can read the display's output a natural and expected action. Further, Izuno already teaches a display. Thus, a POSITA would not have had to modify Izuno to include an additional display, although this would have been a possibility. Instead, Izuno's native display or a display simply substituted (such as Canedy's display) would have sufficed for modifying Izuno per Canedy's teachings. A POSITA looking to Canedy would have positioned the display in a manner visible to the user while seated to advantageously provide information to the user to aid in positioning the vehicle correctly, allowing for inductive charging. This arrangement would have advantageously made use of the display to assist the driver and would have done so with a reasonable expectation of success.

4. Claim 1[c]: "wherein the controller is configured to:"

132. As mapped below, Izuno's controller alone or as modified by Minoshima, Canedy, and/or Yokota is configured to perform the claimed functions. *See Claims 1(c)(i)-1(c)(vii).*

133. I note that for the limitations below where Izuno and/or Minoshima are not mapped as utilizing a controller configured to perform claimed functions,

Canedy is relied on to teach a controller configured to perform such claimed functions. While the overall motivation to combine Izuno-Minoshima and Canedy's teachings is generally the same for claims 1(c)(i)-1(c)(vii), I have provided additional opinions for each limitation, as needed.

5. *Claim 1[c(i)]: “detect a first positional relationship between the first core and the second core at a first time,”*

134. The '996 Patent describes detecting the distance between vehicle sensors 1154 and reference points (sensed elements 1156) on the charging pad (or having known positions with respect to the charging pad) using triangulation, which was “well-known to those skilled in the art.” EX1001, 34:1-9, 34:64-35:1, Fig. 18. As mapped below, the combination teaches *detecting a first positional relationship*.

135. Izuno teaches an ECU (*controller*) controls the charging of the battery in a contactless vehicle charging system. *See* Claim 1(a). Izuno teaches enabling charging when a vehicle is parked in a “predetermined position” in a parking space, such that the vehicles and charging couplers are “positioned opposite each other.” EX1004-Izuno, [0020], [0030], Fig. 2. Izuno-Minoshima teaches *detecting a first positional relationship between the first core and the second core at a first time*.

a) Overview of Izuno-Minoshima

136. Izuno teaches a stationary power transfer core located in a parking space. EX1004-Izuno, [0020], Fig. 2. Minoshima teaches a movable power transmitting coupler attached to a ground-side charging device such that the coupler

extends underneath the vehicle to enable contactless charging. EX1005-Minoshima, [0016], [0018], Figs. 1-2. Minoshima further teaches detecting a positional relationship between the vehicle-side coupler and ground-side coupler. EX1005-Minoshima, [0055]-[0057]. In the Izuno-Minoshima combination, the power transfer core would be stationary as in Izuno's native arrangement, but Minoshima's teaching of using proximity detection sensors would have applied to Izuno for determining alignment of the first and second cores.

137. While Minoshima's setup allows more flexibility in the allowable position for "correctly" parking the vehicle compared to Izuno's native system, Izuno's setup is simpler, less expensive, and requires fewer moving parts to implement. A POSITA would have been motivated to utilize Minoshima's teachings of using proximity sensors to help a user park the vehicle in a position suitable for charging, but the combination would utilize Izuno's native charging setup, which includes a charger that is stationary.

138. Thus, the combination implements Izuno's stationary power transfer core in the parking space but modifies Izuno's vehicle and method to include proximity sensors to assist the user in determining when the vehicle is correctly parked and assist in adjusting vehicle position when incorrectly parked (which inhibits or prevents charging), as taught by Minoshima. A POSITA would have recognized that the combination would have been a tradeoff by choosing amongst

various advantages (e.g., Izuno's simplicity vs Minoshima's flexibility) and would have been simply a design choice. Specifically, Izuno's native system provides more simplicity and fewer moving mechanical parts than Minoshima's arrangement. In other words, using Izuno's native arrangement avoids the use of complicated mechanical systems that require maintenance or are prone to error or breaking down and additionally are not susceptible to driver error impacting the charging stations (e.g., running into the charging station). Thus, utilizing Izuno's native system would have been choosing amongst various advantages such as a simpler and more robust system versus a system with more flexibility in parking position (Minoshima's arrangement). I discuss a motivation to modify Izuno/Izuno-Canedy and Minoshima below.

b) Minoshima's First Positional Relationship ... at a First Time

139. Minoshima teaches a contactless vehicle charging system that comprises a power receiving coupler 3 provided on the front bottom surface of the electric vehicle 1 and a ground-level charging device 9 configured "so that a power transmitting coupler 10, which transmits power to a power receiving coupler 3, is mounted at the end of a support arm 11." EX1005-Minoshima, [0016], [0018], [0041]-[0044], [0061].

140. Minoshima teaches using proximity sensors to detect a position of the vehicle to determine if the parking orientation is correct to allow for charging to

begin. EX1005-Minoshima, [0047]. Minoshima teaches two embodiments regarding the location of proximity sensors: one embodiment where the proximity sensors are in ground-level charging device 9, and another embodiment where the proximity sensors are part of electric vehicle 1. EX1005-Minoshima, [0059] (teaching proximity sensors 17 (“detectors”) are in the electric vehicle and detected component 16 is in ground-level charging station 9). I rely on Minoshima’s embodiment where the proximity sensors are located within the electric vehicle, and the detected component is located in the ground-level charging station. I have provided annotated figures below depicting this embodiment.

141. I note that placing the proximity sensors on the vehicle instead of in the charging station advantageously allows for positioning to be tailored to each vehicle’s dimensions rather than relying on a single width dimension, for example, as would occur when the proximity sensors are spaced a fixed distance apart in a charging station. Thus, utilizing Minoshima’s express teaching, suggestion, or motivation to locate the proximity sensors on the vehicle would have been a tradeoff of tailoring sensors to each vehicle versus only requiring one set of sensors in a charging station and adding a “detected component” to each vehicle instead.

142. Additionally, placing the display in the vehicle where it is in view of the user/driver, as described in the discussion of Claim 1(b) above, would ensure that the user would easily see the positional relationship between the vehicle and the

stationary charging core. This approach would ensure, for example, that no obstructions or glare would prevent the user/driver from viewing the display, as might occur if the display were mounted outside the vehicle. A POSITA would have understood that, if the display and the controller operating the display are mounted in the vehicle, it would be far simpler to mount the proximity sensors in the vehicle as well. Doing so would avoid the need to communicate sensor information from the stationary ground-side charging system to the vehicle. This would also ensure that a single ground-side charging system would serve many different vehicle types even if they implemented different proximity and display systems.

143. In this manner, the Izuno-Canedy-Minoshima vehicle's *controller* (e.g., ECU 11) performs processing for positional relationships based on sensor data from proximity sensors installed on the vehicle and provides feedback to the driver via a display, such as Izuno's display 50 and/or Minoshima's display 34 located within the Izuno-Canedy-Minoshima vehicle. This arrangement is also advantageous because the vehicle already includes a processor/controller, and thus the sensor data would have been processed at the vehicle rather than in the charging station, which would have required wirelessly transmitting proximity sensor data to the charging station and then wirelessly receiving processed data back.

144. Minoshima teaches proximity sensors 17 in the vehicle detect the vehicle's deviation in the width and longitudinal directions relative to a

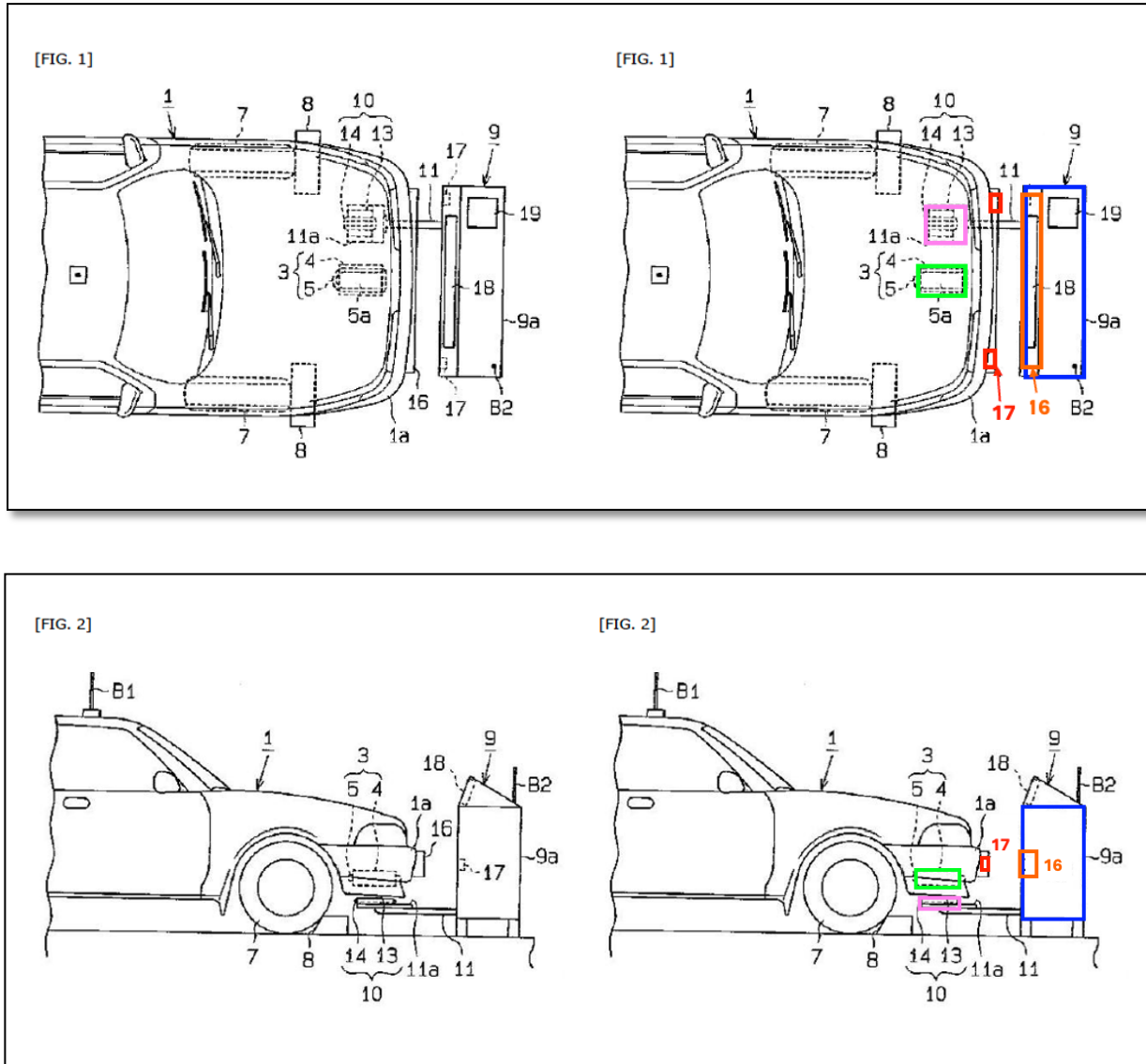
predetermined distance from the ground-level charging device (*positional relationship*). EX1005-Minoshima, [0009], [0021]-[0024], [0039], [0047]-[0049], [0058] (“three or more detectors, such as proximity sensors, may be provided. Increasing the number of detectors allows for more precise detection”), [0065] (“[T]he widthwise misalignment detecting means comprises at least two proximity sensors that detect when the vehicle has approached within a predetermined distance of a predetermined reference position, using two different locations on the vehicle as detection targets. As a result, the system can detect not only widthwise misalignment but also improper angled parking.”). The proximity sensors 17 may consist of optical, magnetic or ultrasonic sensors. EX1005-Minoshima, [0059].

145. If the proximity sensors determine that the vehicle is not parked in a predetermined position to allow charging, the driver is notified to reposition the vehicle before charging is enabled. EX1005-Minoshima, Abstract (“Parking Position NG”), [0011] (“[I]f the parking orientation of the vehicle is unsuitable for charging, information indicating that the parking orientation is unsuitable is provided to the driver via the notifying means, prompting the driver to reposition the vehicle.”), [0039], [0048], [0063]. Thus, the proximity sensors *detect a first positional relationship* between the vehicle-side power-receiving coupler (*first core*) and the ground-level (charging station) coupler (*second core*) *at a first time* by

detecting the position of the vehicle (e.g., the bumper) relative to the ground-level charging device at a first point in time.

146. In particular, in the Izuno-Minoshima combination, the charging coupler is located at a particular portion of parking space near the charging station. Thus, when utilizing proximity sensors to help position the vehicle correctly for charging, the positional relationship would have been a positional relationship between the coupler in the vehicle and the coupler in the parking space. I note that a POSITA would have recognized that since the vehicle may arrive at the charging station at any given point in time, the measurement of the first positional relationship is made at a *first time* relative to any subsequent measurements of the positional relationship. This determination of the *positional relationship at a first time* is compared with the known spatial relationship between the vehicle sensors, charging coils, and ground-side/charging station detected components that corresponds to a “correct” parking position. *Id.* See Claim 1(c)(ii) below mapping when the positional relationship is determined to be a misalignment.

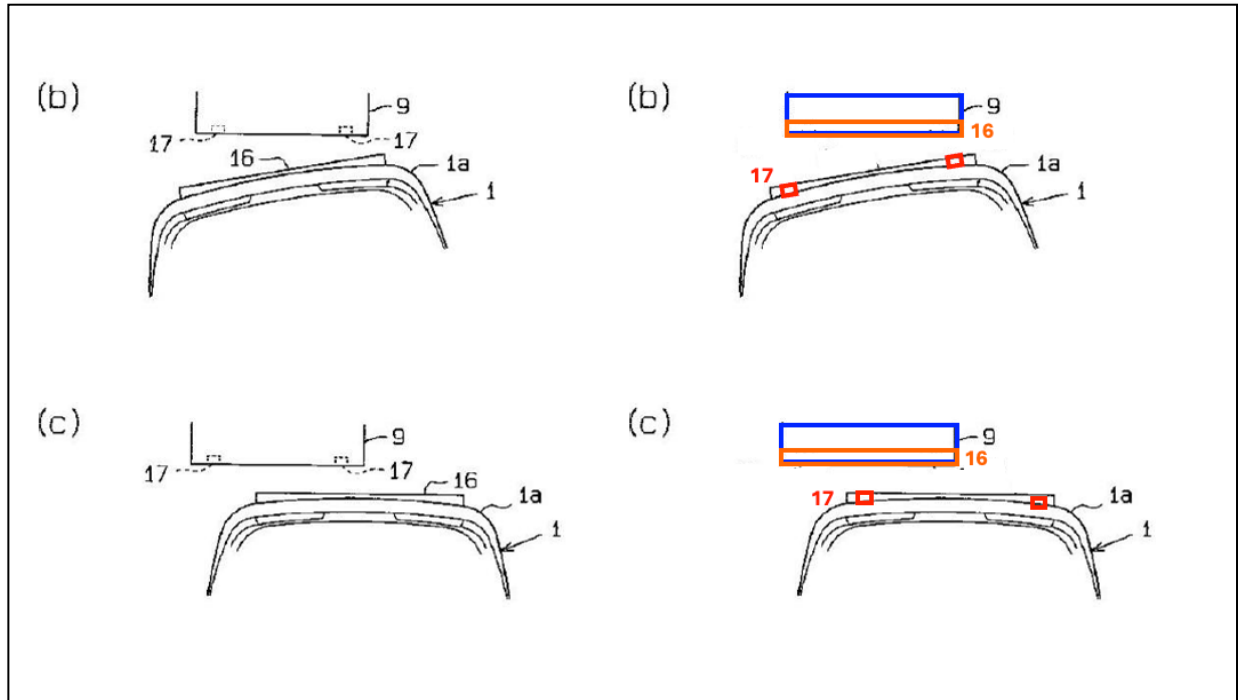
147. Minoshima’s general layout of electric vehicle 1 and ground-level charging device 9 is depicted below, including power receiving coupler 3, detected component 16, power transmitting coupler 10, proximity sensors 17, and ground-level charging device 9:



EX1005-Minoshima, Figs. 1 and 2 (left, original; right, depicting Minoshima's embodiment with **proximity sensors 17** located on the vehicle and **detected component 16** on **ground-level charging device 9**).

148. Minoshima depicts parking scenarios including misalignment (Figs. 3B-3C) of proximity sensors 17 of ground-level charging device 9 and detected component 16 of electric vehicle 1. Minoshima's embodiment where **proximity**

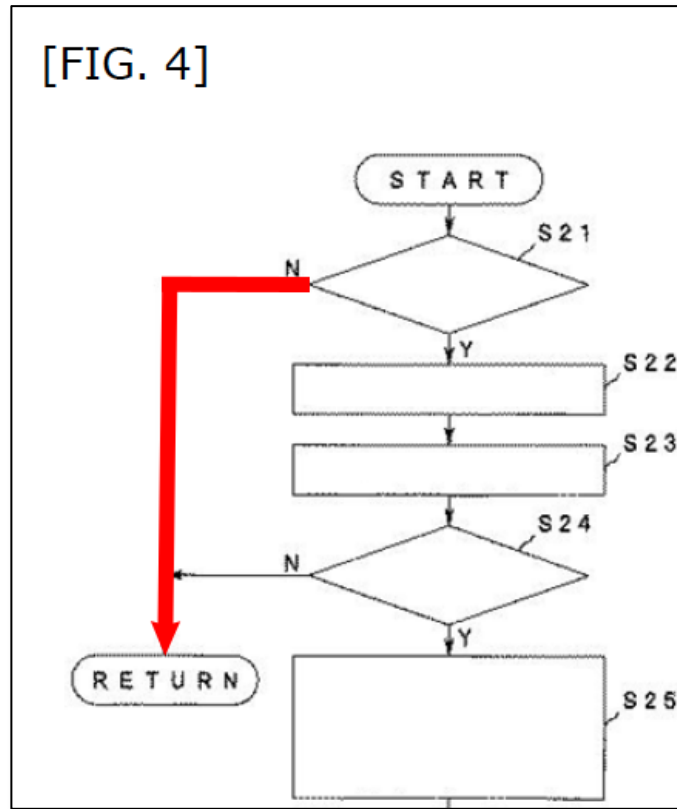
sensors 17 are within the electric vehicle and the detected component 16 is within the ground-level charging device 9 are depicted below (right) as compared to proximity sensors 17 in the ground-level charging device 9 (left):



EX1005-Minoshima, Figs. 3B-3C, [0021]-[0023], [0033], [0036]-[0037]. Fig. 3B depicts misalignment where the vehicle is parked at an angle. Fig. 3C depicts misalignment where the vehicle is parked off-center of the charging coupler. Thus, Minoshima's sensor system would be able to determine not only when the vehicle charging core is properly positioned relative to the ground-side charging core, but also when the cores are misaligned. That misalignment information would then be used to inform the driver which direction to move the vehicle to properly position the charging cores.

c) Motivation to Combine Izuno and Minoshima

149. A POSITA would have been motivated and found it obvious to modify Izuno per Minoshima's known technique of determining a positional relationship between the coil in a vehicle and charging coil at a charging station by utilizing proximity sensors installed in a vehicle and a detected component installed in the charging station. This modification would have advantageously provided the Izuno-Canedy-Minoshima system with components for properly positioning a vehicle for charging, the details of which Izuno does not expressly disclose on its own. Notably, Izuno teaches that if the car is not in the proper position, the process simply ends and no charging takes place. EX1004-Izuno, [0030] ("If the vehicle is not parked in the predetermined position, the processing ends."). Izuno's Fig. 4 below is annotated to depict this scenario, where if the vehicle is not parked in the predetermined position, the result of step S21 is "no" and the flowchart leads to "return," ending the process.



EX1004-Izuno, Fig. 4 (excerpt). Put another way, if the vehicle is not in the predetermined position, steps S22 and beyond are not carried out. In that case, the user is not presented with any ability to issue a charging start instruction. As noted above, while Izuno describes that charging can be started when the vehicle is in a predetermined position, Izuno does not describe how this determination is made or how the user is instructed to re-position the vehicle so that the cores are aligned.

150. A POSITA would have been motivated to modify Izuno's method of controlling a contactless vehicle charging system using an ECU with Minoshima's method of detecting vehicle proximity to the charging device to improve operational reliability and efficiency. In my opinion, modifying Izuno's vehicle in this manner

would have improved the overall system by making correctly positioning the vehicle easier, more easily repeatable, and would have improved reliability and efficiency by ensuring proper positioning for charging where the couplers are properly aligned.

151. Izuno teaches that the ECU sends start and stop charging signals via wireless communication to the contactless charger only when the vehicle is parked in a “predetermined position.” *See* Claim 1(a); EX1004-Izuno, [0030]. ECUs conventionally receive sensor inputs and initiate control decisions. *See* Section VI.C.2. Therefore, a POSITA would have been motivated and found it obvious to extend the ECU’s wireless control to include Minoshima’s proximity detection in the Izuno combination vehicle to allow the system to more effectively detect and confirm that the required positional relationship (e.g., within the predetermined distance) is satisfied before issuing start charging signals. Izuno natively teaches checking if the vehicle is positioned correctly but lacks express details for performing this check. In the combination with Minoshima, proximity sensors would be used, and the ECU in the vehicle would receive sensor data from said proximity sensors regarding positioning of the vehicle and its core in relation to the core in the parking space.

152. A POSITA would have understood that this approach would also result in a significant reduction in time to get the charging started, and the resulting more

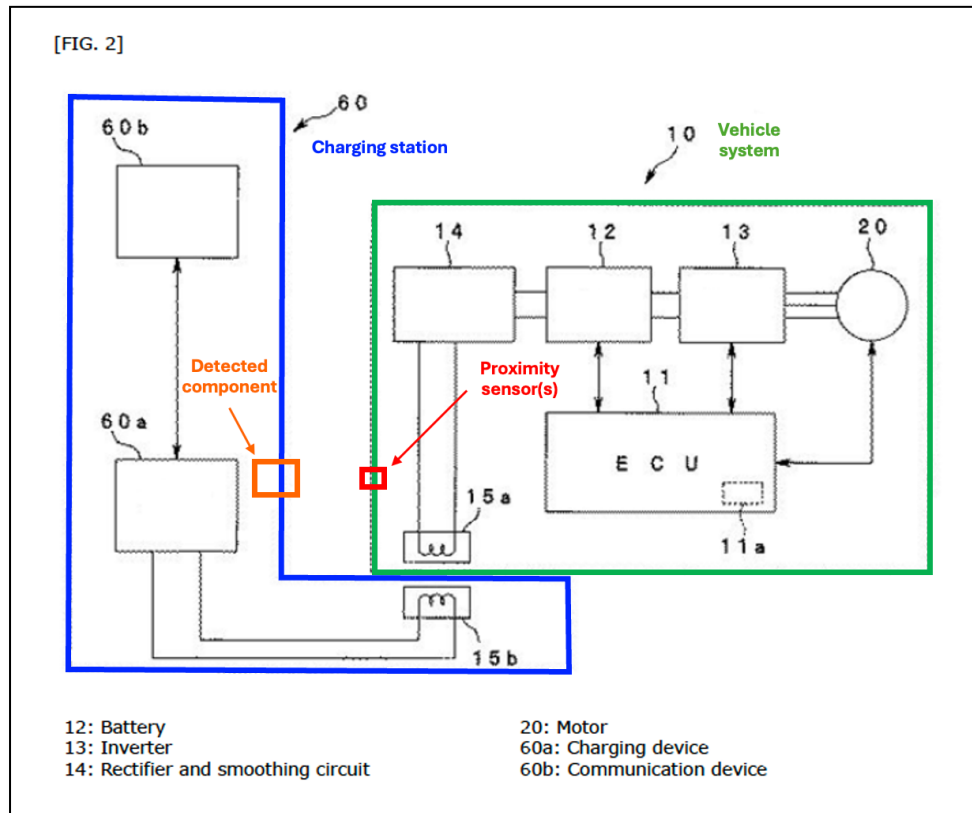
effective time use of the charging resource, not the least of which is that the vehicle would spend less time at the charger, thereby freeing the charger up for use by others.

153. Such a combination would prevent inefficient charging conditions, while providing a centralized control system for the user. Indeed, incorrect positioning would have caused inefficient charging as the magnetic field would not be ideally placed for inducing charge in the vehicle's coupler. Because Izuno teaches that the vehicle must be positioned within a predetermined position (e.g., where couplers are positioned opposite each other) in the parking space to enable charging, a POSITA would have looked to Minoshima for a method of detecting a "correct" position for the vehicle to achieve alignment between the vehicle's receiving coil and the ground-level (charging station's) power transmission coil. This would have ensured the required positional condition is satisfied prior to charging to improve the efficiency and reliability of the charging system and prevent a vehicle from being uncharged due to being improperly parked, as taught by Minoshima. For example, an improperly positioned vehicle when parked would charge slowly and inefficiently or not at all, leaving a user frustrated that the vehicle has not charged when the user thought the vehicle was charging. Thus, combining prior art elements such as Izuno's vehicle and Minoshima's proximity sensors (or similar proximity sensors) according to Minoshima's known method would have yielded predictable results.

154. Further, a POSITA would have been motivated to utilize Minoshima's known technique to ensure proper alignment between the coils to allow for more reliable, efficient, and faster inductive charging. As I noted above, placement of coils affects inductive charging efficiency and may also affect speed. *See* Section VI.B.1; *see also* EX1001, 33:43-46. Additionally, using Minoshima's technique is very beneficial because it avoids the situation of a car being parked in a position in which it will not be charged. For example, Izuno's native processing step simply ends if the vehicle is positioned incorrectly. Modifying Izuno per Minoshima would have provided feedback to the user on positioning, such that the user would know when the charging is able to be initiated. This modification would have been use of Minoshima's known technique involving proximity sensors in a vehicle to improve Izuno's similar electric vehicle in the same way.

155. The proximity sensors in the Izuno combination vehicle detect the location a detected component in the charging station, as taught by Minoshima. *See* EX1005-Minoshima, Figs. 1-2, 3B-3C *above*. As illustrated below in Izuno's Fig. 2, detection of the charging station provides a reference location from which the positions of the charging station coupler and vehicle-side coupler are known based on their fixed spatial relationships with the charging station detected component and vehicle sensors, respectively. By detecting the charging station using the vehicle's proximity sensors, the relative positions of the corresponding charging couplers can

be determined using the known positional offsets between the detected component and coupler 15b, and proximity sensor and coupler 15a.



EX1004-Izuno, Fig. 2 (annotated).

156. A POSITA would have had a reasonable expectation of success when modifying Izuno per Minoshima. Izuno already teaches an electric vehicle and inductive charging system and method requiring the vehicle to be in a particular position to enable charging. Thus, the modification simply adds proximity sensors and any necessary programming to Izuno/Izuno-Canedy's vehicle. Minoshima provides implementation details for achieving proper alignment, including by utilizing proximity sensors in a vehicle and a detected component in the charging

station. Thus, modifying Izuno per Minoshima would have been simply a matter of including proximity sensors and detected component (either in the vehicle and/or charging station) and related programming instructions to provide positional relationship information to help the user properly align the couplers to achieve efficient charging. Modifying programming instructions would have been straightforward and routine, thus leading to a reasonable expectation of success.

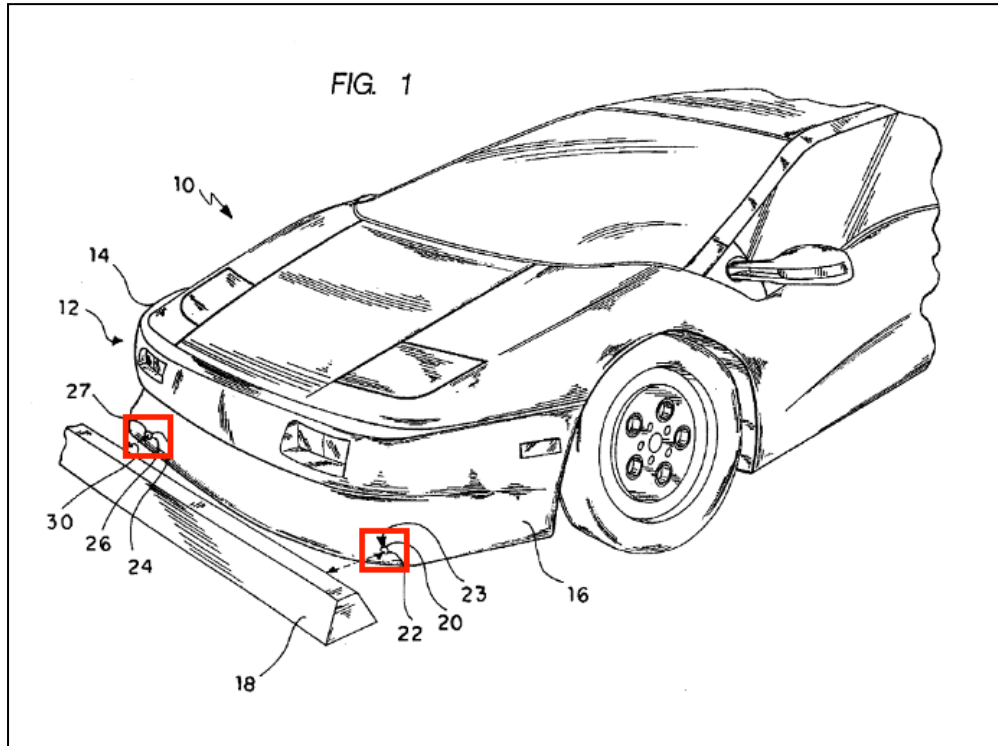
157. For example, Minoshima teaches presenting positioning information to a driver via display 34 in vehicle 1 and/or display 18 in the charging station. *See* Claim 1(c)(i). Thus, when modifying Izuno, positional information would also have been provided to the driver on Izuno's display to help correctly position the vehicle to enable inductive charging. This would have been a natural and logical consequence of utilizing proximity sensors and a display coupled to a processor in the Izuno-Canedy-Minoshima vehicle. Further, because this positional information would have been provided to the vehicle and/or charging system, the inductive charging system would have been informed as well of when the vehicle was properly aligned for efficient charging. I note Izuno already teaches informing server 100 regarding correct vehicle positioning. In the Izuno-Canedy-Minoshima combination, information based on the proximity sensors would have been transmitted to server 100.

d) Canedy's Microprocessor and Sensors

158. To the extent it is argued that Izuno-Minoshima is insufficient to teach *a controller configured to detect a positional relationship*, Canedy teaches the same. Specifically, Canedy teaches a vehicle including microprocessor 100 and proximity sensors, which comprise two pairs of optical sensors (optical transmitter/detectors 20/22 and 24/26 on the left and right side, respectively, of vehicle spoiler 16), communicating via bus 121. EX1006-Canedy, 3:58-65 (“A microprocessor 100 is used to control the detection process. Bus [121]⁴ are used to control the two pairs of optical sensor units.”), 3:7-47 (generally teaching each pair of optical sensors), Fig. 2. Microprocessor 100 processes data from the proximity sensors regarding the proximity of an object in front of a vehicle when being parked. EX1006-Canedy, 3:58-4:51. Canedy also teaches outputting information to a driver on vehicle display 18 including distance from the sensor to the object. EX1006-Canedy, 3:66-4:33, 4:53-5:6, 5:24-43.

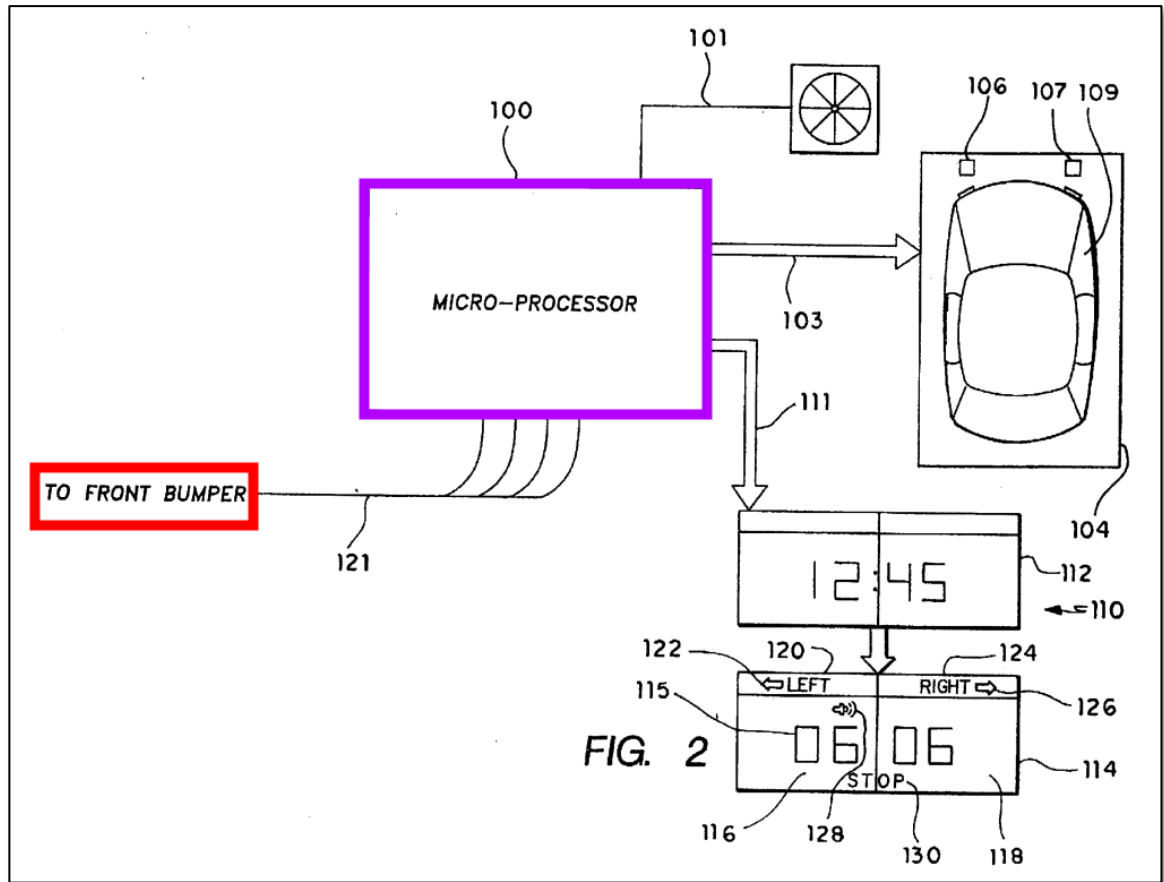
159. Fig. 1 depicts Canedy's vehicle including optical sensors 20, 22 and 24, 26 (proximity sensors) on the front spoiler 16:

⁴ Canedy has a typographical error where “bus 120” should be “bus 121,” as depicted in Fig. 2 “bus 121.” EX1006-Canedy, 3:58-62, 4:19-21, Fig. 2. Element 120 properly refers to “LEFT indicator 120” of display 114. *Id.*



EX1006-Canedy, Fig. 1.

160. Fig. 2 depicts the electronic circuitry, including microprocessor 100 and bus 121 “to front bumper” that houses the optical sensors:



EX1006-Canedy, Fig. 2, 3:66-4:33. Display 104 includes lights 106 and 107 corresponding to the proximity sensors at the front of the vehicle that detect when an object is close to the vehicle's front. EX1006-Canedy, 3:66-4:16. Microprocessor 100 also controls display 114, which displays a distance to the detected object in inches. EX1006-Canedy, 4:24-33. Thus, the display and proximity sensors are *coupled to* the microprocessor (*controller*), which processes information received from the proximity sensors to detect a positional relationship between the front bumper and an object and outputs the result to the display. *See* Claims 1(b), 1(c).

Therefore, Izuno-Minoshima-Canedy's *controller* is *configured to detect a positional relationship*.

e) Motivation to Modify Izuno-Minoshima-Canedy

161. Canedy provides implementation details regarding a processor, communication bus, and proximity sensors in a vehicle that Minoshima does not expressly disclose. As I opined above, Minoshima teaches a charging system for an electric vehicle and teaches including proximity sensors on the vehicle. However, Minoshima does not expressly disclose that in the embodiment where the proximity sensors are located on the vehicle that there would be a processor also in the vehicle to process data from the proximity sensors. However, Canedy teaches these implementation details, including teaching a vehicle with a microprocessor connected to proximity sensors via a bus. A POSITA would have been motivated and found it obvious to modify Izuno-Minoshima to utilize Canedy's well-known circuitry arrangement where a vehicle microprocessor is coupled to vehicle proximity sensors and a display via buses. This modification would thus have provided the Izuno combination with implementation details for modifying the Izuno-Minoshima-Canedy vehicle to include proximity sensors and the hardware for processing signals/data from the proximity sensors.

162. This modification would have been use of Canedy's known technique of coupling a vehicle processor, bus, and proximity sensors that would have

improved the similar Izuno-Minoshima vehicle in the same way as Canedy's vehicle.

A POSITA would have understood or found this obvious especially because Izuno, Minoshima, and Canedy all teach vehicles, and sensors would have worked similarly across said vehicles including utilizing a processor to process the sensor data. Further, this modification would have simply been combining prior art elements (e.g., vehicle, microprocessor, sensors) according to known methods to yield Canedy's predictable result of a functional proximity sensor system in a vehicle where the vehicle's processor processes sensor data to determine proximity of the vehicle to an object. Indeed, Minoshima already teaches using proximity sensors and Izuno already teaches using a processor, such that combining the teachings of Izuno, Minoshima, and Canedy (including teaching using communication buses) would have been simply combining prior art elements according to Canedy's known method and would have yielded predictable results, as I opine below.

163. A POSITA would have been motivated to utilize a circuit setup like Canedy's as this was a known solution for including and allowing components in a vehicle to communicate with one another and perform processing within the vehicle. *See* Section VI.C.4. Indeed, Canedy's setup would have allowed the Izuno-Minoshima vehicle to process proximity information for aligning the cores for inductive charging at the vehicle itself instead of relying on a charging station's processor, for example. This is because Canedy teaches using a microprocessor

within the vehicle connected to proximity sensors via a communication bus, and a POSITA would have understood that in the similar Izuno-Minoshima-Canedy vehicle, a processor in the vehicle would have processed the proximity/position data instead of needing to rely on a processor in a charging station. Specifically, Minoshima does not explain implementation details such as which processor would process proximity data when the proximity sensors are located on the vehicle. Canedy expressly discloses these implementation details to a POSITA.

164. A POSITA would have had a reasonable expectation of success when modifying Izuno-Minoshima because a setup such as Canedy's was known in the prior art and would have been a straightforward, off-the-shelf solution. Indeed, proximity sensors, processors, and communication buses were all well-known components used in vehicles. Thus, a POSITA would not have needed to design or fabricate a circuit but would instead have selected from commercially available, off-the-shelf solutions for implementing modifications to the Izuno combination. Further, Minoshima and Canedy teach placing proximity sensors in the same location on a vehicle (e.g., front bumper/spoiler area), thus not requiring reconfiguring the sensor location, leading to a reasonable expectation of success. EX1006-Canedy, 3:7-33, Fig. 1; EX1005-Minoshima, [0021], [0059], Figs. 1-3. That is, a POSITA would have understood that the manner in which proximity sensors are implemented in Minoshima and Canedy is similar, such that the

modification to the Izuno combination vehicle would have had a reasonable expectation of success.

165. Minoshima simply lacks implementation details for how sensor data is processed for its embodiment where proximity sensors are located in/on the vehicle. As I noted above, Minoshima does not expressly disclose which processor would process proximity sensor data when proximity sensors are located in the vehicle. However, Canedy provides these details, including by teaching a microprocessor and communication bus within a vehicle for processing such data. These implementation details would have allowed a POSITA to have a reasonable expectation of success when modifying the Izuno combination vehicle because Canedy expressly discloses one method for implementing proximity sensors on a vehicle including detailing the circuitry for how the sensors, processor, and communication buses are connected. Izuno's vehicle already includes an ECU (processor/controller) but does not expressly disclose proximity sensors.

166. To the extent it is argued that Izuno's processor was incapable of utilizing proximity sensors, it is my opinion that a POSITA would have been motivated and found it obvious to modify Izuno's processor to include this functionality, whether by swapping the processor for a commercially available, off-the-shelf processor (e.g., such as Canedy's processor) or another suitable processor for processing sensor data along with performing its other, native functions. Thus,

applying Canedy's teachings to Izuno-Minoshima would have required merely straightforward and routine changes to programming instructions and known, off-the-shelf solutions for implementing proximity sensors and a processor/controller in a vehicle, resulting in a reasonable expectation of success. As I noted above, I had experience working on electric vehicles including modifying programming instructions. *See* § I.A above.

6. *Claim 1[c(ii)]: “detect a misalignment of the first core with respect to the second core based at least in part on the first positional relationship between the fir[st] core and the second core,”*

167. Izuno-Minoshima-Canedy teaches Claim 1(c)(ii). Izuno teaches a vehicle with coupler 15a and charging station with coupler 15b (first core and second core, respectively). *See* Claim 1(Pre). Izuno teaches that the vehicle must be parked in a predetermined position in the parking space to enable charging. EX1004-Izuno,[0019]-[0020], [0030] (“If the vehicle is not parked in the predetermined position, the processing ends. If the vehicle is parked in the predetermined position, the processing proceeds to step S22.”); *see* Claim 1(c)(i).

168. As discussed below, a POSITA would have been motivated and found it obvious to modify Izuno's charging process to advantageously detect misalignment and provide feedback to a driver to reposition the vehicle to be enable charging, per Minoshima, instead of simply “ending” processing, as done in Izuno. *See* Motivation to Combine for 1(c)(ii) below.

169. Further, to the extent it is argued that Izuno-Minoshima does not expressly disclose *a controller configured to detect misalignment* of the charging cores, Canedy provides these implementation details, as mapped above. *See* Claim 1(c)(i). Thus, in the Izuno-Minoshima-Canedy combination, a processor/controller such as Izuno's ECU is configured to process information from sensors to detect alignment/misalignment of the couplers based on the positional relationship, per Minoshima and Canedy.

a) Minoshima's Detecting Misalignment

170. As discussed in Claim 1(c)(i), Minoshima teaches proximity sensors 17 detecting vehicle position with respect to ground-level charging device 9 (*positional relationship*), and that an electromagnetic induction voltage can be generated in the vehicle-side coil when the vehicle is correctly parked within a predetermined distance. EX1005-Minoshima, [0065], [0012]-[0013], [0022], [0034], [0037], [0039]. However, if the proximity sensors determine that the vehicle's position is unsuitable (*detect a misalignment*), the driver is notified to reposition the vehicle. EX1005-Minoshima, [0011] ("if the parking orientation of the vehicle is unsuitable for charging, information indicating that the parking orientation is unsuitable is provided to the driver via the notifying means, prompting the driver to reposition the vehicle."). This notification is provided via a vehicle display 34 that indicates the

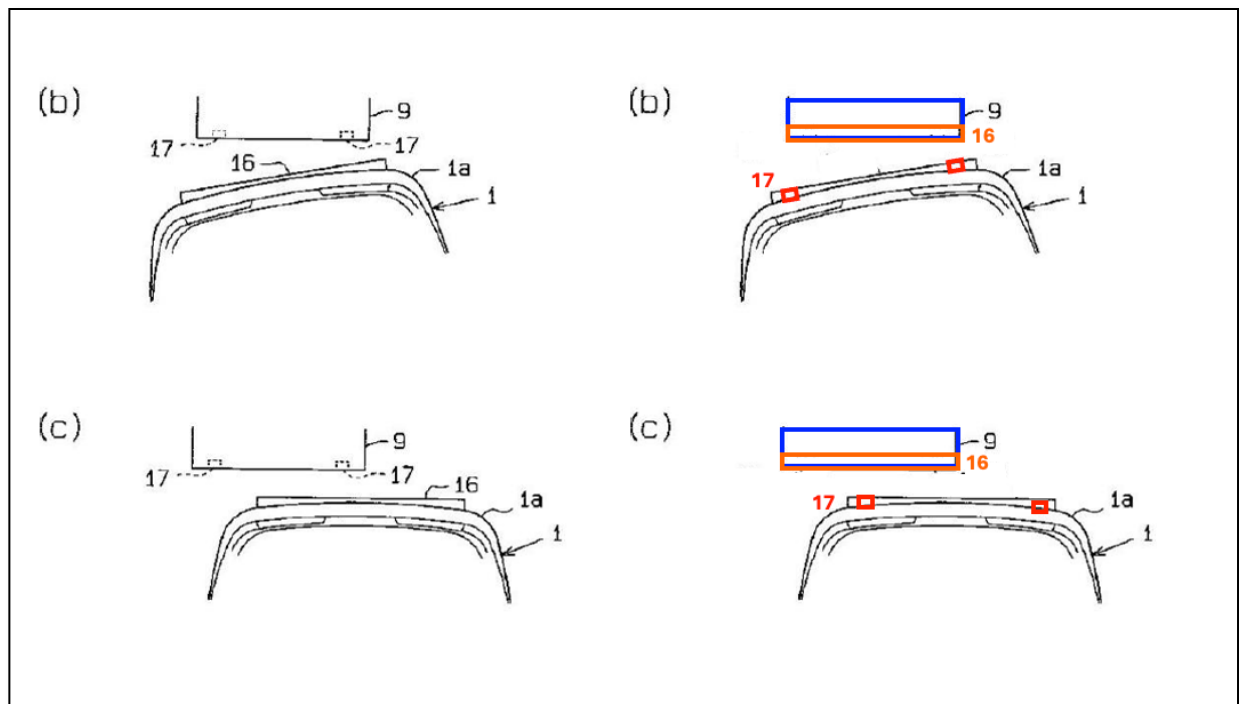
quality of the parking position. EX1005-Minoshima, [0053], [0011], [0025], [0035], [0039], [0047], [0052].

171. As noted, Minoshima teaches two embodiments: one where the proximity sensors are in the ground-level charging station, and another embodiment where the proximity sensors are part of the electric vehicle. EX1005-Minoshima, [0059]. The mapping here focuses on the embodiment where the sensors are located within the electric vehicle and the detected component 16 is located in the ground-level charging station for simplicity. EX1005-Minoshima, [0059]. In this manner, the processor, proximity sensors, and communication buses are all part of the vehicle. Thus, proximity sensors and a processor within the Izuno-Minoshima-Canedy vehicle perform alignment/misalignment detection. *See* Claim 1(c)(i).

172. In the Izuno-Canedy-Minoshima vehicle, the proximity sensors detect a misalignment between the vehicle-side coupler (*first core*) and the charging station coupler (*second core*) by detecting the position of the vehicle (e.g., the bumper) relative to the charging station. EX1005-Minoshima, [0021]-[0023] (teaching detected component 16 and proximity sensors 17), [0033], [0039], [0048], [0053], [0059]. This determination is made in view of the known spatial relationships between the vehicle sensors, charging coils, and charging station detected component(s). EX1005-Minoshima, [0021]-[0023], [0033], [0039], [0047]-[0048], [0053], [0059]. *See* Claim 1(c)(i). I note that in the Izuno combination, the charging

coupler/core is located in the parking space rather than on an extended support arm, such as in Minoshima. Thus, a POSITA would have understood that the proximity sensors and controller detect when the Izuno combination vehicle is in a particular position (i.e., because the system knows the location of the charging cores based on known positional relationships between the sensors and detected component(s)) to detect alignment or misalignment of the charging couplers.

173. Figs. 3B-3C below depict examples width/side-to-side and angle misalignment:



EX1005-Minoshima, [0021]-[0023], [0033], [0036]-[0037], Figs. 3B-3C (depicting Minoshima's embodiments where the proximity sensors 17 are located within the

charging device 9 (left), and within the vehicle (annotated, right)). Thus, the *detecting a misalignment* is based at least in part on the *first positional relationship*.

b) Motivation to Combine Izuno and Minoshima

174. See motivation to combine Izuno and Minoshima and Izuno-Minoshima-Canedy in Claim 1(c)(i).

175. A POSITA would have been motivated and found it obvious to modify Izuno's charging process to configure the controller to advantageously detect misalignment and provide feedback to a driver to reposition the vehicle to be able to perform charging, per Minoshima and Canedy, instead of simply "ending" processing, as is done in Izuno. A POSITA would have recognized that this would have been an advantageous modification of Izuno's native system, because in this way a user would receive feedback to properly position the vehicle for charging instead of simply giving up. Indeed, Izuno does not provide express disclosures on what to do if a user parks in an incorrect position. By modifying Izuno per Minoshima (and Canedy), a POSITA would have expected a predictable and advantageous result of helping the user attempt to correctly position the vehicle on a subsequent try. This use of a known technique would have improved Izuno's similar vehicle and charging method in the same way as Minoshima's vehicle and charging method.

176. Both Izuno and Minoshima are related to charging similar electric vehicles. Thus, the advantage in Minoshima also would have applied to Izuno's charging system and method. A driver would have desired to charge the electric vehicle at some point, and a system and method such as Minoshima's would have been advantageous in aiding the driver to correctly position the vehicle so that the cores are properly aligned and the vehicle can begin charging, thus improving Izuno's native process. Put simply, a POSITA would have looked to Minoshima to provide details on how to improve Izuno's native process by allowing for subsequent attempts to correctly position the vehicle. A POSITA would have recognized that providing feedback to a user was a known, commonplace, and well-understood method for assisting a user in performing a task.

177. A POSITA would have been motivated and found it obvious to modify Izuno's method of controlling contactless vehicle charging with Minoshima's method of detecting misalignment between the vehicle's coil and the charging station's coil to improve charging efficiency. As I noted above, coil alignment was an important factor for charging efficiency because the effect of the magnetic field generated in the charging coupler is weaker the farther away the receiving coupler is located. EX1021-Kurs, 3 ("When the distance D between the centers of the coils is much larger than their characteristic size, [coupling coefficient] κ scales with the D^{-3} dependence characteristic of dipole-dipole coupling."), Fig. 2 (illustrating the

decrease in coupling coefficient κ as coil separation distance increases). Thus, aligning the couplers would have been a strong motivation for a POSITA to implement Minoshima's technique in Izuno's system and method.

178. Proper alignment between the coils is critical for inductive charging, as misalignment reduces magnetic coupling, decreases power transfer efficiency, and can lead to increased energy loss or heat generation. EX1001, 33:43-46; EX1020-Juby, 60-61 ("The increase in primary leakage inductance (L_1) and decrease in magnetizing inductance (L_m) also caused by misalignment produced a considerable reduction in [secondary induced voltage] e."); 46 ("As the device misaligns...[t]he mutual inductance will decrease and tend towards zero."); EX1055-Hayes, 3 ("The power transfer must be highly efficient to minimize heat loss and to maximize the overall fuel economy of the electric vehicle charging and driving cycle."); EX1001, 33:43-46. Accordingly, a POSITA would have recognized the importance of detecting misalignment in the Izuno-Canedy-Minoshima vehicle to ensure that charging occurs and only under optimal conditions and to prevent inefficient operation when the coils are not sufficiently aligned. EX1020-Juby, 32-33 ("any misalignment results in a significant loss of power transfer capability."); EX1056-Shultz, 9 ("The successful magnetic coupling of energy from the charging station to the vehicle provides safety and reliability at the charging interface."). Because Izuno teaches that charging is enabled only when the vehicle is parked in a specified

position in the parking space, a POSITA would have looked to Minoshima's known technique of detecting misalignment to improve the efficiency and reliability of Izuno's similar contactless charging system in the same way as Minoshima's inductive charging system. This would have been a straightforward application of Minoshima's known technique to improve the similar Izuno system and method in the same way as Minoshima.

179. A POSITA would have had a reasonable expectation of success when modifying Izuno per Minoshima. Izuno already teaches electric vehicle inductive charging where the vehicle must be in a particular position to enable charging. Minoshima provides implementation details for achieving this alignment or detecting misalignment. Minoshima teaches detecting misalignment and providing feedback to a user so that the user can reposition the vehicle to achieve alignment. Minoshima and Izuno teach similar vehicles and both teach charging the vehicles with inductive charging. Thus, Minoshima provides implementation details that would have improved Izuno's similar system and method with a reasonable expectation of success.

180. Thus, modifying Izuno per Minoshima would have been simply a matter of including proximity sensors in the vehicle and related programming instructions to detect and provide positional relationship information (including misalignment information) to help the user properly align the couplers to achieve

efficient charging. As I noted above, Canedy teaches a vehicle with a processor coupled to proximity sensors via communication buses. In the Izuno-Minoshima-Canedy vehicle, a similar implementation would have achieved Minoshima and Canedy's benefits with a reasonable expectation of success, including because both Minoshima and Canedy teach positioning a vehicle with the help of sensors.

181. For example, Minoshima teaches detecting and presenting positioning information to a driver via vehicle display 34 and/or charging station display 18. *See* 1(c)(ii)(a) above. Thus, when modifying Izuno, positional information regarding misalignment would have been provided to the driver to help correctly position the vehicle to enable inductive charging. A POSITA would have understood that providing feedback was a known method to help a user achieve a goal (in this case, proper positioning for efficient inductive charging). Further, because this positional information would have been provided to the vehicle, the inductive charging system and driver would have been informed of when the vehicle was properly aligned for efficient charging. Indeed, this would have been a logical consequence of modifying the Izuno combination vehicle to include proximity sensors and to provide feedback to the user, as Minoshima and Canedy teach.

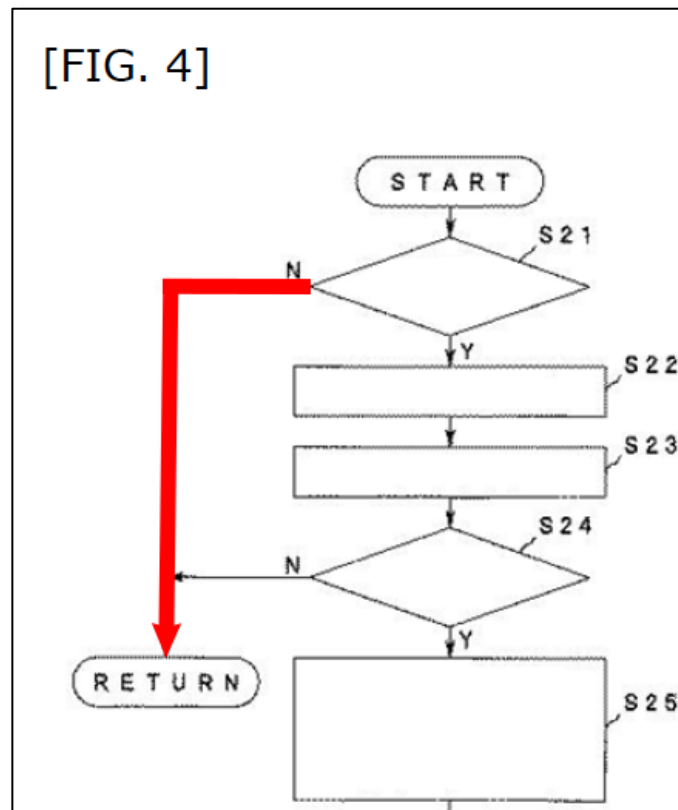
7. ***Claim 1[c](iii): “in response to detecting the misalignment, disable at least one user control on the display usable to control the inductive charging of the battery,”***

182. Izuno-Minoshima-Canedy and further in view of Yokota teaches Claim 1(c)(iii). Izuno teaches a vehicle with a controller (*see* Claim 1(a)) and display (*see* Claim 1(b)). Izuno teaches that charging begins after a command to start charging is issued by the user (user control usable to control the inductive charging of the battery) after a vehicle is correctly positioned. *EX1004-Izuno*, [0034] (“Next, in step S28, the system checks whether a charging start instruction has been received from the user...If a charging start instruction from the user is received within the threshold value time, the system...transmits a charging start signal to the charging station 60, and initiates charging.”), [0022] (“Then, depending on what the user selects—automatic charging, start charging, or stop charging—it transmits a charging instruction to the charging station 60.”), [0014], [0018]. The user can select to start charging via communication terminal 50 or an input device in vehicle system 10, which may be a vehicle *display*. *EX1004-Izuno*, [0027], [0031].

183. As discussed above, Izuno-Minoshima-Canedy teaches detecting misalignment of a first core and second core. *See* Claim 1(c)(ii). Izuno-Minoshima-Canedy teaches a controller configured to perform functions including controlling a display. *See* Claim 1(b), 1(c)(i)-(ii).

184. Notably, Izuno teaches that if the car is not in the proper position (where the cores are aligned), the steps simply end. *EX1004-Izuno*, [0030] (“If the vehicle is not parked in the predetermined position, the processing ends.”). Izuno’s Fig. 4

below is annotated to depict this scenario, where if the vehicle is not parked in the predetermined position, the result of step S21 is “no” and the flowchart leads to “return,” ending the process.



EX1004-Izuno, Fig. 4 (excerpt). Put another way, if the vehicle is not in the predetermined position, steps S22 and beyond are not carried out. In that case, the user is not presented with any ability to issue a charging start instruction. Since steps S25-S27 are not carried out unless the cores are aligned, Izuno effectively teaches not activating the selectable charging start option until the car is aligned. Izuno, however, does not explicitly describe that the user control on the display is disabled.

185. Further, Yokota teaches a system and method for determining whether a function associated with a menu item on a display can be executed and, if not, disabling the corresponding menu item to prevent selection. In the Izuno-Minoshima-Canedy-Yokota combination, the user-selectable control for initiating charging is disabled when the vehicle-side core and the charging station core are misaligned per Minoshima's detection determination. *See* Claim 1(c)(iii). Yokota teaches a central processing unit CPU 17 (*controller*) and memory for controlling device functions, such as enabling/disabling controls on the display. *See* EX1007-Yokota, [0060], Fig. 2.

a) Minoshima's Detecting Misalignment

186. Izuno-Minoshima-Canedy teaches detecting misalignment and notifying a driver via a display to reposition the vehicle. *See* Claim 1(c)(i)-(ii).

b) Yokota's Disabling User Control on a Display

187. Yokota teaches a system and method for executing a function corresponding to a selected menu item displayed on a screen, e.g., a navigation device in a vehicle. EX1007-Yokota, [0004], [0014], [0058]-[0059]. Yokota also includes a central processing unit CPU 17 (*controller*) and memory for enabling/disabling controls on the display. EX1007-Yokota, [0060], [0069], [0072], [0075]-[0077], [0083]-[0084] ("when a desired menu item is selected (step 306), the CPU 17 executes the function corresponding to the selected menu item (step 307).").

188. Specifically, Yokota teaches determining whether a function corresponding to a menu item displayed on the screen can be executed, and when it is determined that the function cannot be executed, disabling the menu item corresponding to that function (*disabling at least one user control on the display*). EX1007-Yokota, [0030] (“The menu item displaying method includes...determining whether a function corresponding to a menu item displayed on the screen can be executed, and when it is determined that the function cannot be executed in the determining step, disabling the menu item corresponding to the function from being selected and displaying a reason why the menu item cannot be selected.”). For example, the menu item associated with that function is shaded (e.g., grayed out) to indicate to a user the function is disabled, and a user cannot select the disabled function. EX1007-Yokota, [0052], [0063]. Yokota teaches that if the menu item is not selectable, the menu skips over the disabled option. EX1007-Yokota, [0071] (“When the user attempts to select the shaded menu item 51 by causing the menu bar to move thereto, since the menu bar skips over it, the menu item 51 cannot be selected (step 105).”), [0032]-[0034], [0084]-[0085]. Additionally, Yokota teaches displaying a reason for why the menu item is disabled. EX1007-Yokota, [0030], [0052]-[0053], [0063], [0084]-[0088].

c) Motivation to Combine Izuno-Minoshima-Canedy-Yokota

189. A POSITA would have been motivated and found it obvious to modify Izuno-Minoshima-Canedy's method of detecting misalignment between the vehicle and the charging station cores with Yokota's method of disabling a menu item if the associated function cannot be executed to advantageously prevent user initiation of charging under improper conditions. This is because a POSITA would have recognized that when the coils are misaligned, inductive charging cannot be efficiently performed or cannot be performed at all (e.g., the distance between the cores is too great), and thus it would be advantageous to disable the user's menu item to prevent initiating charging (or attempting to initiate charging) while the coils are misaligned. For example, if the distance between the cores is too great, charging simply would not initiate even if the user were to select the user control, leading to confusion and frustration.

190. Alternatively, if the cores were close enough to begin charging but not sufficiently aligned, charging would be much less efficient, leading to longer charging times. *See* Section VI.B.1. Incorporating Yokota's method into Izuno-Minoshima-Canedy's charging system would provide the user with a clear indication that the vehicle was aligned and ready for charging because the option to start charging would be present on the display, but disabled to prevent the user from trying to activate charging when misalignment is detected. Conversely, when the vehicle

was properly aligned the disabled display would be enabled, and this would provide a clear indication to the user that the vehicle was now ready for charging. This simple and straightforward modification was a known practice in graphical user interfaces and menu design, with Yokota as one example. Additional examples include Powers and Boies. EX1052-Powers, [0022] (“adaptive display lockout system that provides display lockouts that temporarily disables the display when a threshold display lockout criteria is met. The display lockout criteria may include (1) vehicle speed >5mph and (2) predicted eyes-off-road-time excess driver workload (DW) criterion.”); EX1053-Boies, 3:41-4:3 (describing that the vehicle display may disable the album cover graphic, menu-selection for tuning stations, and on-screen buttons for music balance and tone if the vehicle is traveling above a certain speed).

191. This modification would have provided clear feedback and control to the user and prevented inefficient or inadvertent operation of the contactless charger. Indeed, in this manner, a user would have known when the vehicle is positioned correctly for efficient (or even possible) inductive charging, and this would have helped mitigate situations where the user thinks the vehicle had started charging, but it did not because the coils are not in a position to conduct charging. For example, in a system not using the proposed combination, if the coils are too far apart to perform inductive charging but a menu option were available, a user may think charging started but in reality the menu selection would not have begun charging.

Providing feedback to a user via menu options would have been advantageous in this regard because it would indicate to the user why the charging option is not available and inform the user that vehicle position needs to be adjusted. Indeed, Minoshima already describes that when a vehicle is not properly aligned, the vehicle will receive a message “stop position NG”⁵ to inform the driver that the stop position is “not appropriate,” and the vehicle will not charge. EX1005-Minoshima, [0011], [0012], [0039].

192. Another benefit of engaging the driver in this way (i.e., having the driver initiate charging once the car is aligned and the charge initiation button is active) is that there is a confirmation from the driver that they know that the car is now properly aligned. Without this, the system would sense that the car was aligned while it is changing position, and potentially start charging automatically. But there is a possibility that the driver may not realize this and keep moving the car, leading to the cores then not being aligned. The result is that charging starts when the car passes over the predetermined spot, but then stops, and so on. By activating the

⁵ I note that Minoshima does not expressly disclose what “NG” stands for. However, a POSITA would have understood from the context that “NG” means something like “Not Good” or another similar message indicating the parked position is not proper for inductive charging.

charging button, and having the driver then select it, the system is confirming that the driver knows that the car is now in position, and charging can be started. This avoids the inadvertent starting and stopping of charging that might otherwise occur if the charging just started whenever the car was in position (even if a moment later is not in position).

193. Therefore, a POSITA would have been motivated to use Yokota's known technique in Izuno-Minoshima-Canedy's system to configure the controller to disable a "start charging" command on the vehicle display when misalignment is detected to improve the similar devices in the same way. This would have been simply utilizing a known menu/graphical user interface technique applied to disabling a particular control unless or until conditions are met (i.e., disabling the start charging command until alignment is achieved). Disabling the user control in this manner would have been a straightforward method for informing a user in the vehicle that misalignment of the couplers has been detected and need to be correctly aligned before charging can be initiated. As I opined above, in the Izuno combination, a user would receive positioning feedback regarding whether the vehicle is properly positioned or if the coils are misaligned (that is, not properly positioned).

194. A POSITA would have had a reasonable expectation of success when modifying Izuno-Minoshima-Canedy per Yokota. In my opinion, this modification

is simply utilizing well-known GUI/menu techniques in a vehicle setting, which was also well known in the prior art. “[G]raying out” or otherwise disabling menu options was a known technique in human-machine interfaces. For example, *see* EX1054-Desai, 13:56-14:7 (“If this software operation determines that the user-selected object is, in fact, available, then all of its respective menu items in its popup menu may not be greyed-out on the screen and thus all menu items will be made accessible to the user. Alternatively, some of the menu items may be greyed-out making those inaccessible by the user, where the remaining menu items which are not greyed-out are then accessible by the user.”). This would have required only straightforward and routine changes to programming instructions, which would have been well-within the skillset of a POSITA.

195. Further, context-based/context-aware menu design was known in the prior art, such that a POSITA would have been aware of techniques for modifying menus to restrict or disable items for selection/execution. *See* Section VI.D.1. Additionally, devices such as Yokota’s were known to be mounted in vehicles and controlled by a processor, which the Izuno-Minoshima-Canedy vehicle already includes. As I noted above, the Izuno combination vehicle already includes a processor, communication buses, and other components for executing programming instructions. *See* Claims 1(a)-(b). Thus, a POSITA would have had a reasonable

expectation of success when modifying Izuno-Minoshima-Canedy's vehicle per Yokota's teachings.

8. Claim 1(c)(iv): “detect a second positional relationship between the first core and the second core at a second time occurring after movement of the vehicle,”

196. Izuno-Minoshima-Canedy teaches Claim 1(c)(iv). As discussed above, Izuno-Minoshima-Canedy teaches using sensors and a *controller configured to detect* a first positional relationship, e.g., first and second cores are misaligned. See Claim 1(c)(i)-(ii). In the Izuno-Minoshima-Canedy combination, a processor/controller such as Izuno's ECU is configured to process information from sensors regarding alignment/misalignment, per Minoshima and Canedy.

197. In Claim 1(c)(iv)-(v), Izuno-Minoshima-Canedy teaches detecting a second positional relationship, where the first and second cores are aligned. As mapped below, this *second positional relationship* occurs at a *second time occurring after* a user has repositioned the vehicle (*after movement of the vehicle*). In particular, Izuno's vehicle and vehicle coupler 15a moves relative to coupler 15b because coupler 15a is attached to the vehicle and coupler 15b is stationary. EX1004-Izuno, [0020], [0030], [0037], Fig. 2; see Claim 1(Pre).

a) Minoshima's Second Positional Relationship ... at a Second Time

198. The process for the *second positional relationship* is essentially the same as that mapped above in Claim 1(c)(i)-(ii) except for the driver repositioning

the car based on feedback and the result being *alignment (second positional relationship)* of the cores instead of *misalignment (first positional relationship)*. See Claim 1(c)(i)-(ii). I note that the same general process applies here, but the result of vehicle movement achieves alignment instead of misalignment.

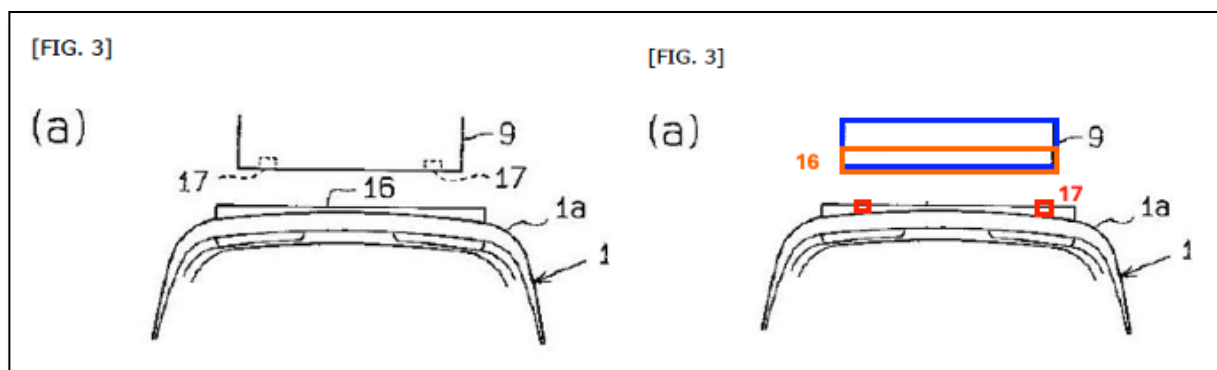
199. Minoshima teaches that if the proximity sensors detect an unsuitable vehicle position (i.e., in the first positional relationship discussed in Claim 1(c)(i)-(ii)), vehicle display 34 notifies the driver to reposition the vehicle before charging can be enabled. EX1005-Minoshima, [0053] (“[A] display 34 may be provided in the cabin of the vehicle, and the driver may be notified whether the parking position and orientation are correct by displaying a message on the display 34.”), [0011], [0025], [0035], [0047], [0052].

200. In response, a user repositions the vehicle. EX1005-Minoshima, [0039] (“Thus, if either of the two proximity sensors 17 does not activate, the message ‘Parking Position NG’ will appear on the display 18 when the gearshift is moved to P. Once this message is seen, the driver will realize that the parking position is inappropriate and will reposition the vehicle.”), [0048] (“the driver can promptly reposition the vehicle after viewing the message displayed on the display 18.”). I note that since the *first positional relationship* of claim element 1[c(i)], results in a detection of misalignment at a *first time*, and the driver subsequently repositions the vehicle to reach a *second positional relationship*, this second positional relationship

occurs at a time different from the first time of claim 1[c(i)];, thus the *second positional relationship* occurs at a *second time*. In the Izuno-Minoshima-Canedy combination, when parking is performed correctly (i.e., detected to be in a *second positional relationship*), the cores are aligned and charging can begin when a user initiates charging. EX1005-Minoshima, Abstract, [0011], [0040]-[0041]; EX1004-Izuno, [0022], [0034], [0037].

201. As noted above, in the Izuno combination, coupler 15a moves with the vehicle and coupler 15b is stationary in the parking space. *See Claim 1(Pre)*. Thus, after the vehicle is repositioned (*after movement of the vehicle*), the proximity sensors detect the vehicle's position relative to the charging station core (*detect a second positional relationship*). EX1005-Minoshima, [0035], [0039], [0048], [0053].

202. Minoshima depicts proper alignment (*second positional relationship*) for charging the battery below including **proximity sensors 17** of electric vehicle 1 and **detected component 16** of **charging device 9**:



EX1005-Minoshima, Fig. 3A (depicting Minoshima's embodiments where the proximity sensors 17 are located in the charging device 9 (left), and within the vehicle (annotated, right)). As discussed in Claim 1(c)(i)-(ii), the mapping relies on Minoshima's embodiment where proximity sensors are in the vehicle and the detected component is in the charging station. *See* Claim 1(c)(i)-(ii).

203. Thus, in the Izuno-Minoshima-Canedy combination, the proximity sensors detect a *second positional relationship* between the vehicle-side coupler (*first core*) and the charging station coupler (*second core*) by detecting the position of the vehicle (e.g., the bumper) relative to the charging station to be in an appropriate position for charging. Minoshima teaches detecting when the vehicle is properly positioned for charging. In the scenario mapped herein, a driver first parks the vehicle in a misaligned position (*a first positional relationship at a first time*). Per Minoshima, the driver receives feedback that the position is not suitable for charging. Then, a driver repositions the vehicle and at some point (*a second time*) achieves the proper positioning (*a second positional relationship*) so that inductive charging can begin. The Izuno combination vehicle determines this proper positioning using proximity sensors and a processor, for example. *See also* EX1005-Minoshima, [0022], [0024], [0033], [0035], Fig. 3A Fig. 3A.

204. This determination is made in view of the known spatial relationship between the vehicle, charging coils, and charging station detected component. A

POSITA would have understood that proximity sensors would have been programmable to sense a particular distance and/or position, such that the system would have informed a user when the vehicle has reached a particular position at which the cores are properly aligned. As I opine above (*see* Claim 1(c)(i)(c)) and below (*see* Claim 1(c)(iv)(c)), Canedy teaches similar functionality where proximity sensors detect an object at a particular predetermined distance (e.g., 18 inches away, 10 inches away) and the system informs the user via a display of the distance to the object as the vehicle moves closer to it (such as when the vehicle is 10 inches from the detected object) or further from it. *See* Claim 1(c)(i)(c) above and *see* Claim 1(c)(iv)(c) below. I note Canedy also teaches providing an alert when a particular distance is reached. EX1006-Canedy, *generally* 3:58-5:6; *see also* EX1005-Minoshima, Abstract, [0022], [0024], [0033], [0035], Fig. 3A; Claim 1(c)(v).

205. The *second positional relationship* is detected *at a second time* after the driver repositions the vehicle for optimal alignment. As I noted above, the sensors and controller would have detected a predetermined proximity distance at a second time after the user repositions the vehicle, and thus the optimal positioning for the vehicle to have the cores aligned would have been achieved. *See also* EX1005-Minoshima, [0035], [0039], [0048], [0053], Fig. 3A.

b) Motivation to Combine Izuno-Minoshima

206. *See* motivation to combine Izuno and Minoshima in Claim 1(c)(i).

207. Modifying Izuno per Minoshima's repositioning technique would have been use of a known technique that would have improved similar devices in the same way to achieve the benefits of quickly and efficiently achieving alignment between coils by informing the user of the correct position. As I noted above, Izuno does not provide implementation details for what to do when misalignment occurs. Minoshima teaches these details including informing a driver that the vehicle is improperly positioned and informing a driver when the vehicle is parked in the proper location for charging. *See* Claim 1(c)(i)(b). A POSITA would have been motivated to utilize Minoshima's technique to ensure faster and more efficient alignment between the coils to allow for more efficient and faster inductive charging. *See* Claim 1(c)(i)(b)-(c) where I opined that coil placement affects inductive charging efficiency and speed). *See* Claim 1(c)(i)(b)-(c). Further, this combination of prior art elements (e.g., vehicle, proximity sensors) according to Minoshima's known method would have yielded the predictable result of detecting a positional relationship between Izuno's first and second cores. *See* Claim 1(c)(i)(b)-(c).

208. A POSITA would have had a reasonable expectation of success for the same reasons discussed in Claim 1(c)(i).

c) Canedy's Microprocessor and Sensors

209. Izuno-Minoshima-Canedy teaches using a microprocessor and proximity sensors configured to detect a first positional relationship. *See* Claim

1(c)(i). For the reasons discussed above, Izuno-Minoshima-Canedy teaches using a microprocessor and proximity sensors configured to detect a second positional relationship after movement of the vehicle. *See* Claim 1(c)(i).

d) Motivation to Combine Izuno-Minoshima-Canedy

210. *See* motivation to combine Izuno, Minoshima, and Canedy in Claim 1(c)(i).

9. Claim 1(c)(v): “detect an alignment of the first core with respect to the second core within a threshold based at least in part on the second positional relationship between the first core and the second core,”

211. Izuno-Minoshima-Canedy teaches *a controller configured to detect a second positional relationship*, where the first and second cores are aligned *within a threshold based at least in part on the second positional relationship*. *See* Claim 1(c)(iv)-(v). As mapped above, this *second positional relationship* occurs at a *second time occurring after* a user has repositioned the vehicle (*after movement of the vehicle*).

212. As mapped above, Canedy provides implementation details for a *controller configured to detect* sensor data, such as an alignment. *See* Claim 1(c)(i)-(ii). Thus, in the Izuno-Minoshima-Canedy combination, a processor/controller such as Izuno’s ECU is configured to process information from sensors regarding alignment/misalignment, per Minoshima and Canedy.

a) '996 Patent's Threshold

213. The claim recites “detect an alignment of the first core with respect to the second core within a threshold based at least in part on the second positional relationship between the first core and the second core.” EX1001, Claim 1(c)(v); *see also id.*, Claims 12(b), 15(b). The '996 Patent specification describes “proper alignment” by detecting a relationship between sensors and sensed elements using conventional algorithms, but no numerical range for a threshold is described. EX1001, *generally* 33:43-35:11. The '996 Patent only describes “alignment within a predetermined acceptable error calculated by the controller.” EX1001, 34:54-59.

b) Minoshima's Detecting Alignment Within a Threshold

214. Minoshima teaches detecting when the vehicle is properly positioned for charging. In the scenario mapped herein, a driver first parks the vehicle in a misaligned position. Per Minoshima, the driver receives feedback that the position is not suitable for charging. Then, a driver repositions the vehicle and at some point achieves the proper positioning so that inductive charging can begin. The Izuno combination vehicle determines this using proximity sensors and a processor, for example.

215. Similar to the '996 Patent's description of “predetermined acceptable error,” Minoshima teaches a permissible alignment range for charging. EX1001, 34:54-59; EX1005-Minoshima, [0035] (“When the P range signal is received and

both proximity sensors 17 are activated, the controller 20 determines that the electric vehicle 1 has been parked in the parking space with the vehicle body positioned within the **permissible misalignment range for charging** and displays the message ‘Parking Position OK’ on the display 18. In this way, the driver recognizes that the vehicle has been parked correctly and is ready for charging.”). In response to receiving messaging regarding misalignment of the cores, a user repositions the vehicle. EX1005-Minoshima, [0039], [0048]. As noted above, Minoshima also teaches displaying parking position messages on vehicle display 34. EX1005-Minoshima, [0053].

216. In the Izuno-Minoshima-Canedy combination, when parking is performed correctly, the cores are aligned *within a* predetermined distance (*threshold*) and charging can begin when a user initiates charging. EX1004-Izuno, [0022], [0033]-[0034], [0035], [0037]; EX1005-Minoshima, Abstract, [0008], [0011], [0041], [0065] (“the widthwise misalignment detecting means comprises at least two proximity sensors that detect when the vehicle has approached within a predetermined distance of a predetermined reference position, using two different locations on the vehicle as detection targets. As a result, the system can detect not only widthwise misalignment but also improper angled parking.”), [0009], [0013].

217. Thus, if the vehicle was not initially aligned properly, then after the vehicle is repositioned (*after movement of the vehicle*), the proximity sensors detect

the vehicle's position relative to the charging station core (*detect a second positional relationship*) "within a predetermined distance of a predetermined reference position" (*within a threshold*). EX1005-Minoshima, [0039], [0048], [0053], [0065], [0008]- [0009], [0013]; *see also* Claim 1(c)(iv).

218. Therefore, the proximity sensors *detect a second positional relationship between the vehicle-side coupler (first core) and the charging station's coupler (second core)* by detecting the position of the vehicle sensors (e.g., in the bumper) relative to the charging station within a predetermined threshold. This determination is made in view of the known spatial relationship between the vehicle, the charging coils, and charging station's detected component. A POSITA would have understood that proximity sensors would have been programmable to sense a particular distance and/or position, such that the system would have informed a user when the vehicle has reached a particular position at which the cores are properly aligned. As I opine above (*see* Claim 1(c)(i)(c)) and below (*see* Claim 1(c)(iv)(c)), Canedy teaches similar functionality where proximity sensors detect an object at a particular predetermined distance (e.g., 18 inches away, 10 inches away) and the system informs the user via a display of the distance to the object as the vehicle moves closer to it (such as when the vehicle is 10 inches from the detected object) or further from it. *See* Claim 1(c)(i)(c) above and *see* Claim 1(c)(iv)(c) below. I note

Canedy also teaches providing an alert when a particular distance is reached.

EX1006-Canedy, *generally* 3:58-5:6.

219. The *second positional relationship* is detected *at a second time* after the driver repositions the vehicle for optimal alignment. As I noted above, the sensors would have detected a predetermined proximity distance, and thus the optimal positioning for the vehicle to have the cores aligned would have been achieved. This process is essentially the same as that mapped above except for the driver repositioning the car based on feedback and the result being *alignment* of the cores within a threshold instead of *misalignment*. See Claim 1(c)(i)-(ii). I note that the same general process applies here, but the result of vehicle movement achieves alignment instead of misalignment.

c) Motivation to Combine Izuno and Minoshima

220. See motivations to combine discussed in Claims 1(c)(i)-(ii), 1(c)(iv).

221. The claims and specification do not recite a specific numerical value or range for the *threshold*. See § X.A.9.a) above. However, to the extent it is argued that a specific numerical value or range is required, a POSITA would have selected a suitable value for a *threshold* for alignment as a design choice to achieve efficient charging in the Izuno combination based on the specifics of the charging system design. For example, both Izuno and Minoshima teach determining when a vehicle is positioned correctly for charging. EX1005-Minoshima, [0035] (“the vehicle body

positioned within the **permissible misalignment range** for charging”); EX1004-Izuno, [0030] (“the system checks whether the vehicle has been parked at the **predetermined position** in the charging parking space.”). To the extent a particular numerical value/range is required for a threshold for alignment, a POSITA would have selected one, which would have been a straightforward design choice based on the particular details of the charger and the charging cores. Further, a selected threshold value would have been selecting from amongst a plurality of tradeoffs between closer alignment for higher charging efficiency versus ease of use for the driver. *See* Section VI.B.1. That is, if only a perfectly aligned parking position is the threshold (e.g., parked in a position in which the cores are aligned within one millimeter), that would be more difficult for a driver to achieve each time before being able to initiate charging, such that some leeway (a threshold) would have been advantageous at the expense of some charging efficiency.

222. This use of Minoshima’s known technique of using a threshold would have improved the similar Izuno system and method in the same way as Minoshima’s system and method. A POSITA would have had a reasonable expectation of success because this modification would have required only straightforward and routine changes to programming instructions for what constitutes “alignment” vs “misalignment” in relation to Izuno-Minoshima-Canedy’s proximity sensors.

10. Claim 1(c)(vi): “in response to detecting the alignment, enable the user control on the display, and”

223. Izuno-Minoshima-Canedy-Yokota teaches Claim 1(c)(vi). As discussed above, Izuno-Minoshima-Canedy teaches a *controller configured to detect* alignment of a first core and second core. *See* Claim 1(c)(v). Also discussed above, Izuno-Minoshima-Canedy teaches a controller configured to detect and display sensor data, such as an alignment. *See* Claim 1(c)(i). In the Izuno-Minoshima-Canedy combination, a processor/controller, such as Izuno’s ECU, is configured to control a display via a communication bus. *See* Claim 1(b).

224. In the Izuno-Minoshima-Canedy-Yokota combination, the user-selectable control for initiating charging is disabled when the charging cores are misaligned. *See* Claim 1(c)(iii). The Izuno-Minoshima-Canedy-Yokota user control for initiating charging would be enabled per Yokota only after repositioning the vehicle and detecting proper alignment between the vehicle-side and charging station cores (per Minoshima and Canedy). In this manner, a user would not be able to attempt to initiate charging until the coils are in the proper position, ensuring charging efficiency and preventing a scenario where a user thinks the vehicle is charging because the charging user control was selected, but the vehicle is not actually charging because the cores are too far apart. Disabling a menu option based on a condition not being met (such as core alignment within a threshold not being met) was well known, with Yokota teaching one example of such context-sensitive

menu design. That is, in the Izuno-Minoshima-Canedy-Yokota combination, the user control on the display is *disabled* when misalignment is detected and *enabled* if properly aligned. As I opine below, this is simply a use of the known technique of context-sensitive (also referred to as context-based or context-aware) menu design. See Section VI.D.1.

a) Yokota's Enabling User Control on a Display

225. Yokota performs a determination step that results in disabling or enabling a menu item. As I opine below, Yokota teaches examples of disabling or enabling menu items based on particular conditions being met or not met, which was a well-known technique in computer interface design. See Section VI.D.1. Specifically, Yokota teaches determining whether a function corresponding to a menu item can be executed. EX1007-Yokota, [0030]-[0031], [0052], [0069], [0075], [0076], [0083].

226. This is simply applying the known technique of context-aware menus that allow menu items to be selected based on certain conditions being met. For example, if a user has not entered a destination address, a navigation device cannot provide navigation instructions, so a route guidance menu item is disabled/grayed out until an address is entered, at which point the route navigation menu item becomes selectable (is *enabled*). If the determination is the function cannot be

executed, the menu item is disabled. Here, “graying out” a menu option was a known way to *disable* a menu item.

227. In more detail, Yokota teaches a system and method for executing a function corresponding to a selected menu item displayed on a screen. EX1007-Yokota, [0004], [0014], [0058]-[0059]. When it is determined the function cannot be executed, the menu item corresponding to that function is disabled (*disabling at least one user control on the display*). See Claim 1(c)(iii).

228. Conversely, Yokota teaches that when it is determined a function can be executed, enabling for execution the menu item corresponding to that function (enabling the user control on the display). EX1007-Yokota, [0030] (“when a predetermined menu item is selected, a function corresponding to the selected menu item is executed. The menu item displaying method includes the steps of determining whether a function corresponding to a menu item displayed on the screen can be executed.”), [0002] (“The present invention...particularly relates to a function executing apparatus and a menu item display method therefor for executing a function corresponding to a selected menu item when menu items are displayed on a screen and a predetermined menu item is selected.”).

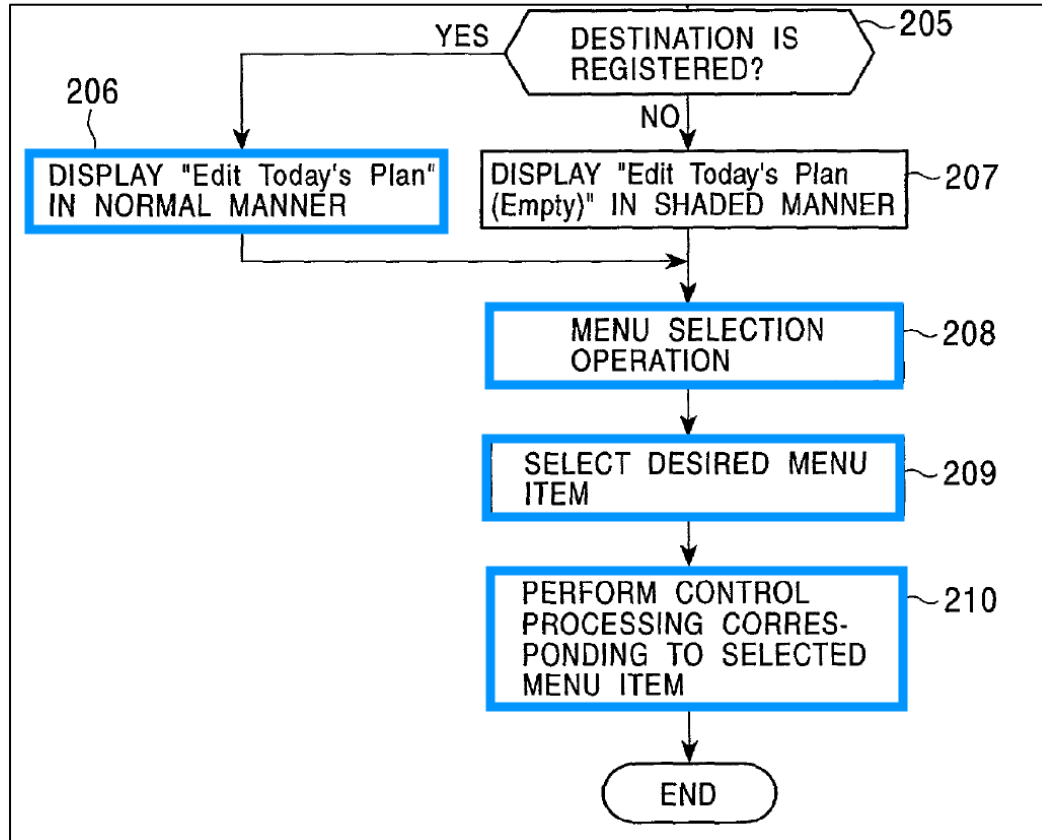
229. To make its determination, Yokota teaches storing the “state of the apparatus.” EX1007-Yokota, [0031], [0052]. Based on the stored state value, menu functions are either disabled (cannot be selected or executed) or enabled (can be

selected and executed). EX1007-Yokota, [0030]-[0031], [0052] (“A function executing apparatus according to the present invention displays menu items on a screen SCR and, when a predetermined menu item is selected, executes a function corresponding to the selected menu item...The function selecting control unit 4 determines based on the apparatus state whether a function corresponding to a menu item displayed on the screen SCR can be executed.”), *id.* (“The function executing control unit 6 executes the function corresponding to the selected menu item.”), [0069], [0075], [0076], [0083]. “[W]hen a menu item corresponding to a desired function is selected (step 106), the CPU 17 executes the function corresponding to the selected menu item (step 107).” EX1007-Yokota, [0072].

230. In one example, Yokota teaches a function that can be executed only during a particular mode (e.g., route guidance). EX1007-Yokota, [0056] (“a navigation apparatus is provided with a function which can be executed exclusively during route guidance. When route guidance is not in progress, the message ‘No Guidance’ is displayed on the field of the menu item corresponding to the function, whereby the user is informed that the menu item cannot be selected.”). When route guidance is in progress, the function is enabled and selectable because the condition for selecting the function was met. This is simply a use of the known technique of implementing context-aware menu options in a human-computer interactive system such as a user display. *See* Section VI.D.1.

231. Yokota also teaches disabling a menu item until a condition is met (or if a condition is not met), and when the condition is met, allowing the menu item to be selectable and executed. EX1007-Yokota, [0076]-[0077] (“When the user attempts to select the shaded menu item 60 or 62 by causing the menu bar to move thereto, since the menu bar skips over it, neither of the menu items 60 or 62 can be selected (step 208).”), *id.* (“Otherwise, by selecting the menu item corresponding to the desired function (step 209), the CPU 17 executes the function corresponding to the selected menu item (step 210).”), [0081], [0083]-[0084], [0087] (teaching displaying a message identifying the reason why the menu item cannot be selected).

Fig. 6 below depicts a flowchart including steps 208 and 210:



EX1007-Yokota, Fig. 6 (excerpt). I note that Yokota's Fig. 6 teaches enabling a user control on a display when the determination at step 205 is YES and the flow moves to steps 206, 208-210). In this example, since the destination is registered "YES," the system determines that "Edit Today's Plan" should be displayed in a "normal manner" (that is, selectable), because a condition for enabling the user control has been met. Conversely, if the result of step 205 is "NO," then the destination is determined not to be registered. Thus, the menu control "Edit Today's Plan" displays with the additional information "(Empty)" to indicate to a user a reason for why the menu control is displayed "in a shaded manner" and is not selectable.

b) Motivation to Combine Izuno-Minoshima-Canedy-Yokota

232. A POSITA would have been motivated and found it obvious to modify Izuno-Minoshima-Canedy's method of detecting alignment between the vehicle and charging station cores with Yokota's method of enabling a menu item if the associated function can be executed to advantageously allow user initiation of charging under proper conditions. This modification would have simply used a known technique of context-based menus to enable a menu item, thus allowing a user to select a start charging user control only when certain conditions are met. A POSITA would have recognized that when the coils are aligned, inductive charging can be efficiently performed, and thus it would be advantageous to enable the user's menu item to allow initiating charging while the coils are aligned within a threshold.

It would be beneficial to provide a clear indication to the user of the state of the vehicle alignment so that they would know when to stop moving the vehicle. Enabling a menu item when the vehicle is aligned for charging would be an intuitive and easy to understand indication that the vehicle was properly positioned and able to charge.

233. By configuring the Izuno vehicle's menus to only enable initiating charging when certain conditions are met (e.g., coil alignment), this would have provided several advantages. For example, I note that this modification would have allowed the system to enable the user control for initiating charging when alignment is detected and provided clear feedback and control to the user, and prevented inefficient operation of the contactless charger including by disabling the initiating charge functionality when coil misalignment is detected. This modification would also have prevented a scenario where a user selects a start charging control and thinks charging has begun, but charging does not initiate because the cores are not sufficiently aligned, which would have led to user frustration. As I opined above, Minoshima already describes indicating to a user via a vehicle display when the parked position is adequate to allow for inductive charging. EX1005-Minoshima, [0053], [0035]. Thus, modifying the Izuno vehicle to use this information and apply a known technique of context-based menus would have predictably provided several advantages.

234. Izuno further teaches using a vehicle display to inform the user of the vehicle charging status and that charging is initiated in response to a user-issued command. Thus, the Izuno system already has a display that can be utilized for this modification. Therefore, a POSITA would have been motivated to use Yokota's known technique in Izuno-Minoshima-Canedy's system to enable a "start charging" command on the vehicle display when alignment within a threshold is detected to improve the similar devices in the same way. This use of a known technique would have improved the similar Izuno-Minoshima-Canedy and Yokota vehicles and devices in the same way.

235. A POSITA would have had a reasonable expectation of success when modifying Izuno-Minoshima-Canedy per Yokota. I note that this modification is simply using straightforward changes to programming instructions to implement known context-based menu functionality in the Izuno vehicle. Enabling menu items when conditions are appropriate was a known technique in human-machine interfaces, as Yokota teaches. *See* Section VI.D.1. In particular, if a menu item is not disabled, it would have been enabled for user selection to execute the particular function associated with the menu item. That is, when conditions for selecting a menu item are not met, a menu item is disabled by being grayed out, for example. Conversely, a POSITA would have understood that if a menu item is selectable in a

context-based menu arrangement, then that menu item is enabled and able to be selected and processed to perform the menu item's function (e.g., start charging).

236. Implementing Yokota's technique in Izuno-Minoshima-Canedy would have required only straightforward and routine changes to programming instructions, which would have been well-within the skillset of a POSITA. Further, context-based/context-aware menu design was known in the prior art, such that a POSITA would have been aware of techniques for modifying menus to allow/enable items for selection. *See* Section VI.D.1. Additionally, devices such as Yokota's navigation device were known to be mounted in vehicles. EX1028-Cramer, [0307] (explaining that vehicle displays "improve[d] occupant safety, environmental friendliness, ergonomics, and compatibility to modify, add, or upgrade vehicle features."). *See also* Section VI.C.1. Thus, a POSITA would have had a reasonable expectation of success when modifying a vehicle such as Izuno-Minoshima-Canedy's vehicle per Yokota's teachings.

11. Claim 1[c(vii)]: "in response to receiving a selection of the user control, initiate inductive charging via the first core and the second core."

237. Izuno-Minoshima-Canedy-Yokota teaches Claim 1(c)(vii). Izuno teaches that a user-issued command to start charging initiates inductive charging via the vehicle's charging coupler 15a (*first core*) and the ground-side coupler 15b (*second core*). Izuno teaches that the charging occurs using electromagnetic

induction (inductive charging). EX1004-Izuno, [0015], [0019]-[0020], [0037]; Claim 1(Pre). Specifically, Izuno teaches a display in vehicle 1 where a user provides a charging start instruction. EX1004-Izuno, [0027] (“Users selects the charging mode using, for example, their own communication terminal 50 or an input device in the vehicle system 10.”), [0034] (“in step S28, the system checks whether a charging start instruction has been received from the user,”), *id.* (“If a charging start instruction from the user is received...”); [0022], [0018].

238. Furthermore, Izuno teaches when the user presses the start control, a signal is transmitted to server 100, server 100 calculates a charging schedule, and server 100 transmits the charging start signal to charging station 60 “in response to instructions from the user.” EX1004-Izuno, [0018], [0022] (“The service system server 100 periodically acquires and manages the user vehicle information, enabling optimal and flexible charging control and monitoring...depending on what the user selects—automatic charging, start charging, or stop charging—it transmits a charging instruction to the charging station 60.”). Thus, when the user selects “start charging,” inductive charging via the first and second cores initiates. This is because in the Izuno combination, when conditions are met, a menu item is enabled. Thus, when a user selects the menu item for start charging, the inductive charging process occurs.

239. As discussed above, Canedy teaches a processor/controller coupled with proximity sensors and a display via a communication bus. *See* Claim 1(b),

1(c)(i). Yokota teaches enabling a user control. *See* Claim 1(c)(vi). Thus, in the Izuno-Minoshima-Canedy-Yokota combination, the ECU/processor/controller is configured to perform the step of *in response to receiving a selection of the user control, initiate inductive charging via the first core and the second core*. As I opined above, ECUs/processors/controllers were commonly utilized in vehicles in the prior art for executing programming instructions. *See* Section VI.C.2.

XI. OPINIONS REGARDING GROUND 2: OBVIOUSNESS OF CLAIMS 7, 12-20

A. Claims 7, 12-20 Are Obvious Over Izuno in Combination with Minoshima and Yokota

1. Claim 7[Pre]: “A method of charging a battery of a vehicle, the method comprising:”

240. *See* Claim 1(Pre).

2. Claim 7[a]: “detecting a positional relationship between a first core on the vehicle and a second core in a location exterior to the vehicle, the first and second cores enabling induction charging of the battery when sufficiently aligned with respect to one another;”

241. Izuno-Minoshima teaches Claim 7(a). *See* Claims 1(Pre), 1(c)(i), 1(c)(v)- 1(c)(vii).

3. Claim 7[b]: “detecting a misalignment of the first core with respect to the second core based at least in part on the positional relationship between the first core and the second core; and”

242. Izuno-Minoshima teaches Claim 7(b). *See* Claim 1(c)(ii).

4. ***Claim 7[c]: “in response detecting the misalignment of the first core with respect to the second core, disabling a user control displayed on a display for controlling the induction charging of the battery.”***

243. Izuno-Minoshima-Yokota teaches Claim 7(c). See Claim 1(c)(iii).

5. ***Claim 12[Pre]: “The method of claim 7, wherein the positional relationship is a first positional relationship and further comprising:”***

244. See Claims 1(c)(ii), 7.

6. ***Claim 12[a]: “detecting a second positional relationship between the first core on the vehicle and the second core after detecting the first positional relationship,”***

245. See Claims 1(c)(iv), 7.

7. ***Claim 12[b]: “detecting an alignment of the first core with respect to the second core based within a predetermined threshold at least in part on the second positional relationship, and”***

246. See Claims 1(c)(v), 7. As discussed in Claim 1(c)(v), Minoshima’s distance for detecting alignment/misalignment is “predetermined.” EX1005-Minoshima, Abstract, [0008]-[0009], [0013], [0011], [0041], [0065].

8. ***Claim 12[c]: “in response detecting the alignment []⁶ of the first core with respect to the second core, enabling the user control.”***

247. See Claims 1(c)(vi), 7.

⁶ Correcting typographical error.

9. ***Claim 13: “The method of claim 12, further comprising, in response to receiving a selection of the user control, initiating induction charging via the first core and the second core.”***

248. See Claims 1(c)(vii), 12.

10. ***Claim 14: “The method of claim 7, wherein the display is mounted within the vehicle.”***

249. See Claims 1(b), 7.

11. ***Claim 15[Pre]: “A method of charging a battery of a vehicle, the method comprising:”***

250. Izuno teaches a method of charging a vehicle battery using electromagnetic induction (a method of charging a battery of a vehicle). See Claims 1(Pre) and 7(Pre).

12. ***Claim 15[a]: “detecting a positional relationship between a first core on the vehicle and a second core in a location exterior to the vehicle, the first and second cores enabling induction charging of the battery when sufficiently aligned with respect to one another;”***

251. Izuno-Minoshima teaches Claim 15(a). See Claims 1(Pre), 1(c)(i), 1(v)-(vii).

13. ***Claim 15[b]: “detecting an alignment of the first core with respect to the second core within a predetermined threshold based at least in part on the positional relationship between the first core and the second core; and”***

252. Izuno-Minoshima teaches Claim 15(b). See Claims 1(c)(v), 12(b).

14. ***Claim 15[c]: “in response detecting the alignment of the first core with respect to the second core, enabling a user control displayed on a display for controlling the induction charging of the battery.”***

253. Izuno-Minoshima-Yokota teaches Claim 15(c). *See* Claim 1(c)(vi)-(vii).

15. Claim 16[Pre]: “The method of claim 15, wherein the positional relationship is a first positional relationship and further comprising:”

254. *See* Claims 1(c)(iv), 15.

16. Claim 16[a]: “detecting a second positional relationship between the first core on the vehicle and the second core before detecting the [first]⁷ positional relationship;”

255. *See* Claims 1(c)(i)-(ii), 15.

17. Claim 16[b]: “detecting a misalignment of the first core with respect to the second core based at least in part on the second positional relationship between the first core and the second core; and”

256. *See* Claims 1(c)(i)-(ii), 15.

18. Claim 16[c]: “in response detecting the misalignment of the first core with respect to the second core, disabling the user control displayed on a display for controlling the induction charging of the battery.”

257. *See* Claims 1(c)(iii), 15.

19. Claim 17: “The method of claim 16, further comprising providing information indicative of the second positional relationship to a user seated within the vehicle.”

⁷ Correcting typographical error.

258. See Claims 1(b), 1(c)(i)-(iii), 16. In the combination, Minoshima's "information indicating that the parking position is unsuitable" (e.g., "Parking Position NG") and Yokota's disabling of a menu item are each provided to the user and *information indicative of the second positional relationship* (i.e., misalignment). See EX1005-Minoshima, [0011], [0012], [0039].

20. Claim 18: "The method of claim 16, further comprising providing information indicative of the misalignment to a user seated within the vehicle."

259. See Claims 1(c)(i)-(iii), 16-17. See EX1005-Minoshima, [0011], [0012], [0039].

21. Claim 19: "The method of claim 16, further comprising providing information indicative of changes of position of the vehicle with respect to the second core to a user seated within the vehicle."

260. See Claims 1(b), 1(c)(iv)-(vi), 16-17.

22. Claim 20: "The method of claim 15, further comprising initiating induction charging via the first core and the second core in response to receiving a selection of the user control."

261. See Claims 1(c)(vii), 16.

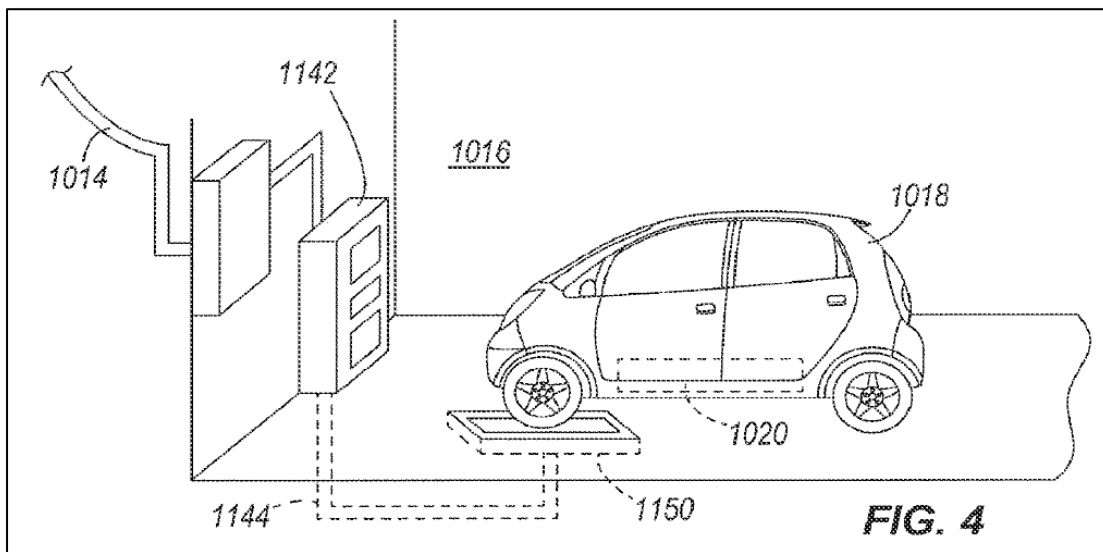
XII. OPINIONS REGARDING GROUND 3: OBVIOUSNESS OF CLAIM 2

A. Claim 2 is Obvious Over Izuno in Combination with Minoshima Canedy, Yokota, and Ross

1. Claim 2: "The vehicle alignment system of claim 1, wherein the second core is part of a pad over which the first core is movable."

a) '996 Patent's Charging Pad

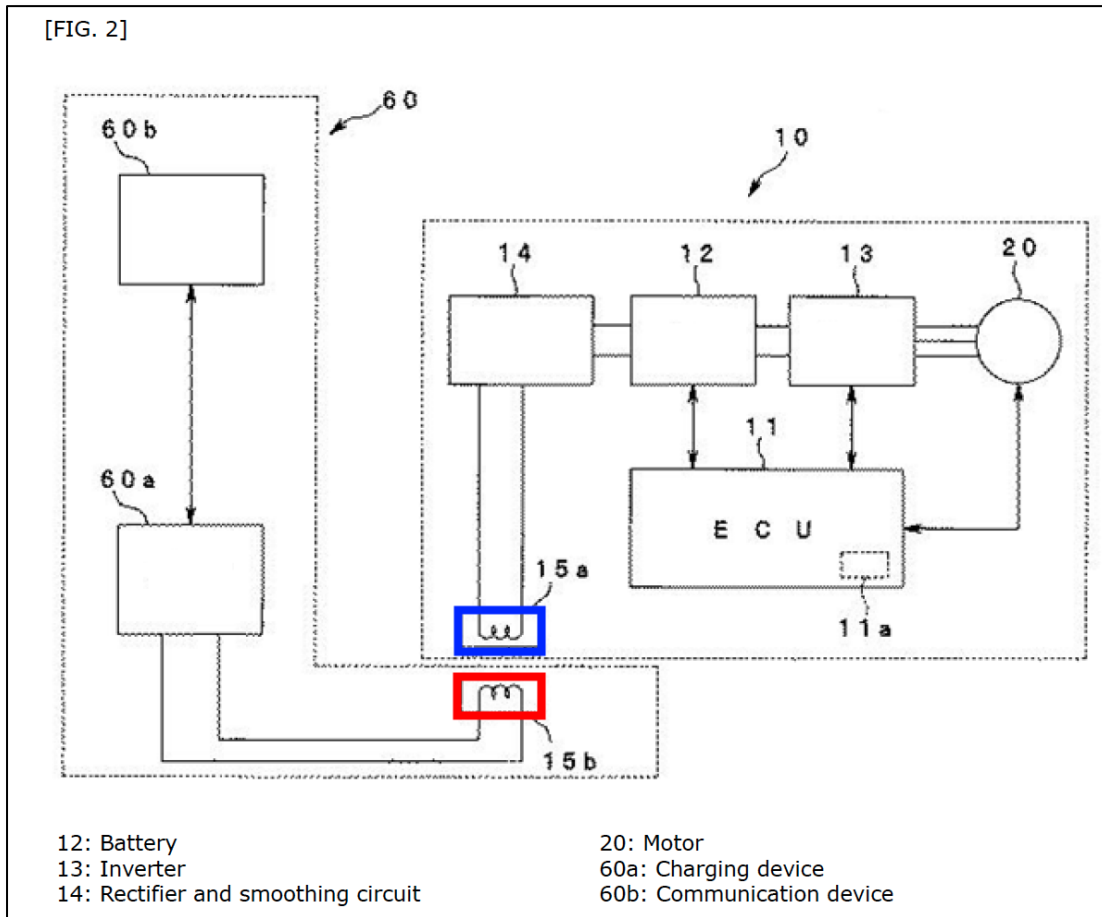
262. The '996 Patent depicts charging pad 1150 in Fig. 4 below. The '996 Patent describes this as a “conventional” inductive charging pad. EX1001, 33:20-24 (“utilizes a conventional battery induction charging system in order to charge the battery 1020 of the vehicle 1018, and includes a charging pad 1150 having a power supply core (not shown) energized to supply power via induction to a power receiving core of the vehicle”).



EX1001, Fig. 4, 33:33-38.

b) Izuno's Charging Pad

263. Similarly, Izuno teaches coupler 15b located in a parking space over which a user drives an electric vehicle to charge the battery. Fig. 2 depicts vehicle coupler 15a and charging station coupler 15b (*part of a pad*):



EX1004-Izuno, Fig. 2. Izuno's charging setup is a charging pad because a vehicle drives over the charger to perform inductive charging.

264. Izuno teaches that charging coupler 15b is "installed in the charging parking space" and is "positioned opposite" the charging coupler 15a mounted to the underside of the vehicle. EX1004-Izuno, [0020], [0015]. A POSITA would have understood that the charging coupler 15b is a charging *pad* because Izuno describes a stationary, contactless inductive charging structure positioned within the parking surface such that the vehicle is driven into position above it. EX1004-Izuno, [0015], [0020]. Furthermore, because Izuno teaches that the vehicle is parked on top of the

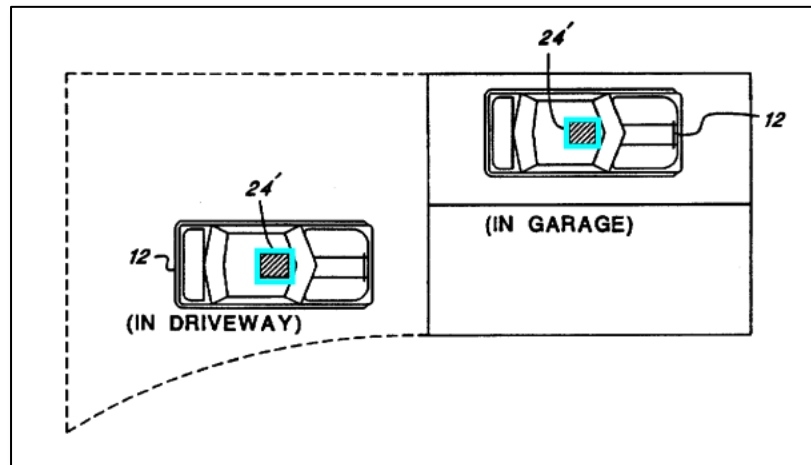
charging coupler 15b for contactless inductive charging, a POSITA would have understood that charging coupler 15b is a planar or low-profile structure, consistent with a charging *pad*.

265. Indeed, other prior art references teach a similar charging pad for performing inductive charging. *See* EX1057-Oglesbee, Title (“Inductive charging pad with alignment indicator”), Abstract (“A contactless, inductive charger having a generally planar surface is provided.”); EX1058-Boys, Abstract, 1:5-7 (“The present invention relates to an Inductive Power Transfer (IPT) pad, a system, method and means for charging a battery of an electric vehicle using multiple power sources and an electric vehicle powered by said battery.”), 3:4-7, 8:12-13 (“More preferably, the pickup pad is coupled to the underside of the vehicle and the charging pad is provided on the ground”), 14:28-32.

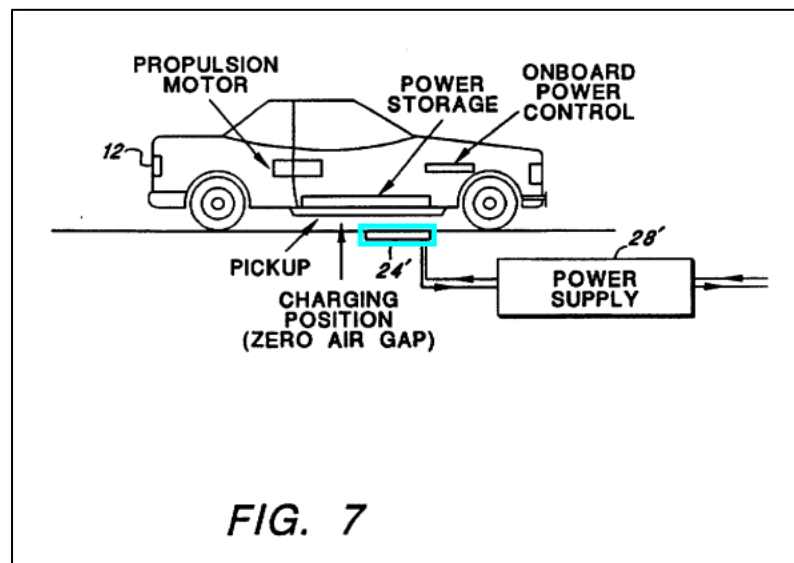
c) Ross’s Charging Pad

266. To the extent it is argued Izuno does not teach a charging pad, Ross teaches a charging system for an electric vehicle that utilizes charging pad 24 to inductively charge an electric vehicle’s battery. EX1008-Ross, 18:1-10, 17:7-13, 9:11-43. Ross’s teaches charging pad 24 is “approximately 1 meter square and 3 cm thick” and “is installed on the surface of a driveway or garage floor.” EX1008-Ross, 18:1-10. Ross teaches “pad 24’ is used for an overnight recharging of the energy

storage system 30” of the electric vehicle.” *Id.* Fig. 7 depicts charging pad 24 and vehicles 12:



EX1008-Ross, Fig. 7 (excerpt). Charging pad 24 is located beneath a vehicle to perform inductive charging:



EX1008-Ross, Fig. 7 (excerpt).

d) Motivation to Combine Izuno-Minoshima-Canedy-Yokota and Ross

267. A POSITA would have been motivated and found it obvious to modify Izuno-Minoshima-Canedy-Yokota per Ross to utilize a charging pad instead of or in addition to Izuno's native charging arrangement. Such a combination would allow Izuno's charging infrastructure to be installed in the ground of a parking space, as expressly taught by Izuno. EX1004-Izuno, [0020]. This would enable contactless charging with the vehicle that is parked in the parking space, such that the vehicle would be driven over the low-profile charging pad until proper alignment position is achieved. EX1004-Izuno, [0019]-[0020]. Utilizing a charging pad would have been a straightforward way to provide inductive charging at a user's home, for example, by arranging the charging pad in a garage or driveway. In one example, implementing the charging pad infrastructure in a garage or driveway of a user's home would increase user convenience by providing charging capabilities whenever the user is parking the vehicle at home. This would enable a more seamless charging experience for the user, such that the vehicle can be charged at convenient times, such as overnight while the vehicle is parked and not in use.

268. In another example, a charging pad would have been utilized in Izuno's native system in place of coupler 15b (and any other necessary related components), thus simplifying the parking space style charging arrangement. Using a low-profile charging pad in the ground of the designated parking area provides a compact and

unobtrusive charging system that reduces mechanical complexity. Thus, whether at a charging station such as Izuno's or at home, a user would have been able to use Izuno's native charging method and utilize a charging pad, per Ross, to charge their electric vehicle. This modification would have provided users with additional charging options that would not have required a permanent installation but instead the charging pad would have sat on a surface, such as a parking space, driveway, or garage floor. By utilizing a low-profile charging pad, the charging system would be implemented with minimal modification to the surrounding infrastructure. That is, the charging pad does not require a particular mechanical system to be individually configured for each parking location.

269. Using Ross's known technique of utilizing a charging pad for implementing inductive charging would have improved the similar Izuno combination in the same way as Ross. Further, this modification would have been a simple substitution of a charging pad for a parking-space charging station to obtain the predictable result of charging an electric vehicle. This modification would have provided increased user convenience, reduced installation complexity, and greater flexibility in selecting charging locations, while still achieving reliable contactless charging of the electric vehicle.

270. A POSITA would have had a reasonable expectation of success when modifying the Izuno combination per Ross. Both Izuno and Ross employ contactless

charging systems whereby the vehicle's charging coil is located on its underside, and the vehicle is parked over top of the external charging coil. EX1004-Izuno, [0020]; EX1008-Ross, 18:1-5, Fig. 7. Implementing Ross's charging pad would have required only straightforward modifications, such as a charging pad and sufficient electrical connections to utilize a charging pad in a user's home (e.g., garage or driveway) or at a charging station, such as in Izuno's native arrangement. A POSITA would have understood that residential EV charging infrastructure, including the electrical service and wiring necessary to deliver charging power to a parking location, was well known. EX1059-Chan-Modeling, 1 ("As an EV is usually parked at home or a storage site at night, the battery charger in the vehicle can be connected into the domestic single-phase AC plug for slow night-time charging...As the electricity demand at night is relatively low, this home charging scheme can facilitate the load level control of power utilities.").

271. Because the Izuno combination's electric vehicle is already configured to perform inductive charging, using a charging pad such as Ross's would have been a straightforward modification. The modification does not require altering the vehicle-side inductive charging components or functionality, but instead only substitutes one well-known external inductive charging interface for another. Furthermore, integrating low-profile charging systems for inductive charging in roadways and parking lots was well-known. EX1017-Covic, 1 ("Flat pickups are

used on the underside of each vehicle to couple power from the track to the vehicle.”), 1 (“Roadway vehicle applications using IPT have been proposed for more than two decades[.]”); EX1015-Mahmood, 1 (“This charging method is suitable for shopping complex’s car park and other places which require a big space of parking lots.”); EX1058-Boys, 8:12-13 (“More preferably, the pickup pad is coupled to the underside of the vehicle and the charging pad is provided on the ground, wherein said selectively coupling the battery to the lower power supply comprises driving the vehicle into a position such that the pickup pad is positioned above, or operably adjacent to, the charging pad.”).

XIII. OPINIONS REGARDING GROUND 4: OBVIOUSNESS OF CLAIM 3

A. Claim 3 is Obvious Over Izuno in Combination with Minoshima Canedy, Yokota, and Kuki

- 1. Claim 3: The vehicle alignment system of claim 1, wherein the controller is configured to detect the first positional relationship between the first core and the second core based at least in part on detection of a magnetic field.***

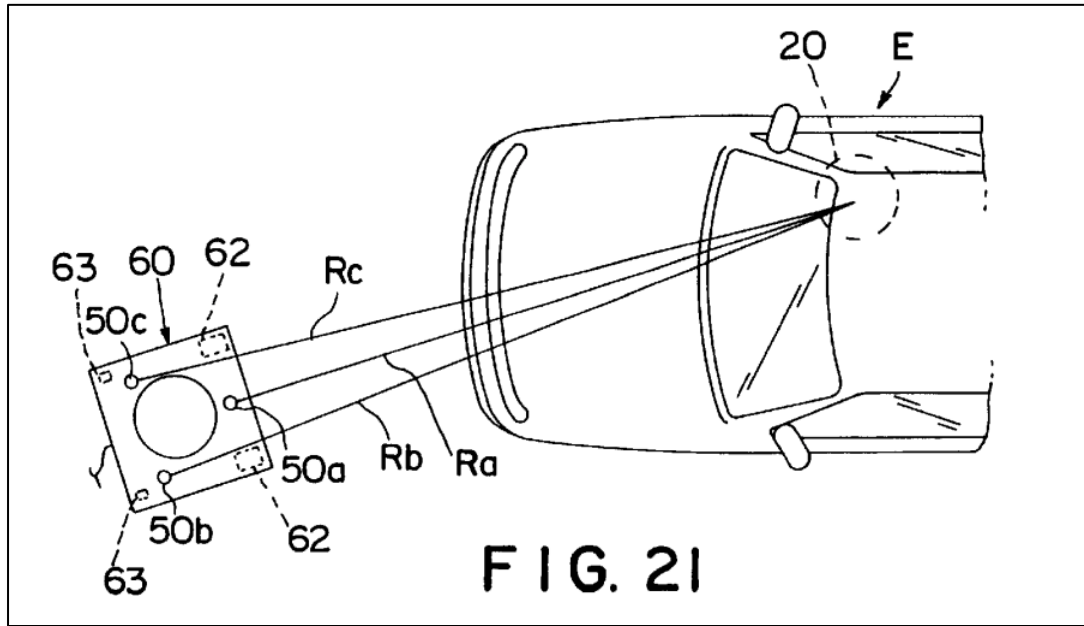
272. As discussed above, the Izuno combination teaches a controller configured to detect a first positional relationship between the two cores. *See* Claim 1. In particular, Minoshima teaches the use of proximity sensors to determine the position of the vehicle relative to the ground-side charging core. *See* Claim 1(c)(i)-(c)(ii). Minoshima teaches that the proximity sensors may be optical, ultrasonic, or electromagnetic sensors. EX1005-Minoshima, [0059].

273. Kuki teaches using magnetic sensors (magnetometers) for detecting positioning of cores in a vehicle and in a charger in an inductive charging system. In the modified Izuno combination, the proximity sensors would be supplemented with magnetic sensors for a more direct measurement of cores aligning or the magnetic sensors would be used instead of proximity sensors (simple substitution).

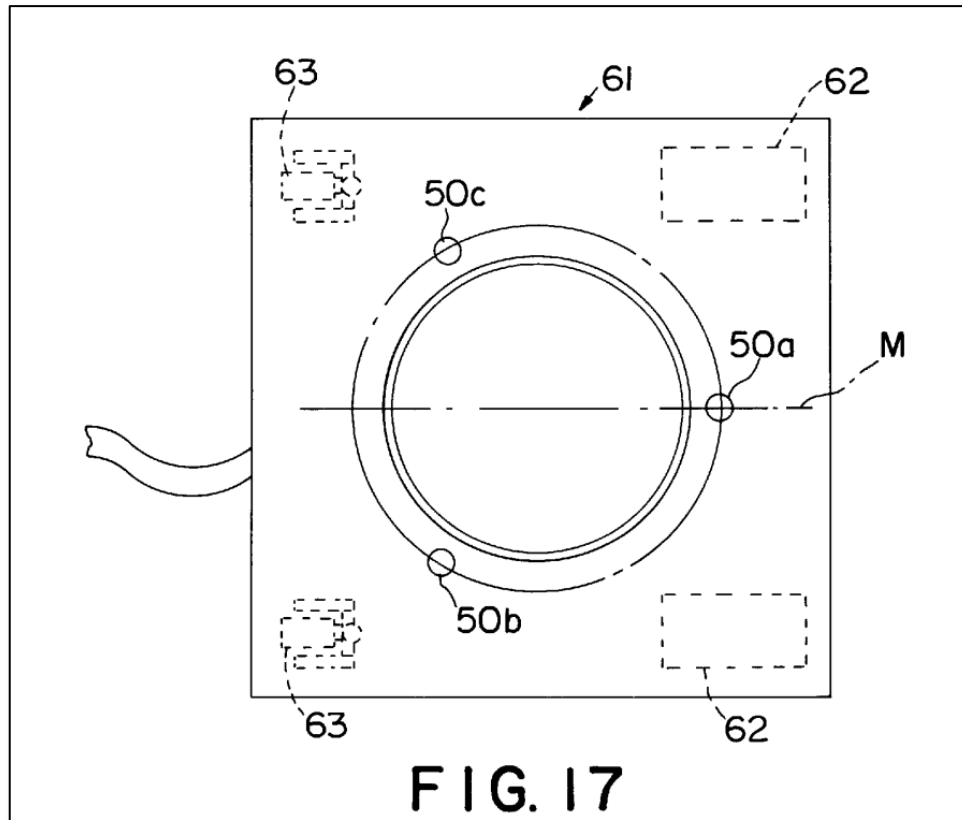
a) Kuki's Magnetic Sensors

274. Kuki teaches an inductive vehicle charging system where three magnetic sensors (50a-c) are utilized for determining when the core in the vehicle and core in the charger are aligned. EX1009-Kuki, 10:19-34, 10:65-11:24, 12:39-51, Figs. 17, 21. In one embodiment, Kuki teaches arranging the sensors in a triangle formation, allowing for magnetic field strength to be detected in both the X- and Y-axis directions. *Id.* Thus, when the magnetic field detected by each sensor is equal, the two cores are aligned. *Id.* Kuki explains that the external charging coil is driven into position under the vehicle “until the intensity deviation becomes nil i.e. the magnetic sensors 50b, 50c detect substantially equal magnetic intensities.” EX1009-Kuki, 12:45-51, Fig. 15. Accordingly, a POSITA would have understood that the external charging coil is aligned with the secondary coil on the vehicle when the magnetic sensors are equidistant from the coil, such that they detect equal magnetic intensities.

275. Fig. 21 depicts sensors 50a-c and a vehicle with a core to be charged inductively:



EX1009-Kuki, Fig. 21. Fig. 17 below depicts a zoomed in view of magnetic sensors 50a-c:



EX1009-Kuki, Fig. 17. While Kuki depicts magnetic sensors 50a-c in the charging coil apparatus, it was also known to locate magnetic sensors in the vehicle instead. For example, Patwardhan teaches an inductive charging system for an electric vehicle whereby magnetometers onboard the vehicle sense the “magnetic field emanating from energized coils” to provide positional information to the user to assist with parking the vehicle over top of the charging coils. EX1036-Patwardhan, [0047], Fig. 7. *See also* Section VI.C.3.

276. While either configuration would have resulted in a functional aligning system, the proposed combination simply adds magnetic sensors (or replaces proximity sensors with simple substitution) in the Izuno combination vehicle,

including because the Izuno combination vehicle already includes a processor, display, and proximity sensors for providing positioning information to a driver. EX1005-Minoshima, [0059]. As I opine in the Motivation to Combine section below, this modification would have been advantageous for the Izuno combination. Thus, the proposed modification is merely combining prior art elements according to known methods or a simple substitution. As I opine below, combining prior art elements or performing a simple substitution would have been advantageous for the Izuno combination.

b) Motivation to Combine Izuno-Minoshima-Canedy-Yokota and Kuki

277. A POSITA would have been motivated and found it obvious to modify the Izuno combination to either supplement the proximity sensors with magnetic sensors or to do a simple substitution of magnetic sensors instead of proximity sensors to provide a more direct and accurate measurement for determining when the cores are aligned compared to proximity sensors. A POSITA would have recognized that using magnetic sensors in the Izuno combination would have improved alignment confirmation and operational reliability by detecting the strength of the magnetic field emanating from the charging coil. By using multiple magnetic field sensors to compare magnetic field strength from different locations around the coil, a more accurate two-dimensional alignment determination can be

made as compared to a proximity sensor that generally provides only a one-dimensional distance measurement. EX1009-Kuki, 12:38-51.

278. Kuki's known technique of using magnetic sensors for positioning cores for inductive charging would have improved the similar Izuno-Minoshima-Canedy-Yokota vehicle and system in the same way as Kuki's vehicle and system. That is, alignment of the Izuno-Minoshima-Canedy-Yokota vehicle relative to the charging coil would have been improved through the use of multiple magnetic sensors arranged around the vehicle-side coil to detect variations in magnetic field strength. Thus, a more precise two-dimensional indication of coil positioning would be obtained as compared to using only proximity sensors. Additionally, by sensing the magnetic field of the ground-side charging core, any error or uncertainties related to the relative position of the ground-side charging core and the detected component would be eliminated. This would also simplify system calibration and ensure that the positional relationship did not change over time due to vehicle maintenance and/or accidents.

279. This modification is merely combining prior art elements (e.g., sensors, vehicle) according to known methods to yield predictable result of configuring a controller to use magnetic sensors to detect magnetic field strength to perform positioning of cores for inductive charging. As discussed previously, the use of magnetic field sensors on vehicles to measure magnetic field strength emanating

from external charging coils was well-known. EX1036-Patwardhan, [0047] (describing magnetometers onboard a vehicle for sensing the magnetic field of energized coils to assist in charging alignment), Fig.7. *See also* Section VI.C.3. Furthermore, the importance of aligning the vehicle-side coil with the charging coil was well known. *See* Section VI.B.1.

280. Alternatively, when modifying the Izuno combination by utilizing magnetic sensors instead of proximity sensors, this simple substitution of one known element/sensor for another element/sensor would have yielded predictable results. The predictable results include detecting the magnetic field emanating from the external charging coil to determine the positional relationship between the vehicle-side coil and external coil and indicating the alignment status to the driver.

281. A POSITA would have had a reasonable expectation of success for several reasons. First, vehicles using magnetic sensors for positioning and other functions were known in the prior art. EX1036-Patwardhan, [0047] (describing magnetometers onboard a vehicle for sensing the magnetic field of energized coils to assist in charging alignment); EX1060-Ishihara, Abstract (discussing magnetic field receiving devices on the front bumper of a vehicle to detect alternating current magnetic fields generated by coils along the center line of a road); EX1061-King, 2:20-36 (describing a magnetic field sensor affixed to the underside of a vehicle that detects a magnet in the ground of a driveway for opening a garage door). Thus, a

POSITA would have expected a similar result when utilizing magnetic sensors in the Izuno vehicle combination to detect the magnetic field emanating from the charging coil.

282. Second, using three or more sensors like Kuki discloses allows for triangulating positioning based on detection of magnetic field strength. Thus, the Izuno combination would have detected core alignment in both the X- and Y-axis. Indeed, the multi-sensor arrangement would have enabled the system to determine not only whether the vehicle was close to the charging coil, but also the direction and magnitude of any positional offset, thereby improving alignment precision and charging efficiency. This would have led a POSITA to a reasonable expectation of success when using magnetic sensors for aligning the two cores.

283. Third, magnetic sensors were commercially available, off-the-shelf components that a POSITA would have been aware of. As discussed previously, utilizing magnetic field sensors on vehicles for various applications including charging coil alignment and self-driving vehicle systems was well known. *See* Section VI.C.3. Modifying Izuno would have required simply adding magnetic sensors around the vehicle-side coil in a configuration such as Kuki discloses and performing any necessary modifications to programming instructions to utilize additional or different sensors, which would have been straightforward and routine. *See* Section VI.C.3. Such programming modifications would have been routine and

straightforward for a POSITA, including updating the processor to receive magnetic field measurements from multiple sensors and calculate alignment or positional offset information based on comparative field-strength data.

284. Indeed, Kuki teaches storing programming instructions in memory (storage device 183). EX1009-Kuki, 19:45-52, 19:62-65, Fig. 44. In the Izuno combination vehicle, such programming instructions would have been stored in vehicle memory and processed by the vehicle's processor. A POSITA would have understood that the vehicle's processor in the Izuno combination would have been capable of executing such additional programming instructions to process magnetic sensor data and determine alignment information without requiring specialized hardware or undue modification. *See* Section VI.C.4 (describing Diller's microcontroller controlling battery charging, displays and vehicle sensors, and Iwashita's ECU managing battery charging based on sensor input); *see also* EX1036-Patwardhan, [0047] (describing the sensed magnetic field being converted to a relative position and providing the information to a user via a user interface).

XIV. OPINIONS REGARDING GROUND 5: OBVIOUSNESS OF CLAIMS 4-6

A. Claims 4-6 are Obvious Over Izuno in Combination with Minoshima, Canedy, Yokota, and Shimizu

- 1. *Claim 4: The vehicle alignment system of claim 1, wherein the controller is further configured to, in response to detecting the misalignment, generate an indicator for display on the display, the indicator indicating a direction of movement of the vehicle***

for improved alignment of the first core with respect to the second core.

a) Minoshima's Indicator Generation

285. As discussed above, the Izuno combination vehicle includes a controller configured to control a display and provide directions to a user for repositioning a vehicle so that the cores are aligned for inductive charging. *See* Claim 1. Minoshima teaches providing an indicator on a vehicle display to indicate misalignment/alignment of the cores. EX1005-Minoshima, [0056]; *see* Claim 1. Minoshima teaches indicating on the display "the direction of misalignment when the parking orientation is unsuitable... [and] enabling the driver to determine whether the misalignment is left or right." EX1005-Minoshima, [0056]. I have included the full text of [0056] below:

“(4) In addition to indicating whether or not the parking orientation is correct, **the device may also indicate the direction of misalignment when the parking orientation is unsuitable.** For example, the system may indicate "front-to-rear misalignment," "widthwise misalignment" (specifically, "right misalignment" and "left misalignment"), and "angled misalignment" (specifically, "angled to the right" and "angled to the left"). In this case, **a visual display and/or an audible alert may be provided for notification purposes. For example, the direction of misalignment may be displayed as a message on the display 18, or indicator lights may be arranged to the left and right as seen by the driver, enabling the driver to determine whether the misalignment is left or right misalignment based on how the left**

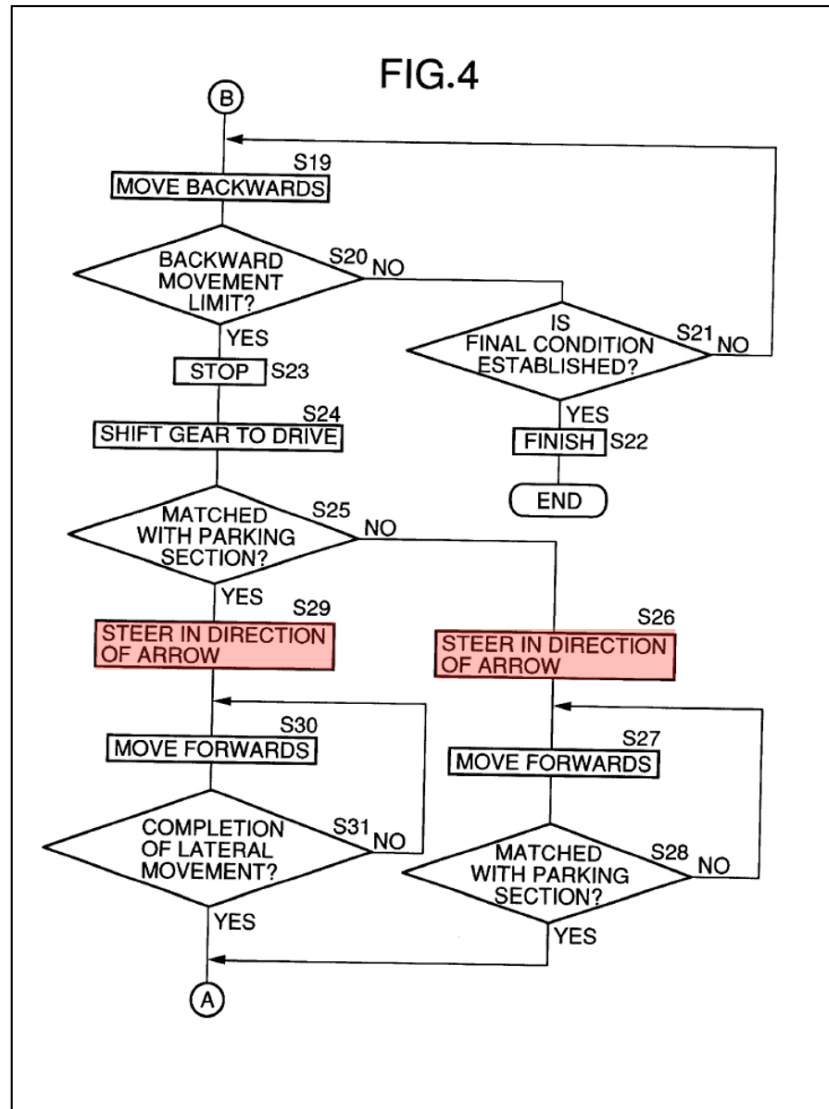
and right indicator lights are lit up (for example, the non-protruding side may be indicated by a blue light, and the protruding side by a red light).”

EX1005-Minoshima, [0056].

286. A motivation to modify Izuno per Minoshima provided in Claims 1(c)(i)-(v) applies herein.

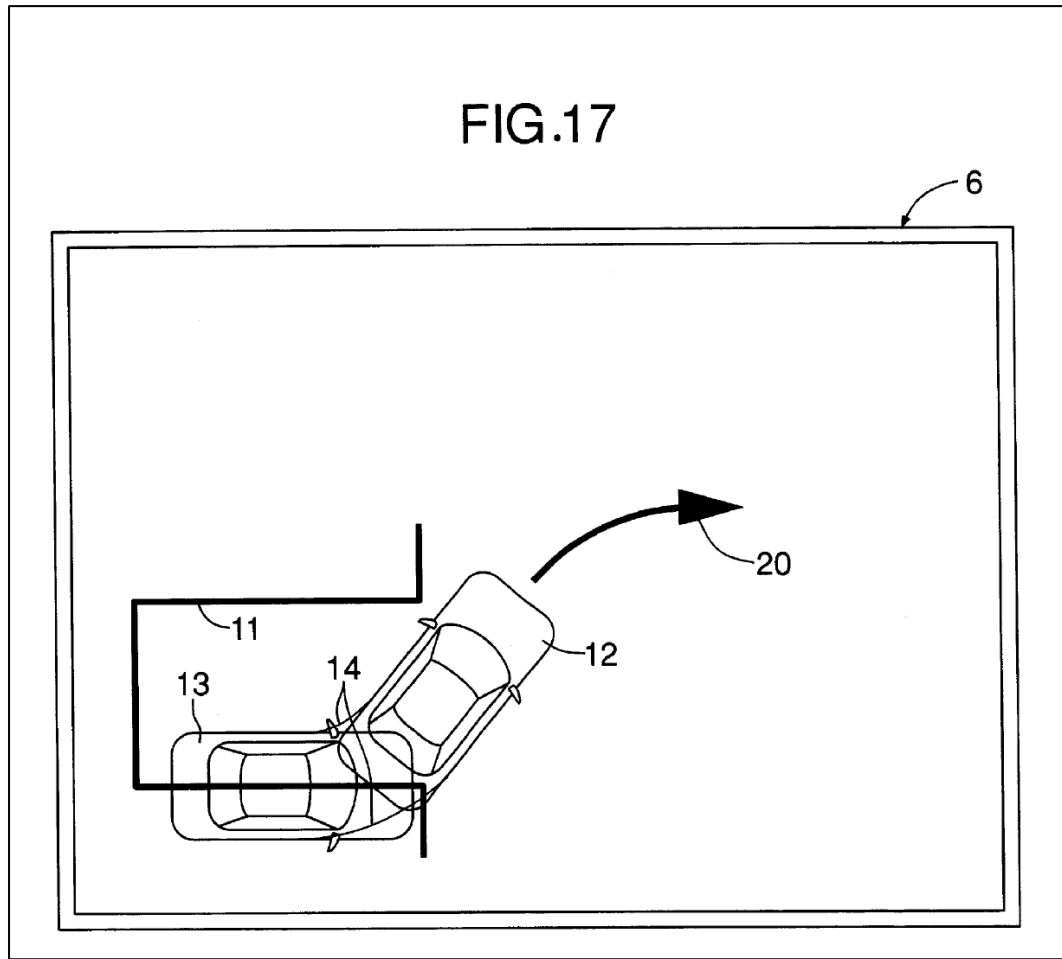
2. *Shimizu’s Indicator Generation*

287. To the extent it is argued that the Izuno combination does not teach *generating an indicator...indicating a direction of movement of the vehicle for improved alignment*, Shimizu does. Shimizu teaches a system for aiding a driver in parking where the vehicle includes a display for displaying parking-aiding information including a target parking position and a vehicle position. EX1010-Shimizu, Abstract, 5:7-13, 5:41-48, 13:1-43. Fig. 4 depicts a flowchart including a driver steering in the direction of an arrow on display 6 to properly park the vehicle in the target parking space:



EX1010-Shimizu, Fig. 4.

288. Specifically, Shimizu teaches displaying a vehicle and indicator (e.g., arrow) on a display where the arrow is in relation to a graphical representation of the vehicle to aid the driver in positioning the vehicle within the target parking space:



EX1010-Shimizu, Fig. 17, *see also id.* Figs. 16, 18-19. Fig. 17 illustrates the parking section 11, current vehicle position 12, expected parking position 13, movement locus 14 and guide arrow 20. EX1010-Shimizu, 13:1-29. Shimizu teaches that the arrow 20 indicates the direction that the driver should move their vehicle in order to have the expected parking position 13 match the desired parking position 11. EX1010-Shimizu, 13:1-29. If the expected parking position 13 is located in the parking section 11, then the driver may “move the vehicle backwards in the direction of the arrow[.]” EX1010-Shimizu, 13:29-43.

3. *Motivation to Combine Izuno-Minoshima-Canedy-Yokota-Shimizu*

289. A POSITA would have been motivated and found it obvious to modify Izuno-Minoshima-Canedy-Yokota per Shimizu to advantageously configure a controller to provide a directional indicator (e.g., arrow) on a display to assist in repositioning a vehicle to a particular parking position, such as a position where the two cores are aligned and inductive charging can begin. Providing such clear directional guidance would have improved the ease with which a driver would align the vehicle, while also reducing positioning errors and increasing the likelihood of achieving efficient inductive charging without repeated repositioning attempts. This would have been particularly useful for making fine adjustments in the lateral position of the vehicle as shown in Shimizu's Fig. 17 above, where to adjust the lateral position of the vehicle requires first steering in one direction while the vehicle moves forward, and then steering in the opposite direction to straighten the vehicle before finally back up into position. Shimizu's arrow indicators would have provided simple, accurate, easy-to-understand directions for a driver for repositioning the vehicle. Arrows represent a clear indication of direction that can be quickly interpreted by a driver with minimal distraction or ambiguity, thereby facilitating faster and more accurate vehicle positioning for inductive charging alignment. This use of Shimizu's known technique for assisting a driver in parking a vehicle would have improved the similar Izuno-Minoshima-Canedy-Yokota vehicle in the same

way as Shimizu's vehicle. Providing directional arrow indicators would enhance parking accuracy, reduced driver guesswork, and improved the overall efficiency and convenience of the parking process for charging alignment.

290. Where arrows are used in place of some other indicator (e.g., lights), modifying the Izuno combination's vehicle would have been a simple substitution of arrows instead of lights or other indicators, and would have yielded predictable results of assisting a driver. Using arrows in lieu of or in addition to other indicators, such as lights and words would have been obvious to try since there are a finite number of symbols used to indicate direction to a user on a display (e.g., words, arrows), and the modification would have had a reasonable expectation of success in better assisting the driver in positioning the vehicle for alignment. While Minoshima teaches that "indicator lights may be arranged to the left and right as seen by the driver, enabling the driver to determine whether the misalignment is left or right misalignment[,]" a POSITA would have understood that the use of an arrow indicator would add additional clarity to the guidance instructions, better assisting the driver in positioning the vehicle for alignment. EX1005-Minoshima, [0056].

291. That is, adding indicator arrows removes any direction ambiguity that may be caused by the indicator lights. A POSITA would have understood that this would have been simply a design choice for presenting information to a user in a particular format. Whether using words, lights, arrows, or some other indicator, the

information would have been outputted to a user. Arrows directing the user to steer the vehicle in a particular direction were an obvious choice and were simply a modified format for information that may be caused by the indicator lights the Izuno combination already outputted. Choosing arrows, for example, would have been picking a known and easily understood symbol to present information to a user to assist in properly positioning the vehicle. There would have been a finite number of symbols (arrows, indicator lights, words, images) from which to select to indicate to a user to move the vehicle in a particular direction, thus selecting arrows would have been obvious to try.

292. A POSITA would have had a reasonable expectation of success when modifying the Izuno combination per Shimizu. The Izuno combination already performs a similar process, but simply does not present arrows to a user to guide the user in positioning the vehicle. Izuno-Minoshima already teaches determining proper alignment of charging cores and notifying a user to reposition the vehicle. *See Claim 1.* Minoshima teaches providing indications to a driver to reposition the vehicle including on display 34 and/or indicator lights 32. EX1005-Minoshima, [0052], [0056], Figs. 6-7 (depicting indicator lights 32 and display 34). Minoshima further teaches that the indicator lights on the instrument panel may represent left and right misalignment by using blue and red light, respectively. EX1005-Minoshima, [0052], [0056].

293. A POSITA would have understood that the addition of an arrow indicator on the instrument panel would offer clearer guidance when communicating the alignment direction to the driver. Shimizu expressly discloses depicting an arrow on a vehicle display to indicate to a driver the direction to reposition the vehicle to a target parking position. Furthermore, utilizing arrows in a vehicle to indicate driving direction to a user was well known. EX1062-Akita, 1:23-33 (“a guide arrow is displayed in the image of the scene ahead of the vehicle in a superimposed manner as route information indicating a route in the intersection, along which the vehicle is to travel, thereby performing further accurate and easily viewable route guidance[.]”). Thus, Shimizu offers a straightforward disclosure and solution for guiding a user to reposition a vehicle by using an easy-to-understand symbol on the display in view of a user.

294. Thus, modifying the Izuno combination per Shimizu would have required only routine and straightforward changes to programming instructions to depict an arrow on a display in addition to or in lieu of Minoshima’s positional indication teachings. Because Minoshima teaches that the display 34 in the cabin of the vehicle may display a message to notify the driver “whether the parking position and orientation are correct[.]” a POSITA would have understood that the display 34 be further utilized to display an arrow, as described by Shimizu. A POSITA would have understood that programming the display 34 to indicate a direction using an

arrow would have been a straightforward modification of the existing display functionality. No hardware modification would have been required, as the Izuno combination already includes a processor, display, and sensors. *See* Claims 1(a)-1(c)(ii). This modification would have simply been adding or modifying a display to include arrows to indicate a direction the vehicle should move. Since the vehicle already performs such an indication with lights or other messaging, this modification would have been straightforward and routine. Specifically, as discussed above, the Izuno combination already teaches using a controller configured to control a display, such that controlling a display to depict arrows would have been a natural use of the Izuno combination's existing hardware.

295. A POSITA would have recognized that implementing Shimizu's directional arrow indicators would have involved only routine software changes while relying on the same underlying sensor inputs, processor functionality, and display components already present in the Izuno combination. Thus, the processor and other hardware required are already present in the Izuno combination. Additionally, modifying programming instructions would have been well-within the skillset of a POSITA, leading to a reasonable expectation of success. Because the Izuno combination already processed positional information and controller driver-facing display outputs, modifying the display to further incorporate an arrow would

have been a simple change to the existing programming instructions executing in the vehicle of Izuno-Minoshima-Canedy-Yokota.

- B. Claim 5: The vehicle alignment system of claim 4, wherein the indicator comprises an arrow indicating the direction of movement.**

296. Izuno-Minoshima-Canedy-Yokota-Shimizu teaches displaying *an arrow indicating the direction of movement*. See Claim 4.

- C. Claim 6: The vehicle alignment system of claim 4, wherein the controller is configured to generate the indicator in a position relative to a graphical representation of at least part of the vehicle displayed on the display.**

297. See Claim 4.

XV. OPINIONS REGARDING GROUND 6: CLAIMS 8-10

- A. Claims 8-10 are Obvious Over Izuno in Combination with Minoshima, Yokota, and Shimizu**

- 1. Claim 8: “The method of claim 7, further comprising, in response to detecting the misalignment of the first core with respect to the second core, generating an indicator for display on the display, the indicator indicating a direction of movement of the vehicle for improved alignment of the first core with respect to the second core.”*

298. See Claims 4, 7.

- 2. Claim 9: “The method of claim 8, wherein the indicator comprises an arrow indicating the direction of movement.”*

299. See Claims 5, 7-8.

- 3. Claim 10: “The method of claim 8, wherein the indicator is displayed in a position relative to a graphical representation of at least part of the vehicle displayed on the display.”*

300. *See* Claims 6-8.

XVI. OPINIONS REGARDING GROUND 7: CLAIM 11

A. Claim 11 Is Obvious Over Izuno in Combination with Minoshima, Yokota, And Ross

1. Claim 11: “The method of claim 7, wherein the second core is part of a pad over which the first core is movable.”

301. *See* Claims 2, 7.

XVII.CONCLUSION

302. I declare that all statements made herein of my knowledge are true, and that all statements made on information and belief are believed to be true, and 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: 6/16/2026

By: 

Scott Andrews

Scott Andrews

(650) 279-0242

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Petaluma, CA

Summary

Creative, energetic, and innovative internationally recognized technical executive experienced in general management, systems engineering, advanced product development, advanced technology, business development, strategic planning, and program management

- Location Based Technologies
- Vehicle Information Systems
- Vehicle Electrical/Electronics Systems
- ITS and Related Industries
- Communications Systems
- Mobile Information Technology
- Multimedia/Internet Computing
- Mobile Technology Test Instrumentation
- Vehicle Safety and Control Systems
- Enterprise Software

Experience

12/2001-Present Cogenia Partners, LLC

Systems engineering consulting supporting and mobile information, mobile electronics and automotive safety and entertainment systems development

Current Engagements:

- Expert witness for patent litigation, contracts and trade secrets:
 - Audi AG, related to automotive systems integration
 - Lordstown Motors, related to infotainment systems
 - Uber, related to location based systems
 - Toyota, related to vehicle-mobile device interfaces
 - Cummins Diesel, related to cloud based vehicle data collection

Prior Engagements/Projects:

- Technical consultant for connected vehicle security credential management system management concepts; Sponsored by Transport Canada
- Technical consultant for sensor supplemented message validation system for vehicle to vehicle communication based collision warning/avoidance systems. Sponsored by US DOT NHTSA
- Technical consultant for connected vehicle security credential management system deployment; Sponsored by US DOT NHTSA
- Subject matter expert and co-principle investigator on DSRC performance Measures development project for U.S.DOT NHTSA.
- Subject matter expert on communications data delivery system study to understand optimal roadside unit placements to support security credential management in connected vehicle systems; Sponsored by U.S. DOT RITA
- Developed systems engineering methodology for vehicle E/E systems; Applied methodology on project for Yazaki to reverse engineer the E/E architecture for a 2004 BMW 5 series vehicle.
- Co-Principal investigator for Integrated Advanced Transportation System; A 30+ year future technical feasibility assessment and strategy for U.S. DOT Federal Highway Admin. (FHWA).
- Technical consultant to American Association of State Highway Transportation Officials (AASHTO) for connected vehicle deployment analysis and strategy.
- Chief System Architect for the Vehicle Infrastructure Integration (VIIC) program

(BMW, Chrysler, Daimler Benz, Ford, GM, Honda, Nissan, Toyota, VW); A connected vehicle research program funded by U.S. DOT FHWA.

- Technical consultant to Michigan State DOT (Enterprise Pooled Fund) to develop a system architecture and deployment strategy for Rural ITS.
- Telematics delivery architecture development for a Fortune 100 service provider
- Technical consultant to the Vehicle Safety Consortium developing Dedicated Short Range Communications (DSRC) standards for safety systems;
- Designed novel super capacitor based high performance hybrid vehicle as part of an early stage startup company; Developed performance requirements, conceptual designs and patented integrated electrical system architecture concept.
- Toyota Motor Sales – 10 year technology survey;
- Connected Vehicle Trade Association- Transferred AMI-C specifications to ISO TC 22, TC 204 AND OSGi. Developed OSGi Vehicle Interface Specification;
- Expert witness for:
 - Orbital Sciences, related to vehicle fleet management
 - Volkswagen, related to vehicle control technologies
 - Apple, related to mobile communications device control
 - Google, related to map displays
 - Platform Sciences, related to location based fleet management
 - Unified Patents, various location based technology cases
 - Uber, related to display of multiple terminals on navigation display
 - Directed Electronics, related to vehicle remote start systems
 - ZTE, related to cell phone location and orientation systems
 - Audi, America, related to vehicle control systems
 - Club Car, related to golf cart navigation systems
 - Unified Patents, various location based technology cases
 - Toyota, related to vehicle communications systems
 - American GNC vs. LG, related to MEMS sensors
 - Dale Progress, Ltd. vs. Toyota, related to vehicle information display systems
 - Blackberry vs. SNAP, related to display of multiple terminals on navigation display
 - Location Services vs. Google, related to augmented reality displays
 - Alert Signal vs. Apple, related to cell phone messaging systems
 - AGIS vs. LG related to cell phone messaging systems
 - Maxell vs. ASUS, related to cell phone navigation systems
 - AGIS vs. HTC, related to cell phone location systems
 - AGIS vs. Huawei, related to cell phone location systems
 - AGIS vs. LG
 - Michigan Motor Technologies vs. Hyundai, related to vehicle control systems
 - Princeton Digital vs. Konami et al, related to video game display systems
 - Delphi, related to automotive safety systems
 - ATT vs. Vehicle IP relating to cell phone navigation systems
 - VW/Audi vs. Beacon, relating to traffic information systems
 - VW/Audi vs. Blitzsafe relating to mobile device integration and mobile audio systems
 - T-Mobile vs. TracBeam relating to wireless location technologies
 - VW/Audi vs. Joao relating to remote service architectures Apple Computer vs. Porto relating to cell phone navigation systems

- Mercedes vs. Adaptive Headlamp Technologies relating to adaptive headlamps
- Liberty Mutual, Geico and Hartford vs. Progressive Insurance relating to usage based insurance systems
- Toyota vs. American Vehicular Sciences (AVS) relating to occupant sensing systems
- Lenovo and Amazon vs. Pragmatus relating to device tracking
- Ford in a patent vs. Eagle Harbor Holdings relating to Bluetooth systems and mobile device integration in the vehicle
- Bentley vs. Cruise Control Technologies relating to adaptive cruise control
- Google vs. Walker Digital relating to 3D navigation displays
- Volkswagen/Sirius-XM vs. case relating to traffic information systems
- Volkswagen, Ford and GM in patent cases vs. Affinity Labs, relating to the iPod interface
- Honda vs. American Calcar, relating to telematics equipment and user interfaces
- Alpine, Denso and Pioneer Corporation in an International Trade Commission patent case vs. Honeywell, related to navigation systems
- BMW vs. American Calcar, relating to telematics equipment and user interfaces

4/2000 to 12/2001 Cogenia, Inc.

President and Chief Executive Officer, Founder

Founded company in 2000 to develop enterprise class data management software system. Responsibilities included development of business concept and plan, corporate administration including financial and legal management, leadership of executive team in product development, fundraising, business development, organizational development, and investor relations. Raised \$2.2M between 8/00 and 5/01 from individuals and funds;

1996 to 4/2000 Toyota Motor Corporation, Japan

Project General Manager, R&D Management Division

Responsibilities included the conceptualization and development of multimedia and new technology products and services for Toyota's future generations of passenger vehicles in the United States and Europe, Heavy emphasis on strategy for information systems, and on development of technical concepts for computing and Internet oriented systems. Led automated vehicle Development program leading up to 1997 Automated Highway Systems (AHS) demonstration in Sand Diego, CA; Supported technology acquisition for hybrid vehicle control systems; Working under direction of Toyota board members, established the Automotive Multimedia Interface Collaboration (AMI-C), a partnership of the world's car makers to develop a uniform computing architecture for vehicle multimedia systems, and led all early technical, planning and legal work. Provided technical management of technical contracts with Carnegie Mellon University Robotics Lab (Image based collision warning systems), and the development of Toyota's position on the US Intelligent Vehicle Initiative.

1983 to 1996 TRW, Inc.

Held a series of increasingly responsible positions in program management, technology development and business development.

1993 to 1996 TRW Automotive Electronics Group

Director, Advanced Product Planning/Development

Specific responsibilities included leadership and overall management of advanced

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development programs such as Automotive Radar, Adaptive Cruise Control, Occupant Sensing, In Vehicle Information Systems, and other emerging transportation products; Managed remotely located advanced development laboratory performing approximately \$6M in annual development projects.

1983 to 1993 TRW Space & Electronics Group

Manager, MMIC Products Organization

Developed TRW's commercial GaAs MMIC business. Responsibilities included development of business strategy and business plan, and overall management of customer and R&D programs. Developed extensive international business base and took operation from start-up to \$5M sales per year in under two years. Developed the first single chip 94 GHz Radar (Used for automotive cruise control and anti collision systems).

1979-1983 Teledyne Microwave

Developed high reliability microwave components. Developed CAD tools.

1977-1979 Ford Aerospace, Advanced Development Operation

Designed, tested and delivered microwave radar receiver systems

Education

MSEE Stanford University, 1982

BSEE University of CA, Irvine 1977

TRW Senior Leadership Program 1992

Publications

1. Two Dimensional Vehicle Control for Obstacle Avoidance in Multi-Lane Traffic Environments; Published in the proceedings of the 1998 IEEE International Conference on Intelligent Vehicles.
2. Automotive Multimedia Interface Collaboration; Briefing Presented to the 9th VERTIS Symposium, April 1999, Tokyo Japan.
3. Privacy and Authenticity in Telematics Systems; Published in the Proceedings of the Society of Automotive Engineers World Congress, 1999
4. Automated Highway Systems Acceptance and Liability; Briefing presented to the Automated Vehicle Guidance Demo 98 Conference, Rinjwoude, The Netherlands, June 1998.
5. What is Telematics? Briefing presented at IIR Telematics Conference Scottsdale, AZ, December 2001
6. Advanced Telematics Services: A Hard Look at Reality; Briefing presented at IIR Telematics Conference Scottsdale, AZ, December 2001
7. Consumer Electronics and Telematics; Briefing presented at Eye For Auto Telematics Update Conference Las Vegas, NV, January 2003
8. The Automotive Multimedia Interface Collaboration Software and Network Architecture: Extending the Concept of Platform Independent Computing;

- Briefing Presented to the Future Generation Software Architectures in the Automotive Domain Conference, San Diego, CA, January 2004
9. Quality, Choice and Value: How New Architectures are Changing the Vehicle Lifecycle; Briefing presented at IEEE Convergence Conference, October 2004
 10. Critical Standards for the Next Generation of Telematics Systems and Services; Briefing presented at the Telematics Update Conference, December 2004
 11. VII System Overview; Briefing presented To Transportation Research Board, ITS and V-HA Committees 2007 Mid-Year Meeting; July 2007
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 13. A Comparison of Communications Systems for VII; Presented at the ITS World Congress, New York, NY, October, 2008
 14. Vehicle Infrastructure Integration Systems Overview; Presented at the ITS America Annual Meeting, June 1 2009, National Harbor, Maryland
 15. Telematics Standards: Logical Next Steps; ITS International, August 2009
 16. IntelliDriveSM Overview; ITS International, May 2009
 17. Time Synchronization and Positioning Accuracy in Cooperative IntelliDriveSM Systems; Presented at the 2010 ITS America Annual Meeting, June 2010, Houston, Texas
 18. Systematic Development of Positioning Requirements for Vehicle Applications; Presented at the 18th World Congress on Intelligent Transportation Systems , November, 2011, Orlando, Florida
 19. The Interpretation of GPS Positioning Accuracy and Measurement Integrity in a Dynamic Mobile Environment; Presented at the 18th World Congress on Intelligent Transportation Systems, November, 2011, Orlando, Florida
 20. Connected Vehicle Positioning Requirements and Possible Solutions; Presented at the 22nd World Congress on Intelligent Transportation Systems, October, 2015, Bordeaux, France
 21. Connected Vehicle Performance Requirements; Presented at the 22nd World Congress on Intelligent Transportation Systems, October, 2015, Bordeaux, France

Patents

1. Mobile Body Reporting Device And Its System; Patent Number: JP11118902; 4/30/1999
2. Multiformat Auto-Handoff Communications Handset; Patent Number: US5,649,308; 07/15/1997
3. A Communications Terminal Device, A Communications System, And A Storing Medium For Storing A Program To Control Data Processing By The Communications Terminal Device; Patent Number: EP0867850, A3; 09/30/1998
4. Communication System For Controlling Data Processing According To A State Of A Communication Terminal Device; Patent Number: US 6,122,682 3/23/1998
5. Method And Apparatus For Controlling An Adjustable Device; Patent Number: US 5,864,105; 01/26/1999
6. Automatic Brake Device; Patent Number: JP2000108866; 4/18/2000
7. Visual Field Base Display System; Patent Number: JP2000029618; 01/28/2000
8. Intersection Warning System; Patent Number: US 5,926,114; 07/20/1999
9. Security For Anonymous Vehicular Broadcast Messages; Patent Number: US 7,742,603 3/27/2006
10. Digital Certificate Pool; Patent Number: US7,734,050 3/27/2006
11. System, Method And Computer Program Product For Sharing Information In A Distributed Framework; Patent Number: US 7,802,263 9/21/2010
12. System, Method And Computer Program Product For Sharing Information In A Distributed Framework; Patent Number: US 8,209,705 6/26/2012
13. System, Method And Computer Program Product For Sharing Information In A Distributed Framework; Patent Number: US 8,566,843 10/22/2013
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15. System, Method And Computer Program Product For Sharing Information In A Distributed Framework; Patent Number: US 9,705,765 7/11/2017
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18. System, Method And Computer Program Product For Sharing Information In A Distributed Framework; Patent Number: US 10,248,477 4/2/1019
19. System for Location Based Triggers for Mobile Devices; Patent Number 9,973,899 5/15/2018
20. System for Location Based Triggers for Mobile Devices; Patent Number 10,194,291 1/29/2019
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22. System for Location Based Triggers for Mobile Devices; Patent Number 10,349,243 7/9/2019
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24. System for Location Based Triggers for Mobile Devices; Patent Number 10,631,146 4/21/2020
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