

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

TESLA, INC.,

Petitioner

v.

GRANITE VEHICLE VENTURES LLC,

Patent Owner

Inter Partes Review Case No. IPR2025-00943

OF U.S. PATENT NO. 11,597,402

DECLARATION OF CHRISTOPHER WILSON

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CLAIM LISTING APPENDIX
U.S. Patent No. 11,597,402 for Claims 1, 3-4, 6, 8-11, and 13-24

Claim Designation	Claim Language
Claim 1(Pre)	A computer program product for controlling a driving mode of a self-driving vehicle (SDV), the computer program product comprising a non-transitory computer readable storage medium having program code embodied therewith, the program code readable and executable by a processor to perform a method comprising:
Claim 1(a)	receiving sensor readings from a system of sensors, wherein the sensor readings describe a current operational state of a SDV;
Claim 1(b)	determining based on the sensor readings, by one or more processors, whether a fault has occurred;
Claim 1(c)	determining, by the one or more processors, whether the fault exceeds a threshold for danger;
Claim 1(d)	determining a corrective action associated with the fault using a fault-remediation table;
Claim 1(e)	the SDV implementing the corrective action.
Claim 3(Pre)	The computer program product of claim 1, wherein:
Claim 3(a)	the sensor readings comprise a reading from a GPS sensor;
Claim 3(b)	the fault comprises a vehicle state;
Claim 3(c)	determining a corrective action associated with the fault using a fault-remediation table comprises a weighted voting parameter;
Claim 3(d)	the corrective action comprises re-routing the SDV.
Claim 4(Pre)	A self-driving vehicle (SDV) comprising:
Claim 4(a)	a sensor system comprising a plurality of sensors;
Claim 4(b)	vehicle controls comprising: engine throttle, steering mechanism, and braking system;
Claim 4(c)	a computer system comprising a processor coupled to a non-transitory computer readable storage medium containing program code, the program code readable and executable by a processor;
Claim 4(d)	the computer system is capable of receiving a sensor reading from the system of sensors;

Claim Designation	Claim Language
Claim 4(e)	the computer system is capable of operating the vehicle controls;
Claim 4(f)	the computer system is capable of determining the operational state of the self-driving vehicle (SDV);
Claim 4(g)	the computer system is capable of determining a vehicle fault;
Claim 4(h)	the computer system is capable of determining a competence level of the processor;
Claim 4(i)	the computer system is capable of determining competence level of a human driver;
Claim 4(j)	the computer system is capable of determining a corrective action using the competence level of the processor and the competence level of the human driver;
Claim 4(k)	the computer system is capable of implementing the corrective action; and
Claim 4(l)	the computer system is capable of issuing an alert indicating the corrective action.
Claim 6(Pre)	The SDV of claim 4, further comprising:
Claim 6(a)	the sensor system comprises sensors that detect a physical state of the human driver;
Claim 6(b)	the sensor readings comprise an input from a steering mechanism sensor;
Claim 6(c)	the computer system determines the competence level of the processor using active learning data, said active learning data including information from other SDVs;
Claim 6(d)	the computer system determines the competence level of the human driver using the sensor readings;
Claim 6(e)	the corrective action is to transfer vehicle controls to the human driver;
Claim 6(f)	the alert indicates take over immediately.
Claim 8(Pre)	The SDV of claim 4, further comprising:
Claim 8(a)	the sensor system comprises sensors that detect a physical state of the human driver;
Claim 8(b)	the sensor readings comprise an input from a steering mechanism sensor;

Claim Designation	Claim Language
Claim 8(c)	the computer system determines the corrective action using weighted voting, wherein a weighted voting parameter is determined based on active learning data, said active learning data including information from other SDVs;
Claim 8(d)	the computer system determines the competence level of the human driver using the sensor readings;
Claim 8(e)	the corrective action comprises the computer system using the engine throttle.
Claim 9(Pre)	A computer program product for controlling a driving mode of a self-driving vehicle (SDV), the computer program product comprising a non-transitory computer readable storage medium having program code embodied therewith, the program code readable and executable by a processor to perform a method comprising:
Claim 9(a)	determining a competence level of a human driver, wherein the competence level describes a competence level of the human driver in controlling the SDV;
Claim 9(b)	receiving sensor readings from a system of sensors about the competence level of the human driver, wherein the SDV is operable to provide autonomous control of driver controls comprising: engine throttle, steering mechanism, braking system, and navigation;
Claim 9(c)	determining a competence level of a processor;
Claim 9(d)	determining a corrective action;
Claim 9(e)	the SDV implementing the corrective action wherein:
Claim 9(e)(i)	the sensor readings comprise information about a current weather condition of a roadway on which the SDV is currently traveling;
Claim 9(e)(ii)	determining a corrective action comprises determining whether a fault has occurred and whether the fault exceeds a threshold for danger;
Claim 9(e)(iii)	the sensor readings comprise a reading from a GPS sensor;
Claim 9(e)(iv)	determining whether the fault exceeds the threshold for danger comprises weighted voting;
Claim 9(e)(v)	a weighted voting parameter comprises active learning data, said active learning data including information from other SDVs.

Claim Designation	Claim Language
Claim 10(Pre)	The computer program product of claim 9, wherein:
Claim 10(a)	the current weather condition comprises reduced visibility of the roadway;
Claim 10(b)	the processor determines whether a fault has occurred using active learning data, said active learning data including information from other SDVs.
Claim 11(Pre)	The computer program product of claim 9, wherein:
Claim 11(a)	the sensor readings comprise a reading from a GPS sensor;
Claim 11(b)	determining whether the fault exceeds the threshold for danger comprises weighted voting;
Claim 11(c)	a weighted voting parameter comprises active learning data, said active learning data including information from other SDVs.
Claim 13(Pre)	The computer program product of claim 9, wherein:
Claim 13(a)	the sensor readings comprise a reading from a GPS sensor;
Claim 13(b)	determining the corrective action comprises using active learning data, said active learning data including information from other SDVs;
Claim 13(c)	the corrective action comprises querying a database for the proper action to take.
Claim 14(Pre)	The computer program product of claim 9, wherein:
Claim 14(a)	the sensor readings comprise a reading from a GPS sensor, a reading from a radar sensor, and a reading from a vehicle maintenance sensor;
Claim 14(b)	the fault comprises a maintenance fault;
Claim 14(c)	the corrective action comprises re-routing the SDV.
Claim 15(Pre)	A computer program product for controlling a driving mode of a self-driving vehicle (SDV), the computer program product comprising a non-transitory computer readable storage medium having program code embodied therewith, the program code readable and executable by a processor to perform a method comprising:
Claim 15(a)	determining a competence level of a human driver using information about a human driver's control of the SDV;
Claim 15(b)	receiving a sensor reading from a system of sensors, wherein the system of sensors comprises a GPS sensor, a radar sensor, and a camera;

Claim Designation	Claim Language
Claim 15(c)	determining a vehicle fault using the sensor reading;
Claim 15(d)	determining a corrective action;
Claim 15(e)	sending a control signal to a control system of the SDV corresponding to the corrective action.
Claim 16	The computer program product of claim 15, wherein the control system comprises: an engine throttle, a steering mechanism, a display, and a braking system.
Claim 17(Pre)	The computer program product of claim 15,
Claim 17(a)	wherein determining a corrective action comprises looking up an entry in a fault remediation table and
Claim 17(b)	wherein sending a control signal comprises sending to a display an alert that corresponds to the entry.
Claim 18(Pre)	The computer program product of claim 15 further comprising:
Claim 18(a)	determining a current condition of a roadway;
Claim 18(b)	determining a competence level of a control processor, wherein determining the competence level of the control processor comprises determining whether the control processor is competent to control the SDV while the SDV encounters the current condition of the roadway.
Claim 19	The computer program product of claim 18, wherein determining the current condition of the roadway comprises determining a weather condition of the roadway.
Claim 20	The computer program product of claim 18, wherein the control system comprises: an engine throttle, a steering mechanism, a display, and a braking system.
Claim 21	The computer program product of claim 18 wherein determining a corrective action comprises looking up an entry in a fault remediation table and wherein sending a control signal comprises sending to a display an alert that corresponds to the entry.
Claim 22	The computer program product of claim 21, wherein determining the current condition of the roadway comprises determining a weather condition of the roadway.
Claim 23	The computer program product of claim 22, wherein determining the weather condition of the roadway comprises receiving a sensor reading from a camera.

Claim Designation	Claim Language
Claim 24	The computer program product of claim 21, wherein the weather condition of the roadway is selected from the group consisting of: rain, snow, sleet, hail, fog, smoke, wet roadway, icy roadway, reduced visibility, temperature exceeding a predetermined threshold, temperature below a predetermined threshold.

I, Christopher Wilson, declare as follows:

I. INTRODUCTION

1. I am over the age of 21 and am competent to make this declaration. I make this Declaration based on facts and matters within my own knowledge and on information provided to me by others.

A. Educational Background and Professional Experience

2. My complete qualifications and professional experience are described in my curriculum vitae, a copy of which is attached as Appendix A to this declaration. The following is a brief summary of my relevant qualifications and professional experience.

3. I have a bachelor's degree in Physics from Princeton University and one year of graduate school in Physics at the University of California, San Diego.

4. I am currently an independent consultant to the transportation industry focused on the use of vehicle data and analytics to provide cloud services in support of safety systems in automated and semi-automated vehicles.

5. I have 35 years of experience in the automotive telematics and safety technology field working for tier 1 suppliers (TRW and TomTom) and vehicle manufacturers (DaimlerChrysler), as well as working with other vehicle manufacturers and government in consortia developing pre-competitive technologies and performance metrics for vehicle safety systems, and consulting. At

TRW, I developed one of the first collision notification and off-board navigation systems, known as TRW's In-Vehicle Information System, in 1995.

6. I worked on the development of traffic management systems in San Francisco, Atlanta, and Houston where I advocated the use of vehicle data for managing the system. These systems often used a combination of vehicle systems with "brought-in" systems, such as cell phones. As part of this work I developed standards for sharing of vehicle probe data, such as weather information, between vehicles and infrastructure, and on methods for analyzing that data and providing the resulting information to vehicles for navigation and planning purposes.

7. At Fastline (Information Access Inc.), in or around 1996, I developed techniques for integrating a PDA (Sony Magic Link) with various vehicle telematics and display systems. The primary application was to collect speed data and display local traffic data to drivers, either through the "brought-in" device, or through an associated vehicle display.

8. From 1996 to 2008, I worked for DaimlerChrysler (under a number of different names, for most of this time this was the parent company of Chrysler, Jeep, Dodge, Mercedes cars and Freightliner trucks, among others) developing telematics systems for various safety and infotainment applications. Many of these systems involved collecting data from vehicles (e.g., camera data, speed, location, diagnostics) using wireless data links, processing the data in the infrastructure, and

providing synthesized information back to vehicles, infrastructure providers, and fleet managers. I worked on precision mapping systems for lane markings and roadside furniture for use in various safety and information systems. I also led a consortia of automotive manufacturers in developing protocols for sharing data between vehicles and infrastructure, known as the Vehicle Infrastructure Integration Consortium, where I worked very closely with transportation departments and other interested parties. I was specifically involved in the use of collected speed data to determine traffic conditions and identify the locations of stop signs, and to notify various parties if the speed data indicated “running” the stop sign. I was involved with the development, validation, and certification of various active safety systems, such as Automatic Cruise Control (ACC), Forward Collision Warning and Automatic Emergency Braking (FCW and AEB), and Lane Keeping Assistance systems (LKW). In particular I was involved in developing regulatory standards for certification of these systems, the various failure modes of these systems, and with the hand-off between these systems and the driver. My work included research on driver distraction and how it can be detected, as well as the time it takes for an inattentive driver to orient to the vehicle situation if they need to take over quickly.

9. In 2008, I began to work for TomTom BV., a manufacturer of navigation systems. While at TomTom I worked on protocols for collecting data from vehicles to develop various map attributes, including the speed limit attribute

to support speed limit advisory applications. I was also involved with integrating TomTom aftermarket devices with vehicle interfaces.

10. Since 2012 I have been a consultant on various automotive projects- including several projects to support self-driving vehicles, including precision mapping and kinematic mapping. I worked extensively on profiling drivers to determine their capabilities (in order to apply the proper insurance premium). I have also served as an Expert Witness for several matters involving Intellectual Property related to active vehicle safety systems.

11. I am the named inventor on ten US and several international patents related to various aspects of navigation and active safety.

12. In summary, I have extensive familiarity with fields involving active safety systems and the operation, deployment, and regulation of self-driving vehicle technology. I am familiar with what the state of this field was at the relevant time.

II. METHODOLOGY; MATERIALS CONSIDERED

13. I have relied upon my education, knowledge and experience as well as the other materials as discussed in this declaration in forming my opinions.

14. For this work, I have been asked to review U.S. Patent No. 11,597,402 (“the ‘402 Patent”) (Ex. 1001) including the specification and claims, and the ‘402 Patent’s prosecution history (“‘402 File History”) (Ex. 1002). In developing my

opinions relating to the '402 Patent, I have considered the materials cited or discussed herein, including those itemized in the Exhibit Table below.

<u>Exhibit</u>	<u>Description</u>
Exhibit 1001	U.S. Patent No. 11,597,402 (“’402 Patent”)
Exhibit 1002	Prosecution History for the ’402 Patent (“’402 File History”)
Exhibit 1004	U.S. Patent No. 9,406,177 (“Attard”)
Exhibit 1005	U.S. Patent No. 9,494,926 (“Frazer”)
Exhibit 1006	U.S. Patent No. 10,377,303 (“McNew”)
Exhibit 1007	U.S. Patent Application Publication No. 2016/0267335 (“Hampiholi”)
Exhibit 1008	U.S. Patent No. 9,063,543 (“An”)
Exhibit 1009	Intentionally Left Blank
Exhibit 1010	Intentionally Left Blank
Exhibit 1011	Intentionally Left Blank
Exhibit 1012	Intentionally Left Blank
Exhibit 1013	U.S. Patent Application Publication No. 2007/0219720 (“Trepagnier”)
Exhibit 1014	Gereon Meyer and Sven Beiker. <i>Road Vehicle Automation</i> . Springer. 2014. (“Meyer”)
Exhibit 1015	Jeff Wit et al. “Autonomous Ground Vehicle Path Tracking.” <i>Journal of Robotic Systems</i> 21(8), 439-449 (2004). (“Wit”)
Exhibit 1016	Keshav Bimbraw. “Autonomous Cars: Past, Present and Future.” <i>Proceedings of the 12th International Conference on Informatics in Control, Automation and Robotics (ICINCO-2015)</i> , pages 191-198, July 21-23, 2015. (“Bimbraw”)
Exhibit 1017	Xavier Mosquet et al. <i>Revolution in the Driver’s Seat</i> . The Boston Consulting Group. April 2015. (“Mosquet”)
Exhibit 1018	Steven E. Muldoon et al. “10.3: Vehicle Fault Diagnostics Using a Sensor Fusion Approach.” <i>IEEE</i> 2002. (“Muldoon”)
Exhibit 1019	U.S. Patent No. 8,825,258 (“Cullinane”)
Exhibit 1020	U.S. Patent No. 9,798,323 (“Tsimhoni-323”)
Exhibit 1021	U.S. Patent No. 9,884,631 (“James”)
Exhibit 1022	U.S. Patent No. 11,040,725 (“Scofield”)
Exhibit 1023	U.S. Patent No. 9,483,059 (“Caveney”)
Exhibit 1024	U.S. Patent No. 9,365,213 (“Stenneth”)
Exhibit 1025	International Publication No. WO 2006/047297 (“Allard”)

Exhibit 1026	Rajesh Rajamani et al. "A Complete Fault Diagnostic System for Automated Vehicles Operating in a Platoon." IEEE Transactions on Control Systems Technology, Vol 9, No. 4, July 2001. ("Rajamani")
Exhibit 1027	U.S. Patent Application Publication No. 2013/0063336 ("Sugimoto")
Exhibit 1028	Matthew McNaughton et al. "Motion Planning for Autonomous Driving with a Conformal Spatiotemporal Lattice." 2011 IEEE International Conference on Robotics and Automation. May 9-13, 2011, Shanghai, China. ("McNaughton")
Exhibit 1029	A. de la Escalera. "Traffic sign recognition and analysis for intelligent vehicles." Image and Vision Computing 21 (2003) 247-258. ("Escalera")
Exhibit 1030	"Surface Vehicle Information Report J3016." SAE International. January 2014. ("J3016")
Exhibit 1031	U.S. Patent No. 9,430,944 ("Grimm")
Exhibit 1032	U.S. Patent No. 8,874,305 ("Dolgov")
Exhibit 1033	U.S. Patent Application Publication No. 2014/0336935 ("Zhu")
Exhibit 1034	U.S. Patent No. 8,378,849 ("Chandra")
Exhibit 1035	U.S. Patent No. 5,779,593 ("Takada")
Exhibit 1036	Intentionally Left Blank.
Exhibit 1037	Harding, J., Powell, G., R., Yoon, R., Fikentscher, J., Doyle, C., Sade, D., Lukuc, M., Simons, J., & Wang, J. (2014, August). "Vehicle-to-vehicle communications: Readiness of V2V technology for application." (Report No. DOT HS 812 014). Washington, DC: National Highway Traffic Safety Administration. ("Harding")
Exhibit 1038	U.S. Patent No. 9,950,740 ("Sato")
Exhibit 1039	Dannheim, C., Icking, C., Mäder, M., & Sallis, P. (2014, May). Weather detection in vehicles by means of camera and LIDAR systems. In <i>2014 Sixth International Conference on Computational Intelligence, Communication Systems and Networks</i> (pp. 186-191). IEEE. ("Dannheim")

15. I have considered these materials from the viewpoint of a POSITA as of the priority date of the '402 Patent. For the purposes of this declaration, I have

been asked to assume that the priority date of the '402 Patent is September 25, 2015.

I note that my opinions provided in this Declaration are made from the perspective of a POSITA as of this priority date of the '402 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 '402 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

16. In formulating my opinions, I have been instructed to apply certain legal standards. I am not a lawyer. I do not expect to 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 proceeding, patent claims may be deemed unpatentable if it is shown that they were anticipated or rendered obvious in view of the prior art. I understand that prior art in an inter partes 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

17. I understand that the '402 Patent, the record of 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 include: (i) the levels of education and experience of persons working in the field; (ii) the types of problems encountered in the field; and (iii) the sophistication of the technology. I may also consider, if available, the education level of the inventor, prior art solutions to the problems encountered in the art, the rapidity with which innovations are made in the relevant art.

18. 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. This hypothetical person has knowledge of all prior art in the relevant field as if it were arranged on a workshop wall and takes from each reference what it would teach to a person having the skills of a POSITA.

B. Obviousness

19. I understand that a claim may be invalid under § 103(a) if the subject matter described by the claim as a whole would have been “obvious” to a hypothetical POSITA in view of a single prior art reference or in view of a

combination of references at the time the claimed invention was made. Therefore, I understand that obviousness is determined from the perspective of a hypothetical POSITA. I further understand that a hypothetical 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 inter partes review proceeding is evaluated using a preponderance of the evidence standard, which means that the claims must be more likely obvious than nonobvious.

20. I also understand that an analysis of whether a claimed invention would have been obvious should be considered in light of the scope and content of the prior art, the differences (if any) between the prior art and the claimed invention, and the level of ordinary skill in the pertinent art involved. I understand as well that a prior art reference should be viewed as a whole. I understand that in considering whether an invention for a claimed combination would have been obvious, I may assess whether there are apparent reasons to combine known elements in the prior art in the manner claimed in view of interrelated teachings of multiple prior art references, the effects of demands known to the design community or present in the marketplace, and/or the background knowledge possessed by a POSITA. I also understand that other principles may be relied on in evaluating whether a claimed invention would have been obvious, and that these principles include the following:

- A combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results;
- When a device or technology is available in one field of endeavor, design incentives and other market forces can prompt variations of it, either in the same field or in a different one, so that if a POSITA can implement a predictable variation, the variation is likely obvious;
- If a technique has been used to improve one device, and a POSITA would have recognized that it would improve similar devices in the same way, using the technique is obvious unless its actual application is beyond his or her skill;
- An explicit or implicit teaching, suggestion, or motivation to combine two prior art references to form the claimed combination may demonstrate obviousness, but proof of obviousness does not depend on or require showing a teaching, suggestion, or motivation to combine;
- Market demand, rather than scientific literature, can drive design trends and may show obviousness;
- In determining whether the subject matter of a patent claim would have been obvious, neither the particular motivation nor the avowed purpose of the named inventor controls;

- One of the ways in which a patent's subject can be proved obvious is by noting that there existed at the time of invention a known problem for which there was an obvious solution encompassed by the patent's claims;
- Any need or problem known in the field of endeavor at the time of invention and addressed by the patent can provide a reason for combining the elements in the manner claimed;
- "Common sense" teaches that familiar items may have obvious uses beyond their primary purposes, and in many cases a POSITA will be able to fit the teachings of multiple patents together like pieces of a puzzle;
- A POSITA is also a person of ordinary creativity, and is not an automaton;
- A patent claim can be proved obvious by showing that the claimed combination of elements was "obvious to try," particularly when there is a design need or market pressure to solve a problem and there are a finite number of identified, predictable solutions such that a POSITA would have had good reason to pursue the known options within his or her technical grasp; and

- One should not use hindsight in evaluating whether a claimed invention would have been obvious.

21. I also understand that an obviousness determination includes the consideration of various factors such as: (1) the scope and content of the prior art, (2) the differences between the prior art and the asserted claims, (3) the level of ordinary skill in the pertinent art, and (4) the existence of secondary considerations such as commercial success, long-felt but unresolved needs, failure of others, and so forth.

22. I am informed that it is improper to combine references where the references teach away from their combination. I am informed that a reference may be said to teach away when a person of ordinary skill in the relevant art, 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. In general, a reference will teach away if it suggests that the line of development flowing from the reference's disclosure is unlikely to be productive of the result sought by the patentee. I am informed that a reference teaches away, for example, if (1) the combination would produce a seemingly inoperative device, or (2) the references leave the impression that the product would not have the property sought by the patentee. I also am informed, however, 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.

23. I am informed that even if a *prima facie* case of obviousness is established, the final determination of obviousness must also consider “secondary considerations” if presented. In most instances, the patentee raises these secondary considerations of non-obviousness. In that context, the patentee argues an invention would not have been obvious in view of these considerations, which 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; (h) teaching away from the invention in the prior art.

24. I am 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 the Patent Owner here has not offered any secondary considerations at this time, I will

supplement my opinions in the event that the Patent Owner raises secondary considerations during the course of this proceeding.

25. Finally, I understand that obviousness in an IPR must be proven by a preponderance of the evidence.

C. Analogous Art

26. 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. I have been informed that a reference is analogous art to the claimed invention 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). In order for a reference to be “reasonably pertinent” to the problem, it must logically have commended itself to an inventor’s attention in considering his 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 all of the references that my opinions in this IPR are based upon are well within the range of references a person having ordinary skill in the art would consult to address the type of problems described in the Challenged Claims.

D. Claim Construction

27. I understand that the claim terms in this IPR will be construed according to their ordinary and customary 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 in 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 '402 Patent, the prior art cited herein, and the ordinary skill factors described in this section, a POSITA in the field of the '402 Patent at the time of the earliest possible priority date (September 25, 2015) would have been knowledgeable regarding the field of vehicle telematics and safety systems. In my experience working in this field, most workers of ordinary skill in the art as of the earliest possible priority date of September 25, 2015, would have had a bachelor's degree in computer engineering, computer science, electrical engineering, mechanical engineering, physics, or a related field, with at least four years of experience in the field of vehicle telematics and safety systems, or a master's degree in the same fields with at least three years of experience in the field of vehicle telematics and safety systems. Additional education or experience might substitute for the above requirements. *See, e.g.*, the '402 Patent (Ex. 1001), 1:26-27 (describing

the “Field of the Invention”). When I refer to the understanding of a POSITA, I am referring to the understanding of such a person as of September 25, 2015.

29. As of September 25, 2015, 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 knew people working in the field while I was developing models for automated vehicle behaviors, and working to improve the reliability of automated vehicle systems in the 2015 timeframe.

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

V. BACKGROUND OF THE TECHNOLOGY

A. History of Autonomous Vehicles

31. In a non-autonomous vehicle, “the driver remains a critical component of the vehicle’s control system” and they are responsible for “steering, obstacle and hazard recognition, and avoidance thereof.” *Trepagnier* (Ex. 1013), [0004]. Autonomous or self-driving vehicles (SDVs) are attractive, for example, to improve driver safety. *Id.*, [0007] (describing the attractiveness of autonomous vehicles for “addressing human deficiencies in the control of a vehicle or whether in environmentally hazardous conditions where human control is not preferred...”); *see also, Meyer* (Ex. 1014), p. 72 (describing “[e]missions reduction”, “[c]ongestion

avoidance”, and “supporting unconfident drivers” as additional benefits of SDVs).

“An autonomous vehicle is one that is capable of automatic navigation. It is self-acting and self-regulating, therefore it is able to operate in and react to its environment without outside control.” *Wit* (Ex. 1015), p. 439. In general, an SDV may be capable of performing various functions, including “(1) perceiving and modeling the environment, (2) localizing the vehicle within the environment, (3) planning and deciding the vehicle’s desired motion and (4) executing the vehicle’s desired motion.” *Wit*, p. 439-440.

32. Autonomous vehicles were well-known and in development before the ’402 Patent (September 2015) as “[t]he timeline of autonomous cars begins in 1926 with world’s first radio controlled car ‘Linriccan Wonder’.” *Bimbraw* (Ex. 1016), p. 191. “In the subsequent decades, we see fairly autonomous electric cars powered by embedded circuits in the roads” and “the 1980s saw vision guided autonomous vehicles, which was a major milestone in [SDV] technology....” *Id.* For example, “the vision guided Mercedes-Benz robotic Van in 1980” (which employed “LIDAR, radar, GPS and computer vision”) laid the foundation for “autonomous technologies present in modern cars like adaptive cruise control, lane parking, steer assist etc.” *Id.*

33. As shown below, various autonomous features were available in cars prior to the ’402 Patent:

- *Adaptive cruise control*, introduced in 2006, monitors the speed of the vehicle directly ahead of it and maintains a safe distance.
- *Parallel-park assist*, also introduced in 2006, uses cameras and ultrasound sensors to guide the vehicle into a parking space.
- *Automatic emergency braking*, first available in 2008, activates itself when the vehicle risks colliding with another vehicle, a person, an animal, or an object.

Mosquet (Ex. 1017), p. 6 (excerpt). In fact, some of these features were available earlier than indicated by *Mosquet*; regardless, all were well-known prior to the '402 Patent. For example, automatic lane keeping was present in Nissan's 2014 Infiniti 150, which was released in 2013. *Bimbrow*, 195.

34. SDVs were in development by commercial automotive companies by 2015. "Audi, for example, presented its highly autonomous A7 model, which has highway-driving capability, at the 2015 Consumer Electronics Show in Las Vegas." *Mosquet*, p. 3. Additionally, "Volvo and various Swedish government bodies in 2014 launched the 'Drive Me' initiative, in which 100 self-driving cars navigate public roadways in everyday conditions in and around the city of Gothenburg." *Id.*

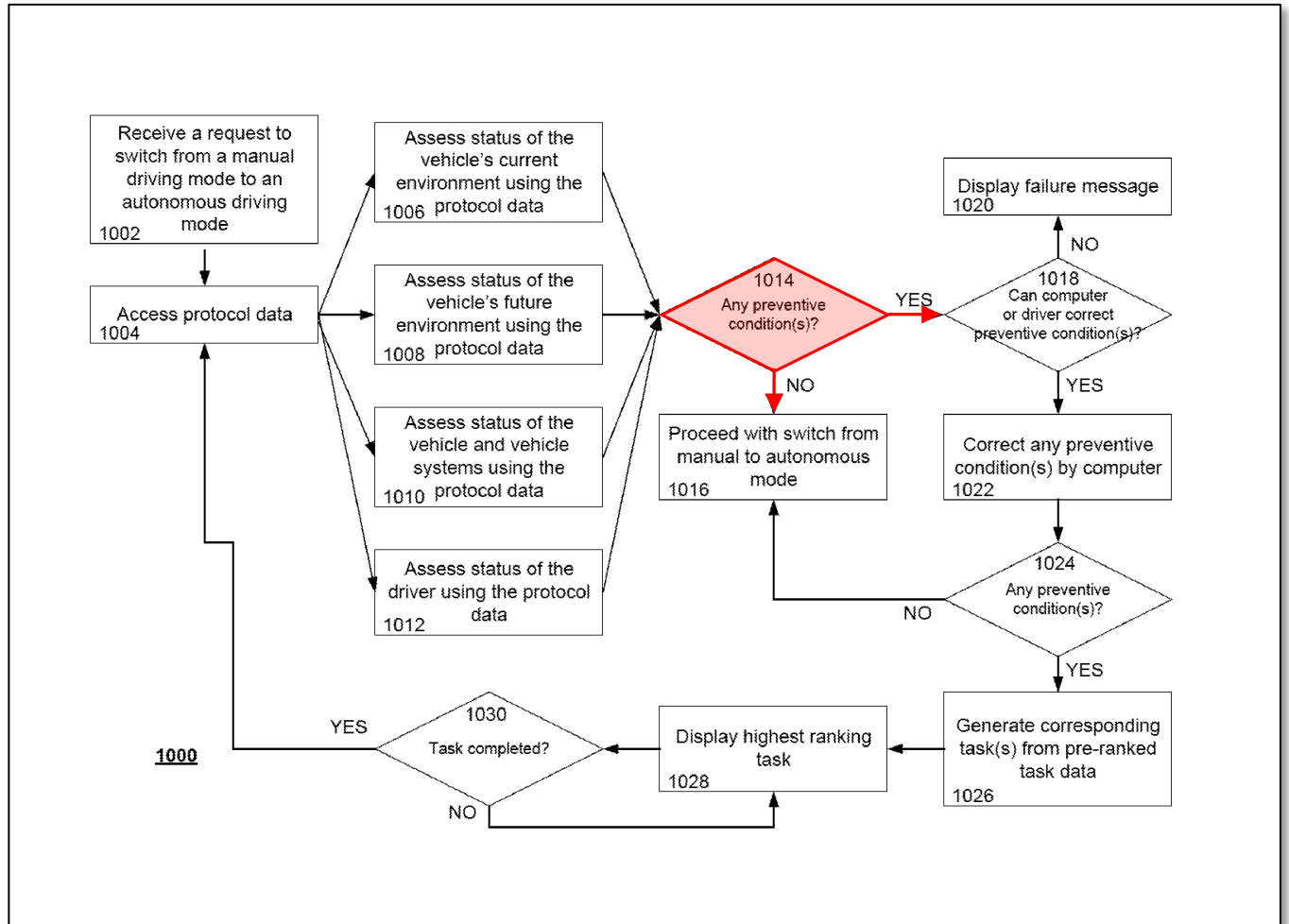
B. Faults

35. Vehicles were known to generally monitor "vehicle diagnostics" such as providing "a simple reminder to the driver that the standard maintenance (i.e.,

replacing filters and fluids) is required.” *Muldoon* (Ex. 1018), 1591; *see also, id.* (describing “Fault Diagnosis can be generally defined as the process that identifies the root cause of a failure.”). It was further understood that autonomous vehicles utilize additional “fail-safe architecture” “that keeps the vehicle in a safe state in the event of a **fault**” to ensure driver safety and continued confidence in SDVs. *Meyer*, p. 77 (emphasis added).

36. Prior to the ’402 Patent, SDVs were capable of “switching between autonomous and manual driving modes. In order to do so, the vehicle’s computer may conduct a series of environmental, system, and driver checks to identify certain conditions.” *Cullinane* (Ex. 1019), Abstract, FIG. 10. Upon detecting “some emergency or some preventative condition such as a loss of communication with some component of the autonomous driving system, the computer 110 may immediately inform the driver of the need to switch to the manual driving mode.” *Cullinane*, 16:38-43; *see also, Tsimhoni-323* (Ex. 1020), Abstract (describing “[a]n automated vehicle [that] includes a control system configured to selectively transfer the automated vehicle from an automated control mode to a manual control mode based on a transfer-of-control criterion.” This “criterion is based on a current context of the automated vehicle and a dataset of previous transfer-of-control events and previous contexts” of other SDVs. Thus, SDVs were known to switch driving modes

in response to detecting a fault (such as a “faulty braking system[,]” per the ’402 Patent). ’402 Patent, 5:59-6:8.

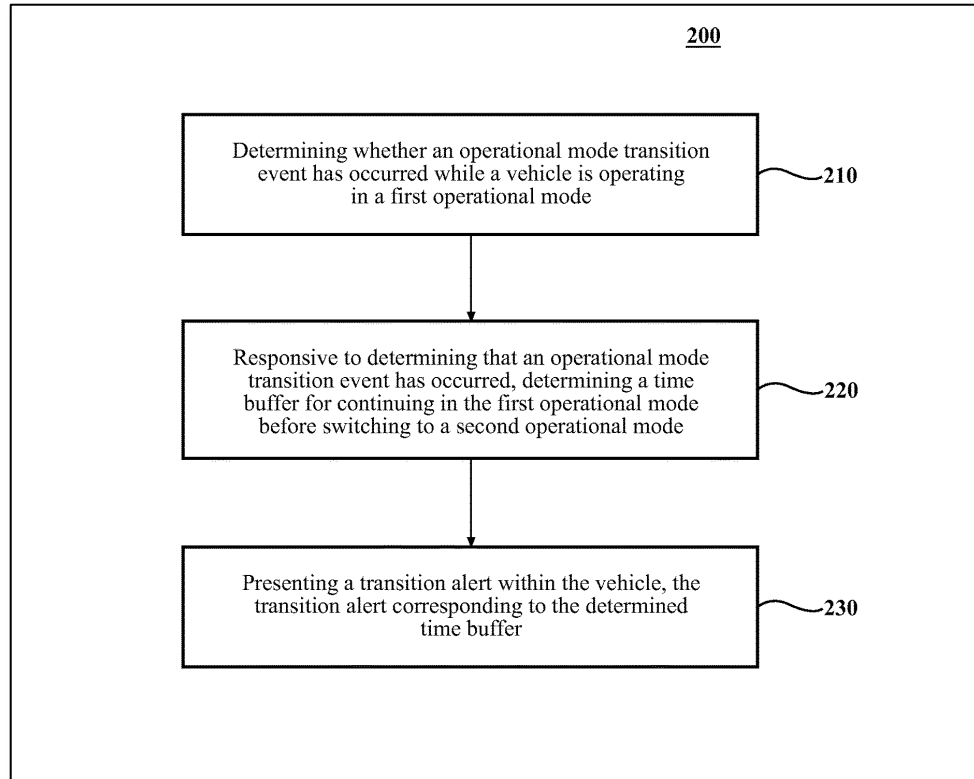


Cullinane, FIG. 10¹. FIG. 10 is annotated to demonstrate an SDV system “assessing the status of the vehicle’s environment (current and likely future), the status of the vehicle and the vehicle systems, as well as the status of the driver to identify any

¹ All emphasis and annotations added unless noted otherwise.

preventive conditions” (e.g., faults) which would inhibit a safe change in driving mode from manual to autonomous. *Cullinane*, 10:37-40; *see also, Id.*, 15:29-32.

37. *James* further teaches “transitioning a vehicle between a first operational mode and a second operational mode” dependent on if “an operational mode transition event has occurred” (e.g., a fault). *James* (Ex. 1021), 1:30-38, FIG. 2. “Such an event may be indicative of a **problem** which is to be communicated to the driver to prepare to take a greater degree of involvement in the vehicle control.” *James*, 10:52-55 (emphasis added), 19:19 (describing adjusting the autonomous driving mode depending on if the “driver is asleep, distracted, etc.”). FIG. 2 below describes the process for transitioning driving modes:



James, FIG. 2.

38. Additionally, *Meyer* teaches “fault detection and handling” “maneuvers” during “coordinated automatic longitudinal control of a platoon of three Class 8 tractor-trailer trucks” as highlighted below:

- Level 1 faults: driver is alerted to take over control immediately;
- Level 2 faults: trucks will split to a longer distance and continue platooning;
- Level 3 faults: all three trucks will continue platooning unless another fault appears;

Meyer, pp. 247, 248, 255 (excerpt).

39. As another example, *Tsimhoni-323* teaches “an automated vehicle control system that utilizes crowdsourced data...to determine whether transfer-of-control from automated to manual (or vice versa) is likely and/or desirable.” *Tsimhoni-323*, 2:16-22. *Tsimhoni-323* teaches transferring modes in an SDV in response to differing environmental conditions (“e.g., ‘night time+rain’”). *Tsimhoni-323*, 2:16-22. For example,

dataset 114 might reflect that many automated vehicles have difficulty recognizing the lane markers on a particular stretch of highway when the **sun is at a particular position**. Subsequently, when vehicle 10 is driven on that stretch of highway under **similar conditions** (e.g., same time-of-day), the driver might be **notified that he or she should take manual control**.

Tsimhoni-323, 5:1-7 (emphasis added); *see also, Id.*, 5:46-48 (describing how calculating the likelihood of transferring driving modes depends on “a ‘context’ [of

an SDV] that is characterized by a vector of features f_i (e.g., ‘raining’, ‘night time’, geographical location, etc.”).

40. It was well-known to alert the driver when the SDV was transitioning driving modes. *See, e.g., James*, FIGs. 3-4, 15:39-41 (describing how the “transition alert can have any suitable form. For instance, the transition alert can be a visual transition alert, an audial transition alert, a haptic transition alert, and/or combinations thereof.”); *Cullinane*, 13:8-10 (describing how “computer 110 may generate and display a notification explaining that the autonomous driving mode is currently unavailable due to the weather conditions.”); *Tsimhoni-323*, 4:43-46 (“In some embodiments, the alert includes a visual representation (e.g., shown via display 25) of a reason for transferring from the automated control mode to the manual control mode.”).

C. Driving Modes

41. *James* teaches various levels of automation in the vehicle, including levels defined by National Highway Traffic Safety Authority (NHTSA) 2013 policy. *James*, 3:1-4:43. For example, a vehicle may have level 0 automation (*James*, 3:47-53), which indicates manual control is required. *James*, 3:47-53 (“The vehicle 100 can have a manual operation mode. ‘Manual operational mode’ means that a substantial majority or all of the navigation and/or maneuvering of the vehicle along

a travel route is performed by a human driver with minimal or no input from a computing system.”).

42. Similarly, at levels 1 or level 2, various semi-autonomous or autonomous features may be activated, such as adaptive cruise control. *James*, 3:1-46. *James* teaches a single vehicle may transition (including automatically) from a level with lower automation to a level with higher automation, or the reverse where the transition is from a level with higher automation to lower automation. *James*, 4:4-43. In general, in the manual mode, the driver must control the vehicle. *James*, 3:47-53. However, in higher levels of automation, a human driver may or may not need to operate various functions of the vehicle (e.g., controlling engine throttle, braking, or turning) as those features are handled by the self-driving vehicle. *James*, 3:1-4:43.

D. Assessing Competence Levels

1. Driver Competence

43. One of the primary features of SDVs is ensuring driver safety. *See* ¶ 31. Therefore, it was known prior to the '402 Patent to assess the capability of the driver to safely drive the vehicle in manual mode and further determine if instead engaging the autonomous driving mode is safer if driver competence is deemed low. Thus, SDVs were known to monitor driving habits. *See e.g., Scofield* (Ex. 1022), 6:31-51 (“Before generating a driver alert to assume manual vehicle control of the

vehicle 402, the driver alert component 404 may evaluate a cognitive load of the driver. For example, a camera may indicate that the driver is sleeping” and the SDV would therefore not transition to manual mode.); *Caveney* (Ex. 1023), 1:22-26 (“Partially-automated or monitored driving systems are designed to assist drivers in operating a vehicle safely and efficiently on the road. For example, they may use techniques such as eye-tracking of the driver to send a warning when the driver becomes inattentive....”).

44. One of the problems limiting the ability to deploy autonomous vehicles, and in fact making many doubt that “level 3” autonomy is even possible is the handoff from automated control to a driver. In level 3 autonomy it is assumed that the driver is always prepared to take over control on “short notice,” however, there is no established method for ensuring this is the case, or what “short notice” means in terms of a threshold time. Note that this has nothing to do with the skill of the driver, rather it is a measure of the driver’s cognitive focus and ability to orient and control the vehicle. Many tests have determined that this time is usually on the order of a few seconds, but can extend to excess of 15 seconds. *See, e.g., McNew* (Ex. 1006) 4:47-61 (1.5 seconds for driver response time). The possibility that a driver is incapacitated and cannot take over must also be considered. *See, e.g., Meyer*, 50 (describing driver out of the loop), 56 (describing driver handover), 204 (describing the need to surveil the driver for handover); *Scofield*, 6:31-51.

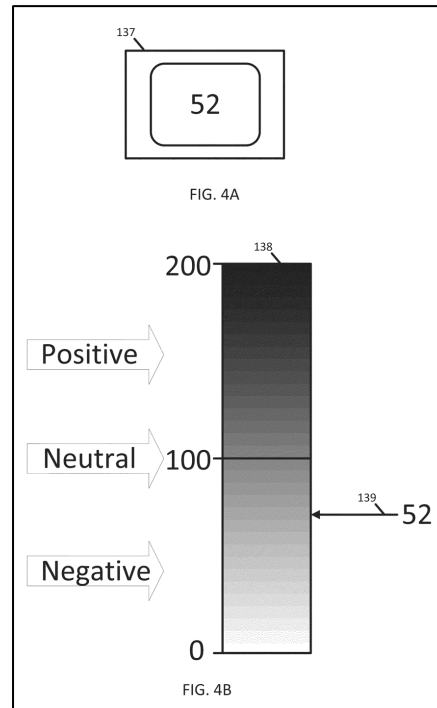
2. SDV Competence

45. It was well-known prior to the '402 Patent to demonstrate to the driver how capable their SDV is of driving autonomously.

46. For example, *Stenneth* (Ex. 1024) teaches either a “numeric” (FIG. 4a, below) or “gradient” (FIG. 4b, below) “confidence score display” showing the “vehicle confidence level” that determines when an SDV transitions between autonomous and manual driving modes. *Stenneth*, Abstract (“[T]he driving mode command transitions the autonomous vehicle to the autonomous mode, if applicable, when the vehicle confidence score exceeds the confidence threshold.”), 9:65-10:4. *Stenneth* further teaches that

[t]he vehicle may calculate a vehicle confidence level based on the current external conditions the vehicle is facing. The vehicle confidence level may be compared to a threshold value to determine the appropriate mode for the vehicle. Alternatively, the vehicle confidence level may be compared to a geographic confidence level that describes the requisite confidence for the current geographic area.

Stenneth, 2:43-49.



Stenneth, FIGs 4a, 4b.

E. SDV Infrastructure

47. It was widely known that systemic infrastructure was utilized to support safe and functional SDVs. For example, *Meyer* teaches that information gathered by an SDV itself “will be supplemented by information from other vehicles (V2V communication), infrastructure (V2I communication) or a back-end server depending on availability.” *Meyer*, p. 55. *Mosquet* similarly teaches that

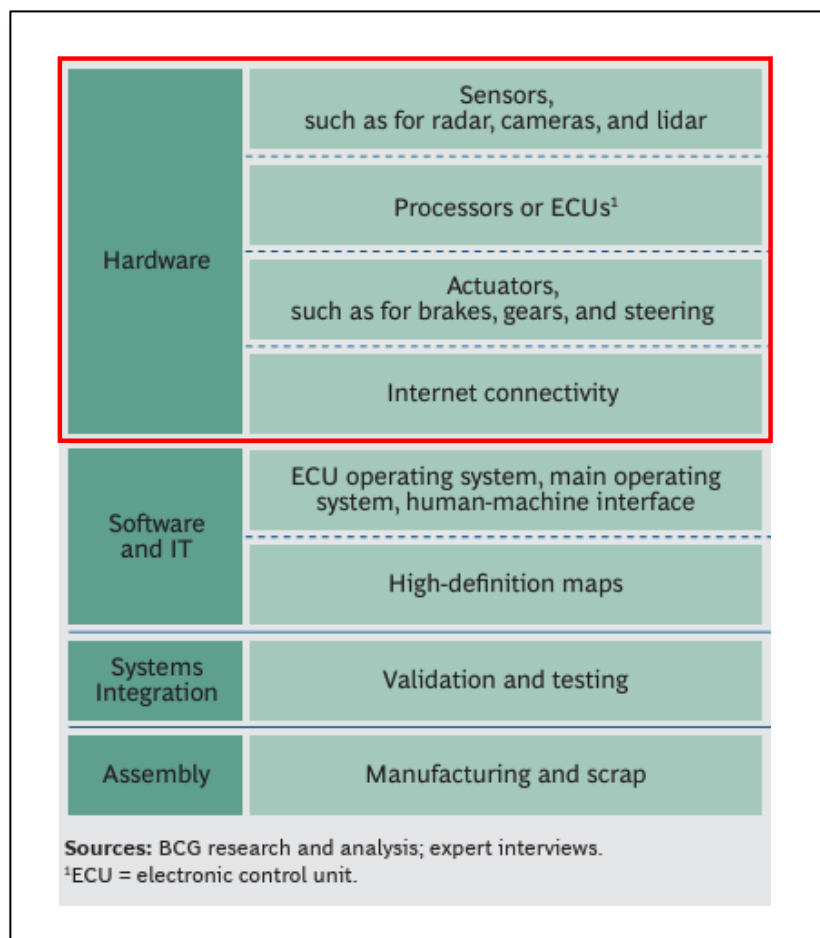
[s]hort-range communications technology—such as vehicle-to-vehicle and vehicle-to-infrastructure communication, collectively referred to as V2X—can be effectively applied to complex driving environments to enhance the safety of AVs [autonomous vehicles]. V2X technology can supplement on-board sensors to gather and transmit environmental

data, enabling the car to, for example, peer around corners and negotiate road intersections, just as—in fact, better than—a human driver would.

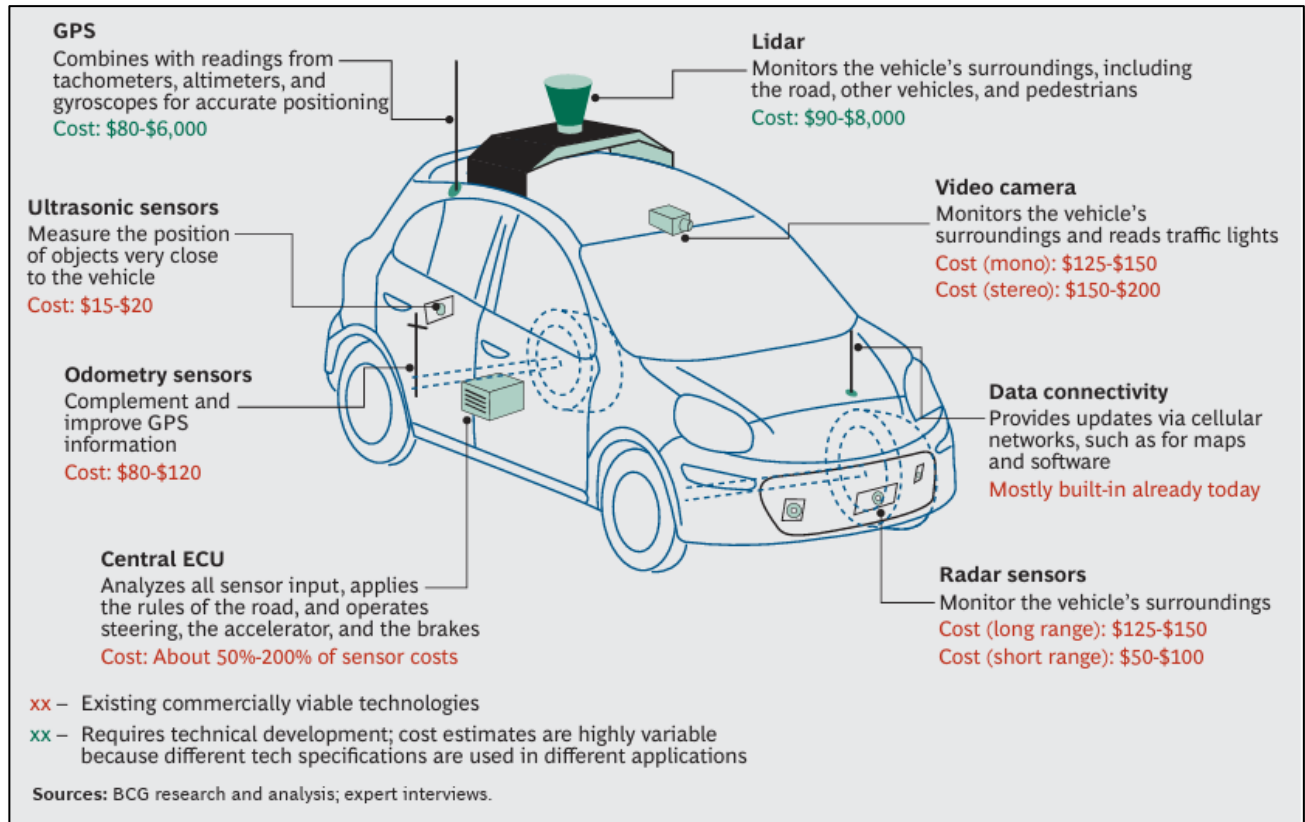
Mosquet, p. 14.

1. SDV Hardware

48. Like traditional vehicles, SDVs were known to include diverse hardware (e.g., displays, sensors, brakes, steering) before 2015.



Mosquet, FIG. 5 (excerpt, annotated to show hardware commonly associated with autonomous vehicles including sensors and processors/ECUs).



Mosquet, FIG. 6 (excerpt, demonstrating “crucial pieces of hardware” for autonomous vehicles).

49. In another example, *James* teaches vehicle 100 includes various levels of automation and hardware such as a processor, memory, and also including programming instructions for performing operations including switching between the automation levels. *James*, 3:1-4:43, 5:13-52, 6:31-64 (also teaching sensors), 10:37-11:53 (teaching transitioning between modes).

a) Sensors

50. SDVs included sensors for monitoring and navigating the environment. Additionally, sensors were used to monitor both the vehicle and the driver to ensure

competence for safe autonomous driving. *See e.g., Stenneth*, 4:8-11 (describing how “external vehicle sensor 115 may determine road status such as the shape or turns of the road, the existence of speed bumps, the existence of pot holes, the wetness of the road, or the existence of ice, snow, or slush.”), 4:52 (“One or more of the vehicle sensors 113 may detect a driver.”); *Allard* (Ex. 1025), [0023] (“While operating unmanned, the vehicle uses its onboard local area sensors and its perceptual context software to detect the presence of unsafe conditions.”); *Meyer*, p. 55 (“Surround sensing will require a combination of multiple sensors including radar and video sensors to generate a reliable and comprehensive 360° environment model of the vehicle environment.”). Examples of such sensors are provided below:

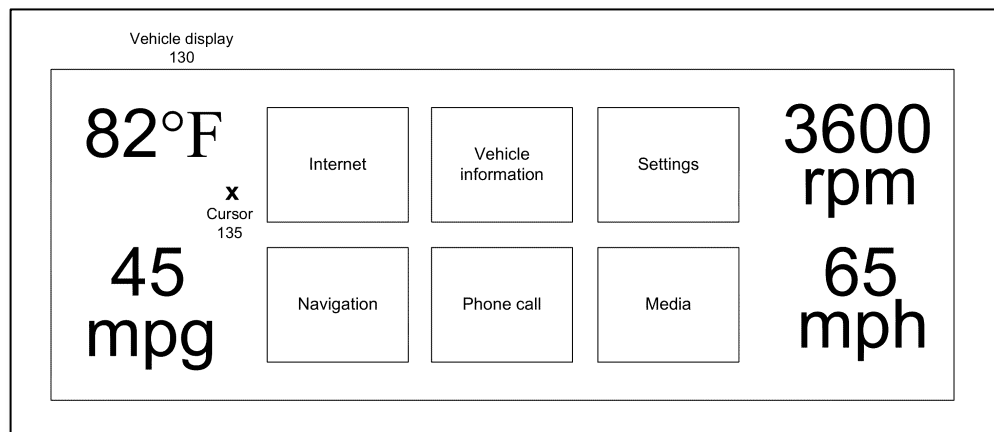
TABLE I COMPLETE SET OF SENSORS	
SENSOR FAULT	INFORMATION LOST
STEERING ANGLE SENSOR	Steering angle
YAW-RATE SENSOR	Yaw rate
MAGNETOMETER	Lateral displacement of car with respect to magnetic markers on the road
LATERAL ACCELEROMETER	Lateral acceleration of car
RADIO	Lead and previous vehicle's velocity and acceleration
RADAR	Distance and relative velocity from preceding car
LONGITUDINAL ACCELEROMETER	Acceleration (used by following cars in the platoon)
WHEEL SPEED SENSOR	Velocity
THROTTLE ANGLE SENSOR	Throttle angle
BRAKE PRESSURE SENSOR	Brake-line pressure
MANIFOLD PRESSURE SENSOR	Intake manifold pressure
ENGINE RPM SENSOR	Engine speed

Rajamani (Ex. 1026), Table 1, pp. 555-556 (Listing the required sensors for “longitudinal and lateral control systems” of autonomous vehicles.) “The information lost due to a fault in any of these sensors is also indicated in the table.”
Id.

b) Displays

51. SDVs included displays for communicating with the driver. *See e.g., Cullinane*, FIG. 2; *James*, FIG. 1. These displays present relevant information to the driver, including vehicle speed, notifications, warnings, temperature, and

navigational tools. *See e.g., Sugimoto* (Ex. 1027), FIG. 1b, [0023] (“The display 130 in the embodiment of FIG. 1b displays internal and external vehicle information. For example, the display 130 displays the temperature outside the vehicle (82° F)...and the speed of the vehicle (65 miles per hour).”); *Cullinane*, 3:6-9 (describing how “in response to an indication by the user that the user wants to return to manual mode, a warning may be displayed to the driver when switching to manual driving mode is not recommended.”).



Sugimoto, FIG. 1b.

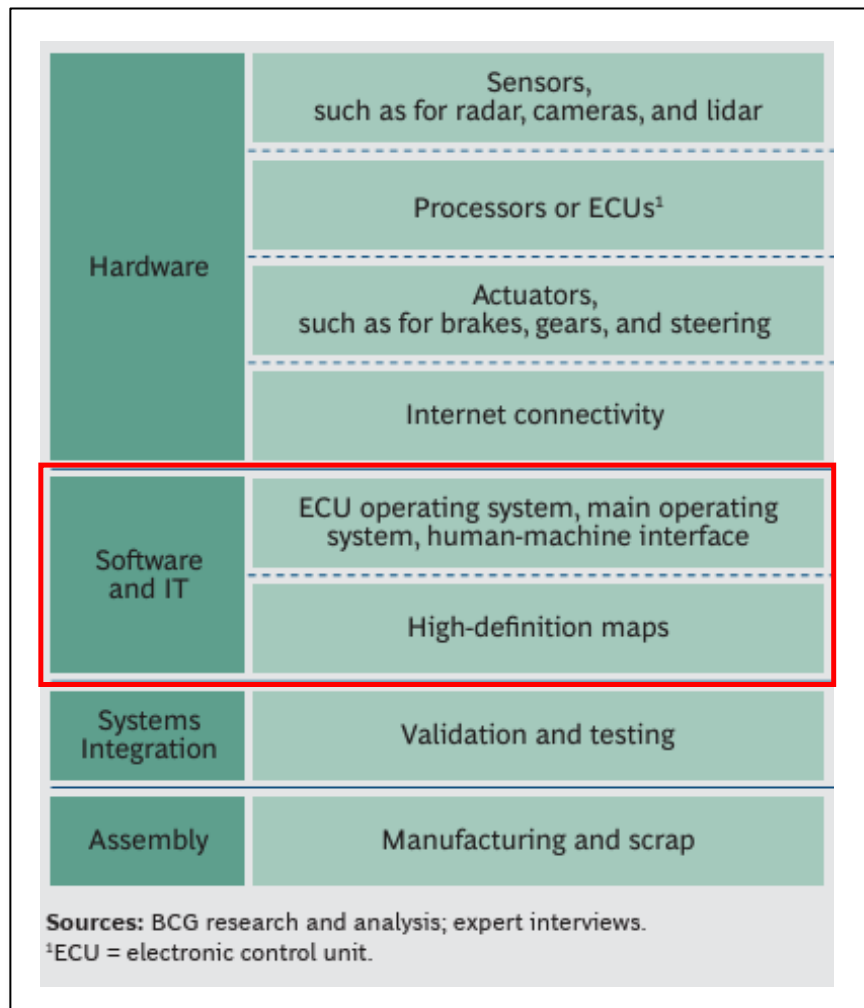
c) Braking and Steering

52. Like non-autonomous vehicles, SDVs were known to include additional hardware, such as braking and steering mechanisms, that the SDV system controls when driving. *See e.g., Caveney* (Ex. 1023) 5:60-64 (describing an autonomous vehicle with a “computing device 100 [which] can also be in communication with one or more vehicle systems 118, such as vehicle **braking**

systems, vehicle steering systems, vehicle propulsion systems, etc.”) (emphasis added).

2. SDV Software

53. It was well-known that software was required to support autonomous driving.



Mosquet, FIG. 5 (excerpt, annotated to demonstrate the general software required by SDVs).

54. It was understood that SDVs “must be able to plot a precise and safe trajectory through busy traffic while observing the rules of the road and minimizing risk due to unexpected events....” *McNaughton* (Ex. 1028), 4889. *Meyer* further teaches that autonomous vehicle

[s]oftware methods [] need to be further developed include methods for the highly dynamic modeling and simulation of the vehicle environment like e.g. electronic horizon, methods for sensor data fusion and for the communication and processing of big amounts of traffic and operation data, as well as for their fusion with sensor data. Furthermore, dynamic online maps, methods for prediction and decision finding will increasingly play a role as enabling technologies.

Meyer, p. 78.

55. Therefore, it was known that SDV software “must be able to produce a plan within a small fixed time window.” *McNaughton* (Ex. 1028), 4889. Therefore, *McNaughton* teaches “a motion planner for autonomous highway driving that adapts the state lattice framework pioneered for planetary rover navigation to the structured environment of public roadways” applicable to “an autonomous passenger vehicle.” *Id.* *McNaughton*’s planner uses a “search algorithm to systematically and efficiently explore both spatial and temporal dimensions in real time” to perform complex driving functions (e.g., “follow a leading vehicle, perform lane changes, and merge between other vehicles.”). *Id.*

56. It is also necessary for SDVs to identify and interpret objects in their environment, such as road signs. *Escalera* (Ex. 1029) teaches “an algorithm for the detection and recognition of traffic sign[s]” accounting for “difficulties that exist for object recognition in outdoor environments” such as “lighting changes.” *Escalera*, pp. 256-257; *see also Id.* (“The process is executed in two steps. First, the extraction of the information contained in the sign and second, its recognition by the NN [Neural Network].”).

VI. OVERVIEW OF THE PRIOR ART

A. Attard

57. USPN 9,406,177 to *Attard* (Ex. 1004) was cited but not substantively discussed during prosecution of the '402 Patent. *Attard* was filed February 20, 2014, qualifying as prior art under § 102(a)(2). *Attard* teaches determining actions to take when faults are detected in an autonomous vehicle. *Attard*, 1:15-24, 2:28-54.

58. *Attard* is analogous to the claimed invention of the '402 Patent because *Attard* is from a same field of endeavor: vehicles, and specifically self-driving vehicles. *Cf. Attard*, 1:15-24, 9:63-67 with '402 Patent, 1:26-27.

59. *Attard* is also reasonably pertinent to particular problems addressed by the '402 Patent: evaluating a computer's ability to autonomously operate a vehicle and determining actions to take when faults are detected. *Cf. Attard*, 1:15-24, 2:28-54, with '402 Patent, 1:26-59, 8:13-18.

B. Frazer

60. USPN 9,494,926 to Frazer (Ex. 1005) was neither cited nor considered during prosecution of the '402 Patent. *Frazer* was filed October 5, 2012, qualifying as prior art under § 102(a)(2). *Frazer* is narrowly utilized in the Petition to teach using an event table to perform an action when one or more conditions are fulfilled, as determined via a set of sensors. *Frazer*, 21:20-22:22, FIG. 6.

61. *Frazer* is analogous to the claimed invention of the '402 Patent because *Frazer* is from a same field of endeavor: vehicles, including those using programmable logic controllers. *Cf. Frazer*, 1:19-23 (expressly envisioning use in an autonomous vehicle), 21:20-22:22 *with '402 Patent*, 1:26-27, 3:17-24 (expressly envisioning use of a PLC), 8:29-46.

62. *Frazer* is also reasonably pertinent to a particular problem with which the inventor of the '402 Patent was involved: autonomously controlling a device's operational mode. *Cf. Frazer*, 19:23-25, 21:20-22:22, FIG. 6 *with '402 Patent*, 1:26-59, 3:17-24.

C. McNew

63. USPN 10,377,303 to McNew (Ex. 1006) was neither cited nor considered during prosecution of the '402 Patent. *McNew* was filed September 4 2014, qualifying as prior art under § 102(a)(2). *McNew* teaches managing vehicle

control states of a semi-autonomous vehicle while simultaneously managing a driving state of a driver. *McNew*, 1:17-21.

64. *McNew* is analogous to the claimed invention of the '402 Patent because *McNew* is from a same field of endeavor: vehicles, including managing the level of automation of a vehicle. Cf. *McNew*, 1:17-30, 3:5-52, FIG. 1, with '402 Patent, 1:26-59, 6:33-59, 9:57-10:15, FIG. 5.

65. *McNew* is also reasonably pertinent to a particular problem addressed by the '402 Patent: selecting appropriate corrective actions for a given driving situation. Cf. *McNew*, 20:7-31, 4:3-5, 8:41-44, with '402 Patent, 7:59-8:18, 9:19-37, 10:32-62. *McNew* is utilized in the Petition to teach at least using inputs from a steering wheel sensor to aid in assessing driver status (Claim 6b) and immediate transfer of control to a human driver (6e).

D. Hampiholi

66. US Application No. 2016/0267335 to Hampiholi (Ex. 1007) was neither cited nor considered during prosecution of the '402 Patent. *Hampiholi* was filed March 13, 2015, qualifying as prior art under § 102(a)(2). *Hampiholi* teaches a vehicle determining appropriate responses to detected driver distraction. *Hampiholi*, [0002]-[0004].

67. *Hampiholi* is analogous to the claimed invention of the '402 Patent because *Hampiholi* is from a same field of endeavor: vehicles, including evaluating

a human's ability to safely operate a vehicle. Cf. *Hampiholi*, [0050]- [0051], [0057]-[0058], with '402 Patent, 1:26-59, 8:46-54.

68. *Hampiholi* is also reasonably pertinent to a particular problem addressed by the '402 Patent: adjusting an operation of a vehicle based on driver competence (e.g., level of distraction). Cf. *Hampiholi*, [0001]-[0004], [0057], with '402 Patent, 8:52-59.

E. Scofield

69. USPN 11,040,725 to *Scofield* (Ex. 1022) was neither cited nor considered during prosecution of the '402 Patent. *Scofield* was filed September 4, 2015, qualifying as prior art under § 102(a)(1). *Scofield* teaches notifying drivers to assume manual control of autonomous vehicles. *Scofield*, Abstract, FIG. 1, 1:30-54.

70. *Scofield* is analogous to the claimed invention of the '402 Patent because *Scofield* is from a same field of endeavor: vehicles, and specifically self-driving vehicles. Cf. *Scofield*, 3:9-17, 5:7-13 with '402 Patent, 1:26-27.

71. *Scofield* is also reasonably pertinent to particular problems addressed by the '402 Patent: evaluating a computer's ability to autonomously operate a vehicle and determining actions to take when faults are detected. Cf. *Scofield*, 1:55-60, with '402 Patent, 1:26-59, 8:13-18. *Scofield* discloses using active learning data from other vehicles to determine a processor competence level and weather conditions.

F. Grimm

72. USPN 9,430,944 to Grimm (Ex. 1031) was neither cited nor considered during prosecution of the '402 Patent. *Grimm* was filed November 12 2014, qualifying as prior art under § 102(a)(1). *Grimm* teaches crowd sourcing traffic data from vehicles to determine traffic conditions and events. *Grimm*, 1:9-19.

73. *Grimm* is analogous to the claimed invention of the '402 Patent because *Grimm* is from a same field of endeavor: vehicles. Cf. *Grimm*, 1:9-19, 2:57-59, 3:44-52, FIG. 1, with '402 Patent, 1:26-59, 6:33-59, 9:57-10:15, FIG. 5.

74. *Grimm* is also reasonably pertinent to a particular problem addressed by the '402 Patent: selecting appropriate corrective actions for a given driving situation. Cf. *Grimm*, 4:57-5:4, with '402 Patent, 7:59-8:18, 9:19-37, 10:32-62. *Grimm* teaches at least collecting active learning information from multiple vehicles to determine traffic and safety conditions and events (such as reduced visibility), and the use of weighted voting for determining a corrective action.

G. Dolgov

75. USPN 8,874,305 to *Dolgov* (Ex. 1032) was cited but not substantively discussed during prosecution of the '402 Patent. *Dolgov* was filed September 29, 2011, qualifying as prior art under § 102(a)(2). *Dolgov* teaches maneuvering an autonomous vehicle based on wear. *Dolgov*, 3:5-12, 8:10-62.

76. *Dolgov* is analogous to the claimed invention of the '402 Patent because *Dolgov* is from a same field of endeavor: vehicles, and specifically self-driving vehicles. *Cf. Dolgov*, 1:17-29, 3:5-16, FIG. 1 *with '402 Patent*, 1:26-27.

77. *Dolgov* is also reasonably pertinent to particular problems addressed by the '402 Patent: evaluating a computer's ability to autonomously operate a vehicle and determining actions to take when faults are detected. *Cf. Dolgov*, 1:51-60, *with '402 Patent*, 1:26-59, 8:13-18. Specifically, *Dolgov* teaches vehicle maintenance sensors such as tire pressure sensors and tread wear sensors. *Dolgov*, 4:39-56, FIG. 2.

H. Zhu

78. US Publication No. 2014/0336935 to Zhu (Ex. 1033) was neither cited nor considered during prosecution of the '402 Patent. *Zhu* was filed May 7, 2013, qualifying as prior art under § 102(a)(2). *Zhu* teaches detecting weather conditions using onboard sensors in autonomous vehicles and taking actions based on the weather conditions. *Zhu*, [0004], [0023], [0029].

79. *Zhu* is from a same field of endeavor: vehicles, and specifically self-driving vehicles. *Cf. Zhu*, [0002]-[0003], [0031]-[0032], *with '402 Patent*, 1:26-59, 6:33-59, 9:57-10:15, FIG. 5.

80. *Zhu* is also reasonably pertinent to a particular problem addressed by the '402 Patent: selecting appropriate corrective actions for a given driving situation. Cf. *Zhu*, [0029], with '402 Patent, 7:59-8:18, 9:19-37, 10:32-62.

VII. GROUNDS OF UNPATENTABILITY

Proposed Grounds of Unpatentability
Ground 1: Claims 1 and 3 are obvious under § 103(a) over <i>Attard</i> and <i>Frazer</i> .
Ground 2: Claim 4 is obvious under §103(a) over <i>Attard</i> and <i>Hampiholi</i> .
Ground 3: Claim 6 is obvious under §103(a) over <i>Attard</i> , <i>Hampiholi</i> , <i>McNew</i> , and <i>Scofield</i> .
Ground 4: Claim 8 is obvious under §103(a) over <i>Attard</i> , <i>Hampiholi</i> , <i>McNew</i> , <i>Scofield</i> , and <i>Grimm</i> .
Ground 5: Claims 9-11 are obvious under §103(a) over <i>Attard</i> , <i>Hampiholi</i> , and <i>Grimm</i> .
Ground 6: Claim 13 is obvious under §103(a) over <i>Attard</i> , <i>Hampiholi</i> , <i>Grimm</i> , and <i>Frazer</i> .
Ground 7: Claim 14 is obvious under §103(a) over <i>Attard</i> , <i>Hampiholi</i> , <i>Grimm</i> , and <i>Dolgov</i> .
Ground 8: Claims 15-16 and 18-20 are obvious under §103(a) over <i>Attard</i> , <i>Hampiholi</i> , and <i>McNew</i> .
Ground 9: Claims 17, 21-22, and 24 are obvious under §103(a) over <i>Attard</i> , <i>Hampiholi</i> , <i>McNew</i> , and <i>Frazer</i> .
Ground 10: Claim 23 is obvious under §103(a) over <i>Attard</i> , <i>Hampiholi</i> , <i>McNew</i> , <i>Frazer</i> , and <i>Zhu</i>

VIII. GROUND 1: CLAIMS 1 AND 3 ARE OBVIOUS OVER *ATTARD* AND *FRAZER*

A. Claim 1

1. **Claim 1(Pre):** “A computer program product for controlling a driving mode of a self-driving vehicle (SDV), the computer program product comprising a non-transitory computer readable storage medium having program code embodied

therewith, the program code readable and executable by a processor to perform a method comprising:”

81. To the extent the preamble is limiting, *Attard* teaches a computer program product that manages fault handling in an autonomous vehicle (“SDV”) including controlling a driving mode by changing from an autonomous driving mode to a manual driving mode (or semi-autonomous driving mode) in response to a detected fault (“controlling a driving mode of a self-driving vehicle”). Further, *Attard* teaches computer readable storage medium such as non-volatile memory and programming code stored thereon that is *readable and executable by a processor*.

a) *Attard* Teaches Controlling a Driving Mode

82. *Attard*’s vehicle 101 is capable of driving autonomously. *Attard*, 1:15-52, 2:28-32, 9:63-67. A POSITA would have understood that a vehicle capable of driving autonomously is a self-driving vehicle (SDV). Many such self-driving/autonomous vehicles were known. For example, *J3016* (Ex. 1030) is a document from SAE International that teaches various levels of automation for vehicles, including levels where a vehicle is capable of driving autonomously by using sensors to sense the environment and by autonomously steering, braking, and controlling engine throttle. *J3016*, generally 1-5. *Attard*’s vehicle 101 includes three driving modes: (1) an autonomous driving mode (in which autonomous driving module 106 of computer 105 controls vehicle 101’s functions such as steering, braking, and speed), (2) a semi-autonomous mode (in which the driver/operator

controls one or more of vehicle 101's functions and computer 105 controls one or more of vehicle 101's functions), and (3) a manual mode in which a human driver is in "complete" control of vehicle 101. *Attard*, 1:15-52 (autonomous, semi-autonomous), 1:62-2:9, 2:55-3:4 (semi-autonomous, manual; "an alert may inform the vehicle 101 occupant of a need to resume partial or complete manual control of the vehicle 101."), 3:22-27 (autonomous, semi-autonomous), 3:56-67 (autonomous, "module 106 may control various vehicle 101 components and/or operations without a driver to operate the vehicle 101. For example, the module 106 may be used to regulate vehicle 101 speed, acceleration, deceleration, steering, braking, etc."), 7:39-46 (semi-autonomous, manual; "manual braking, to take complete control of the vehicle"), 9:67-10:12 ("all vehicle 101 operations, e.g., steering, braking, speed, etc., could be controlled by the module 106 in the computer 105."), 10:36-41. Thus, a POSITA would have understood or found obvious that *Attard* teaches or renders obvious (1) an autonomous driving mode, (2) a semi-autonomous mode in which both driver and computer each control one or more vehicle functions, and (3) a manual mode in which a driver has "complete" manual control over vehicle functions including steering, braking, and speed. A POSITA would have understood from *Attard's* teachings that vehicle 101 would have included all three of these modes, including because it was known for self-driving vehicles to have multiple possible levels of automation even within a single vehicle. *See J3016, generally 1-*

5; *see* V.C (discussing *James* teaching vehicle automation level 0 through level 5 as defined by the NHTSA 2013 Policy).

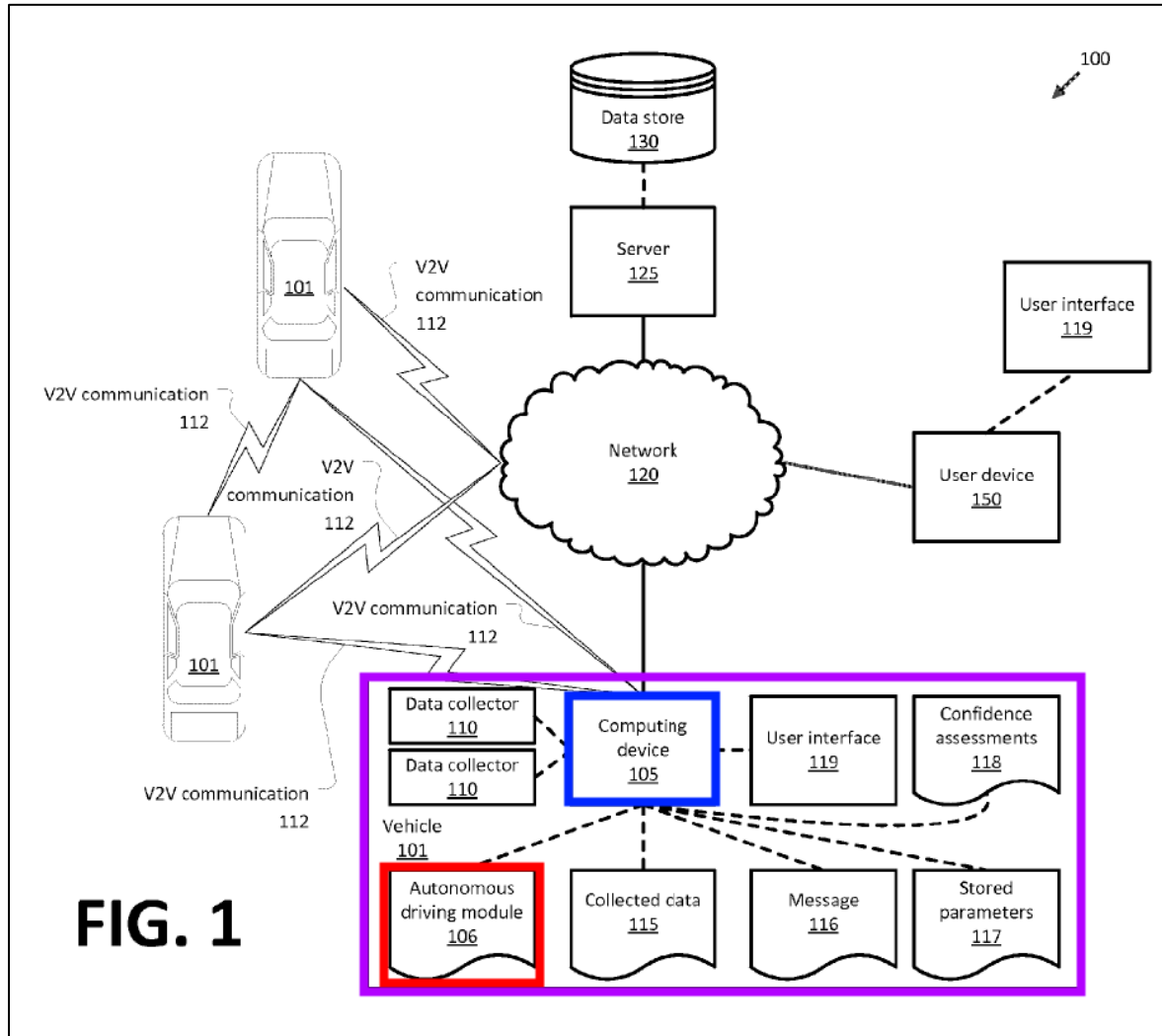
83. Regarding *controlling a driving mode*, *Attard* teaches disabling autonomous mode (that is, transitioning from autonomous mode to either semi-autonomous mode or manual mode) in response to a detected fault. *Attard*, 1:62-65 (“when a fault is detected in a vehicle 101, the vehicle 101 could cease and/or disable one or more particular autonomous operations dependent on a data collector 110 in which the fault was detected.”), 2:55-3:4 (“an alert may inform the vehicle 101 occupant of a need to resume partial or complete manual control of the vehicle 101.... e.g., immediate manual control is recommended ... manual control is recommended for mechanical reasons, manual control is recommended for environmental or weather conditions, manual control is recommended because of traffic conditions, etc.”), 3:5-13.

84. A POSITA would have recognized that *Attard’s* computer 105 (including autonomous driving module 106) controlling vehicle 101 to transition from autonomous mode to either of semi-autonomous or manual modes would have been *controlling a driving mode*. As I discussed above, it was known for a vehicle to have multiple levels of automation, including for a single vehicle to have multiple modes for driving autonomously, semi-autonomously, or completely manually. *See* V.C. A POSITA would have understood that when disabling vehicle 101’s

autonomous functions such as braking, steering, and acceleration, a human driver would have taken over managing such functions, as is done in a typical non-self-driving vehicle (e.g., standard non-SDV car). That is, a vehicle in “manual” (i.e., non-autonomous) mode requires a human driver to manage functions such as engine throttle, braking, and steering just like in a typical non-SDV that does not have self-driving capabilities. *See V.C; James*, 3:47-53 (“The vehicle 100 can have a manual operation mode. ‘Manual operational mode’ means that a substantial majority or all of the navigation and/or maneuvering of the vehicle along a travel route is performed by a human driver with minimal or no input from a computing system.”). While *Attard* does not expressly use the phrase “manual mode,” a POSITA would have understood or found obvious that *Attard*’s driving mode in which the driver takes “complete control” of the vehicle teaches a “manual mode.” Manual mode here means a human driver manages functions such as engine throttle, braking, and steering. I refer to this as “manual mode” to describe the state of the vehicle in which the human driver is required to actively drive the vehicle. As I discuss above, vehicle 101 includes an autonomous mode, a semi-autonomous mode, and a manual mode, where in the manual mode the human driver manages the engine throttle, braking, and steering.

b) *Attard*’s Computer Program Product Comprises Non-Transitory Computer-Readable Memory and Processor

85. *Attard*'s Fig. 1 below depicts **vehicle 101** (annotated purple) including **computer 105** (annotated blue) and **autonomous driving module 106** (annotated red):



Attard, Fig. 1 (annotated), 1:41-52.

86. *Attard* teaches the autonomous operations of vehicle 101 may be stored as a set of instructions in vehicle 101's memory *and executable by a processor of computer 105*. *Attard*, 2:27-32 ("Autonomous operations of the vehicle 101, including generation and evaluation of confidence assessments 118, may be

performed in an autonomous driving module 106, e.g., as a set of instructions stored in a memory of, and executable by a processor of, a computing device 105 in the vehicle 101.”), 3:15-22 (“In any case, the vehicle 101 generally includes a vehicle computer 105 that includes a processor and a memory, the memory including one or more forms of computer-readable media, and storing instructions executable by the processor for performing various operations, including as disclosed herein.”), 15:11-46 (teaching computer-executable instructions, processor, and computer-readable medium including non-volatile media). Thus, a POSITA would have understood or found obvious that *Attard* teaches a *computer program product* for vehicle 101 including for *controlling a driving mode* and that the computer program product comprises non-volatile memory and a processor for executing programming instructions. I note that it was commonplace and well known for SDVs like *Attard’s* vehicle 101 to include a processor, memory, and programming instructions to controlling various features of the vehicle including for controlling a driving mode. See Section V.E.

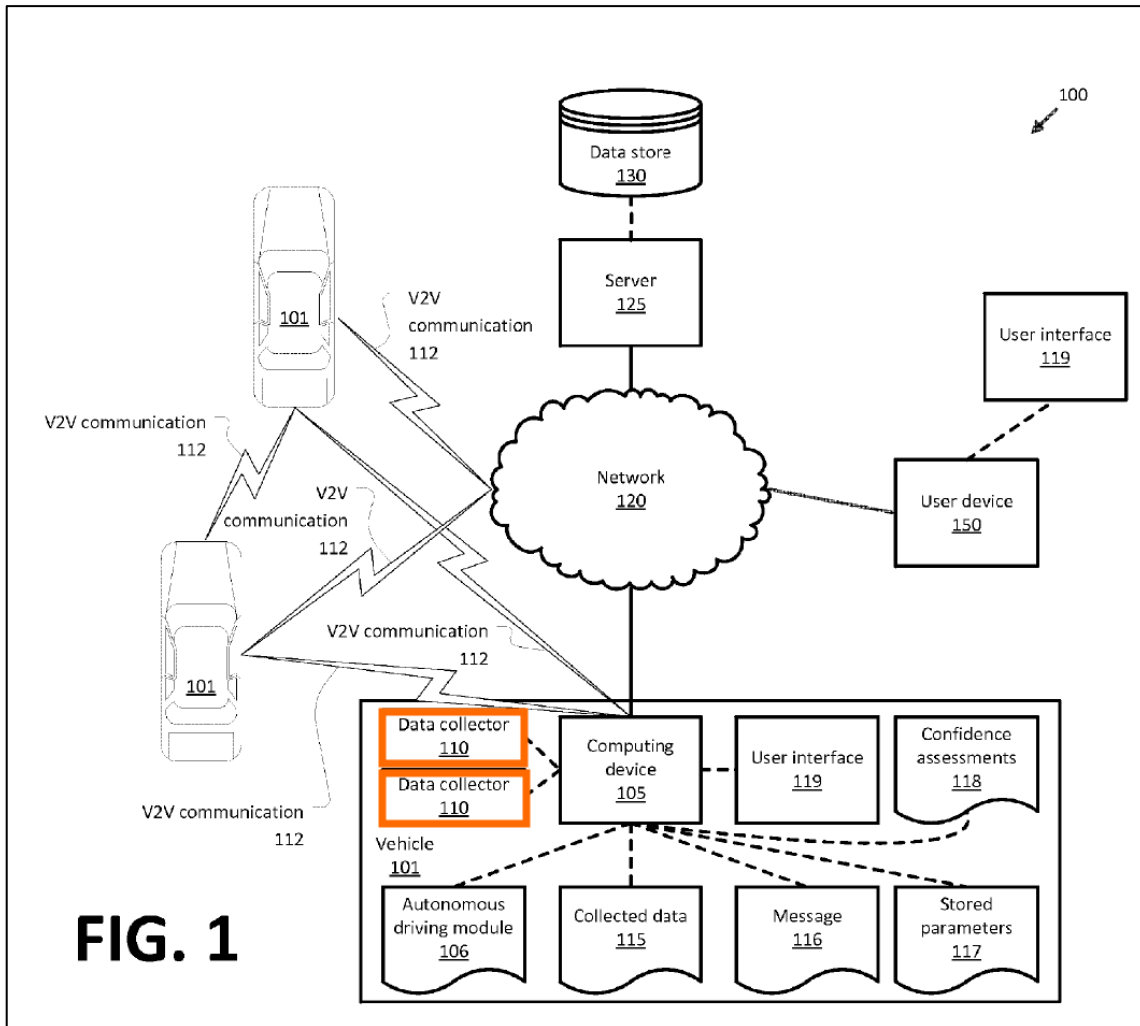
2. Claim 1(a): “receiving sensor readings from a system of sensors, wherein the sensor readings describe a current operational state of a SDV;”

a) *Attard’s* System of Sensors and Sensor Readings

87. *Attard’s* computer 105 receives collected data 115 (“*sensor readings*”) from a plurality of sensors 110 (“*system of sensors*,” also called data collectors 110

in *Attard*), which include cameras, Global Positioning System (GPS) equipment, sensors relating to vehicle speed or acceleration, RADAR, LIDAR, and sonar. *Attard*, 4:1-31, 1:50-52, 1:62-2:9, 4:65-5:3, 6:16-35, 9:51-56, 10:13-17. *Attard*'s sensors 110 transmit collected data 115 to computer 105. *Attard*, 3:45-55 (“computer 105 ... generally includes instructions for receiving data, e.g., collected data 115 from one or more data collectors 110”), 4:1-17 (“data collectors 110 to provide data directly to the computer 105.”), 4:32-45 (“A memory of the computer 105 generally stores collected data 115.”), 6:14-35, 10:13-17.

88. Collected data 115 may include “a variety of data collected in a vehicle 101 from data collectors 110.” *Attard*, 4:32-45. *Attard* teaches numerous examples of data collectors 110 collecting collected data 115. A POSITA would have understood that a camera data collector would have collected image or video data, and similarly a GPS sensor would collect data related to GPS. I also note it was commonplace for self-driving vehicles such as *Attard*'s vehicle 101 to include a plurality of sensors. See V.E. Additionally, *Attard* teaches collected data 115 includes not only data gathered by one or more collection devices 115, but also includes data derived from the sensor readings. Specifically, *Attard* teaches collected data 115 includes “any data that may be gathered by a collection device 110 and/or derived from such data.” *Attard*, 4:32-45. *Attard*'s sensors 110 (annotated orange) are depicted below:



Attard, Fig. 1 (annotated). I note that *Attard* teaches a plurality of data collectors 110, including depicting at least two in Fig. 1. Further, *Attard* refers to data collectors 110 as plural, also indicating to a POSITA that *Attard* teaches a plurality of data collectors 110. One example is a plurality of cameras. *Attard*, 1:50-61 (“one or more data collectors 110, e.g., sensors or the like”), 2:6 (“data collectors 110”), 2:10-18 (“data collection devices 110 such as sensors”), 2:28-34, 3:60-65, 4:1-45, 6:36-44.

89. A POSITA would have understood or found obvious that *Attard's* sensors 110 are a *system of sensors* because *Attard* teaches a plurality of such sensors and the sensors work together with vehicle 101 including computer 105 and autonomous driving module 106 to collect data 115. *Attard*, 4:1-17, 1:62-2:6. To the extent PO argues *Attard* does not expressly teach *sensor readings*, a POSITA would have understood or found it obvious that *Attard's* cameras capture collected data 115, which are *sensor readings*. Compare *Attard* with '402 Patent's descriptions of sensors 153. For example, the '402 Patent describes sensors 153 "are sensors that detect an operational state of an SDV, including anomalous states such as, but not limited to, a presence of snow tires mounted on the SDV during a first road condition of the roadway, an absence of snow tires ... tire pressure ... tire tread ...an inoperable headlamp ... a faulty braking system." '402 Patent, 5:59-6:8. In my opinion, *Attard's* sensors are a system of sensors that detect operational states of the SDV, as I discuss in more detail below.

b) *Attard's* Sensor Readings Describe a Current Operational State of an SDV

90. The '402 Patent describes that an "operational state" of a vehicle including states (e.g., presence/absence of snow tires), conditions (e.g., road conditions), and measured parameters (e.g., tire pressure, fluid volume) detected via its system of sensors. '402 Patent, 5:59-6:8. A POSITA would have understood that faults described in the '402 Patent are thus a subset of all the operational states,

where a fault indicates an anomalous operational state. Operational states may, in some cases, indicate “anomalous” or “faulty” states, including failure of a particular system (e.g., an “all wheel traction system”) or a fault (e.g., a “faulty braking system.”). *Id.* Thus, a fault is a subset or species of the broader genus of operational states.

91. *Attard* teaches sensors which similarly “provide indicia related to collected data 115 pertaining to a particular vehicle 101 and/or vehicle 101 subsystem, environmental attribute, or condition,” where “an attribute or condition such as road conditions, weather conditions, braking capabilities, ability to detect a lane, ability to maintain a speed of the vehicle 101” are all taken into consideration and are related to collected data 115. *Attard*, 10:42-52. As described regarding Fig. 2, at block 210 the vehicle’s sensors collect data, providing it to computer 105. *Attard*, 10:13-17, Figs. 1-2.

92. Because *Attard*’s collected data 115 (*sensor readings*) detect conditions external to the vehicle (e.g., weather conditions, road attributes) and data internal to the vehicle (e.g., acceleration, speed) used to perform autonomous driving, *Attard*’s *sensor readings describe a current operational state of a SDV*, as claimed. Compare *Attard*, 1:61-2:6, 4:1-17, 6:4-13, 10:13-27 with ’402 Patent, 5:59-6:8. Indeed, as I discussed above, the ’402 Patent describes sensors indicating operational states such as presence or absence of snow tires and weather or road conditions. *Attard*’s sensors

110 are similarly capable of indicating conditions on the roadway, weather, and also operational states related to the vehicle itself.

3. Claim 1(b): “determining based on the sensor readings, by one or more processors, whether a fault has occurred;”

93. *Attard* teaches “faults” as recited in limitation 1(b) via its “confidence attribute sub-assessments 118” (also denoted as “ ϕ_i ” below). *Attard*, 7:39-46. As mapped below, when ϕ_i falls below $\phi_{\min}$, *Attard*’s vehicle determines *a fault has occurred*.

a) ’402 Patent’s Fault Description

94. As discussed above regarding limitation 1(a), the “operational state” of a vehicle, as described by the ’402 Patent, may indicate that a fault has occurred, such as a “faulty braking system.” *’402 Patent*, 5:59-6:8. Though a fault is sensed, in some instances the fault may be tolerable, so long as a threshold for danger has not yet been exceeded (as further described below regarding limitation 1(c)). *Id.*, 8:6-18 (“A threshold for seriousness of the fault may be applied to vehicle measures in order to determine if the switch (from manual mode to autonomous mode or vice versa) is required.”), 8:16-18 (“Based on the detected fault exceeding a threshold for danger, the SDV either switches from autonomous mode to manual mode or from manual mode to autonomous mode.”), 9:13-17.

b) *Attard's* Fault Teachings

95. As discussed above, *Attard* teaches computer 105 and at least one processor performing its steps. *See*, Claim 1(Pre)-1(a). As further discussed, *Attard* teaches collecting sensor data 115 describing a current operational state of the vehicle. *See*, Claim 1(a).

96. *Attard* uses collected sensor data 115 to produce confidence assessments 118² indicating whether the vehicle “can and/or should be operated autonomously.” *Attard*, 5:54-6:3, 5:21-53, 6:14-35. Both Φ and ϕ are generated and present in all embodiments of *Attard*. That is, Φ and ϕ are *not* alternatives to one another; rather, Φ and ϕ are both generated and both are necessary in *Attard*. When expressed as a vector, each confidence assessment (ϕ) comprises a plurality of sub-assessments ϕ_i , each ϕ_i related to a single sensor (e.g., camera) or a group of sensors (e.g., lane-tracking system). *Attard* names ϕ_i “confidence attribute sub-assessments

² *Attard* uses element 118 to refer to both overall confidence assessment Φ and vector confidence assessments ϕ . *Attard*, 2:10-48, 5:54-6:44, 6:61-7:23, 7:39-46, 7:62-8:45. Element “118” is omitted, and each confidence assessment is referred to as its specific type (i.e., overall, vector, sub-assessment) for clarity.

118.”³ *Attard*, 7:39-46. I also note that in *Attard* the vector confidence assessment φ can be determined for a group of sub-assessments φ_i , such as for φ^{PL} and φ^{AL} . Thus, φ_i is referred to as a sub-assessment of a vector confidence assessment φ . Each of *Attard*’s vector components φ_i may indicate a potential fault within one sensor or a group of related sensors, if it is determined that the particular φ_i falls below a threshold.

97. In particular, *Attard*’s sub-assessments φ_i may indicate a fault related to a single attribute of the vehicle 101 or a single condition related to the environment or operation of the vehicle (e.g., a weather condition, a road condition, vehicle speed, braking performance, acceleration, steering, navigation, traffic, etc.). *Attard* 6:4-13, 7:39-46 (teaching specific content of an alert message is based on the condition/attribute of φ_i), 7:65-8:13. In particular, *Attard* teaches generating an alert message with semantic content S_i based on φ_i . *Attard*, 7:65-8:45. As depicted below, the equation at *Attard*, 8:8 includes φ_i to indicate a single attribute, such as optical lane-tracking.

³ *Attard* refers to φ_i as “confidence attribute sub-assessments,” “vector component,” and other related phrasing. *Attard*, 7:65-8:4, 11:10-15. For clarity, in the Petition and in this Declaration, φ_i is referred to as “sub-assessment” throughout.

$$S_i = S(\phi_i) \forall \phi_i < \phi_{min}$$

Attard, 8:8. Here, the function $S(\phi_i)$ is evaluated for all (denoted by the turned A “universal quantification symbol” $\forall$) conditions where ϕ_i is less than ϕ_{min} .

98. *Attard* explains each sub-assessment ϕ_i is compared with threshold(s) specified by *Attard*’s parameter 117 corresponding to that particular sub-assessment. *Attard*, 5:21-65. That is, for each sub-assessment ϕ_i , an associated parameter 117 is stored comprising thresholds (ϕ_{min}) for comparison with sub-assessment ϕ_i to determine when associated collected data 115 indicates a particular driving condition/attribute has become problematic. *Attard*, 5:21-29, 6:4-13. Thus, each sub-assessment ϕ_i represents a potential fault. I note that whether the sub-assessment ϕ_i represents a fault depends on the threshold for the particular ϕ_i and whether ϕ_i has exceeded the threshold.

99. In one example, *Attard* describes a sub-assessment ϕ_1 representing optical lane-tracking confidence. *Attard*, 8:10-39. Though *Attard* is not express on this point, a POSITA would have understood this particular sub-assessment ϕ_1 would have been based on collected data 115 received from a component such as an external camera or infrared sensor used for lane tracking. As an example, collected data 115 includes data obtained from sensors 110 such as camera images, radar,

lidar, data from infrared sensors, etc.). *Attard*, 4:67-5:3. In any case, *Attard* explains sub-assessment φ_1 is compared to a threshold $\varphi_{\min}$ (from an associated parameter 117), and if $\varphi_1 < \varphi_{\min}$, a message may be generated regarding the fault, where the urgency/severity of the fault may be indicated in the message. *Attard*, 8:10-39. As an example, *Attard* teaches various levels of severity, including “Deadly,” “Danger,” “Warning,” “Caution,” and “Notice,” where “Deadly” indicates the highest level of severity and “Notice” indicates the lowest level of severity. *Attard*, 8:10-39. Regardless of the level of severity, a POSITA would have understood that a fault occurs when $\varphi_1 < \varphi_{\min}$. Thus, sub-assessment φ_i falling below threshold $\varphi_{\min}$ determines *a fault has occurred*, as claimed. *Id.*

100. As will be further discussed below regarding limitation 1(c), this “fault” may, in some cases, be tolerable to *Attard*’s SDV, much like the method described by the ’402 Patent. For example, when a sub-assessment φ_i falls below a particular threshold, a low-urgency fault message may be presented such as “Notice,” “Caution,” or “Warning.” *Attard*, 8:10-25. Here, the fault may not yet have exceeded the threshold for “Danger,” which would warrant a message indicating higher urgency. *Id.* As I discussed above, *Attard* teaches various levels of high severity such as “Deadly” and “Danger” and lower levels of severity including “Caution” and “Notice.” *Attard*, 8:10-39. Indeed, if a more severe problem has occurred, a POSITA would have understood that sending a more urgent message would have made sense.

For example, if a sensor that is critical to autonomous driving (e.g., LIDAR or a camera, for example) has experienced a fault, a more urgent response would be needed than if a redundant sensor has failed or experienced a fault. In another example, a fault may indicate that one of multiple cameras has failed, but, due to redundancy, the vehicle may continue operating autonomously. *Attard*, 14:64-15:1. In such a case, a POSITA would have understood that a less urgent message would have been warranted to inform the driver that a problem has occurred but that the problem is not critical. Indeed, some faults may not exceed the threshold for danger because they are not severe enough to significantly impact the autonomous driving mode, for example. In such a case, there may be a fault that causes a lower urgency message to be sent to the driver, such as “Notice” or “Caution,” where the fault does not rise to the level of severity to send a message indicating “Deadly” or “Danger.” Thus, some faults may be “tolerable.”

101. Though *Attard* does not provide detailed mathematical description regarding Φ , a POSITA would have known various approaches for its calculation. As I discuss below, there were numerous known mathematical methods for converting one or more vectors into a scalar quantity, and it would have been obvious to a POSITA to utilize such a calculation to generate Φ from a plurality of sub-assessments ϕ_i . For example, a POSITA would have understood or found obvious techniques for converting *Attard's* **vector** confidence assessments ϕ directly to a

scalar via a well-known mathematical method (e.g., computing magnitudes of φ^{PL} and φ^{AL} and summing or averaging their values, or computing the dot product of φ^{PL} and φ^{AL}) to yield overall confidence assessment Φ (a scalar value). I note that *Attard* does not expressly teach a specific method for performing such conversion, but a POSITA would have understood or found obvious using any number of mathematical approaches for such a calculation. In my opinion, any mathematical approach for calculating *Attard's* Φ would have satisfied claim 1, including approaches in which Φ is not directly calculated using φ whatsoever. However, a POSITA would have understood that an approach using φ to calculate Φ would have made sense within *Attard*.

4. Claim 1(c): “determining, by the one or more processors, whether the fault exceeds a threshold for danger;”

102. As discussed regarding limitation 1(b), *Attard* teaches determining a fault when a sub-assessment φ_i falls below a threshold φ_{min} , triggering message generation such as “Notice,” “Caution,” or “Warning.” *See*, Claim 1(b) *citing Attard*, 8:10-25. As further explained, *Attard* teaches computer 105 and at least one processor performing its steps. *See*, Claim 1(Pre)-1(a).

103. *Attard* continues, explaining that if the confidence assessment φ_i component continues to fall below another threshold, a message for “Danger” is generated. *Attard*, 8:10-39. As I discussed above for Claim 1(b), *Attard* teaches several exemplary levels of severity, including “Deadly,” “Danger,” “Warning,”

“Caution,” and “Notice,” where “Deadly” indicates the highest level of severity and “Notice” indicates the lowest level of severity. Thus, if sub-assessment ϕ_i falls below $\phi_{\min}$, the severity of the fault is determined, which in some cases means the fault has exceeded a threshold for danger. For example, severity levels of “Danger” and “Deadly” exceed a threshold for danger. A POSITA would have understood that the value of ϕ_i when compared to one or more thresholds $\phi_{\min}$ thus determines the severity level, and an appropriate corrective action is taken. Thus, *Attard* teaches determining, by its processor(s), whether the fault (such as poor lane-tracking confidence, as explained above regarding 1(b), or a weather condition, such as icy roads) falls below a *threshold for danger*, as claimed. *Id.*

104. Though *Attard*’s disclosure describes sub-assessment ϕ_i falling *below* a threshold for danger, a POSITA would have understood that *Attard* teaches surpassing, and thus “*exceeding*” the threshold for danger, as claimed. *Attard*, 8:10-25. *Attard*, 7:18-23 (“When an overall confidence assessment 118 for a specified value or range of values, e.g., a confidence interval, meets or exceeds a predetermined threshold within a predetermined margin of error, e.g., 95 percent plus or minus three percent, then the computer 105 may include instructions for providing a message 116, e.g., an alert, via the affective interface 119.”), 11:15-25 (teaching generating an alert based on a second assessment 118 meeting or exceeding a threshold even if a first assessment did not meet or exceed a threshold).

Particularly, *Attard* expressly uses the word “exceed” to describe surpassing a threshold in the negative direction, i.e., the quantity “exceeds” a threshold by dropping below the threshold, though the value of the parameter is becoming smaller. A POSITA would have understood that “exceeding” may occur in either a positive or negative direction depending on the values of the scale, and that this is merely a design implementation detail that is essentially arbitrary. Additionally or alternatively, a POSITA would have had the skill and would have understood how to invert *Attard*’s scale such that surpassing/exceeding would be in the positive direction. For example, multiplying values by -1 would have inverted the threshold to be exceeded in the positive direction. Such a modification would have required only basic and straightforward changes to programming instructions, well within the skillset of a POSITA.

a) Overall Confidence Assessment – Capital Φ

105. *Attard*’s process of determining if a sub-assessment φ_i exceeds a threshold for danger only occurs if overall confidence assessment Φ falls below a threshold $\Phi_{\min}$. These two sub-steps of *Attard*’s process, wherein Φ falls below $\Phi_{\min}$ AND φ_i falls *below* a threshold for danger, are collectively mapped as limitation 1(c).

106. Thus, *Attard*’s overall confidence assessment Φ (mapped below as the *control processor confidence level*) is *determin[ed]* as part of the step of

“determining, by the one or more processors, whether the fault exceeds a threshold for danger.”

5. Claim 1(d): “determining a corrective action associated with the fault using a fault-remediation table;”

a) *Attard* Teaches a Corrective Action Associated with a Fault

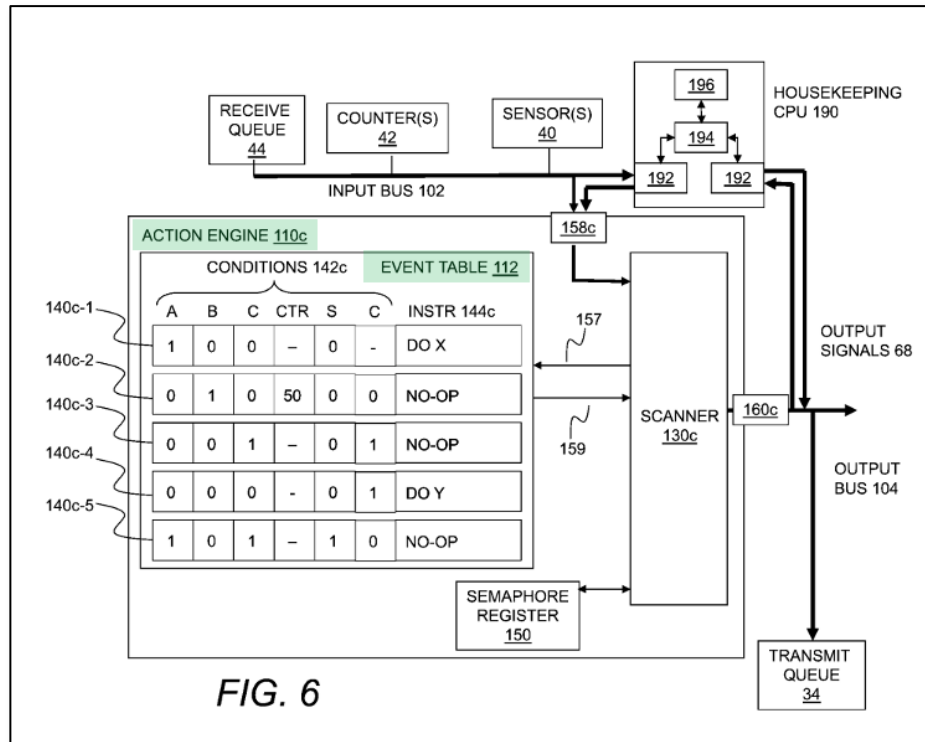
107. *Attard* teaches a fault. *See* Claim 1(b). Further, *Attard* teaches taking one or more corrective actions based on the fault that occurs. *Compare Attard*, 3:9-13 (including “ceasing one or more autonomous operations”), 14:63-15:4. For example, like the ’402 Patent, corrective actions may include sending a message (e.g., “Caution” or “Danger”) or performing an action (e.g., slowing the vehicle to a stop) based on the fault. *Compare Attard*, 2:28-3:4, 3:9-13, 7:18-57, 8:10-39, 14:27-33 with ’402 Patent, 8:26-28, 12:3-9. In one example, content of message 116 to be displayed “may be determined according to an identity of the component that has dropped below” (i.e., “exceeded”) the threshold. *Attard*, 8:1-13. Here, *Attard* teaches the “component” refers to sub-assessment ϕ_i , and thus the message is related to the specific fault that has occurred. As discussed above, each sub-assessment ϕ_i relates to one or more sensors, such that a fault with a particular ϕ_i may be a fault in a particular sensor. Additionally, a requested action (“RA”) may be included in the message, where the RA is a function of the vehicle “subsystem i” and sub-assessment ϕ_i . *Attard*, 8:36-38 (“A requested action (RA); in the example above,

$RA=f(i, \varphi_i)$ is the phrase “Driver intervention.”). Here, the RA is a function of a specific sensor related to φ_i , which a POSITA would have understood means a requested action may be based on a fault of a single sensor. Thus, a POSITA would have recognized *Attard* teaches determining performing particular actions in response to particular determined faults.

108. However, *Attard* does not expressly teach using a fault-remediation table to determine the corrective action associated with a fault. As discussed below, *Frazer* teaches using event table 112 (“*fault-remediation table*”) that performs an action based on a set of one or more conditions being fulfilled.

b) *Frazer* Teaches a Fault-Remediation Table

109. *Frazer* teaches action engine 110c including event table 112 for use with autonomous or semi-autonomous vehicles. *Frazer*, 21:20-32. Event table 112 includes registers (rows 140c-1, 140c-2, etc.) containing particular sets of conditions 142c and an instruction/action 144c to be taken conditions are met. *Frazer*, 21:20-22:22. In more detail, *Frazer* teaches conditions of a “dynamic environment” monitored by sensors. *Frazer*, 21:52-56. If input signals match a given condition 142c stored in event table register 140c, corresponding action(s) 144c stored in event table register 140c are executed. *Frazer*, 22:6-22. *Frazer*’s event table 112 is depicted below:



Frazer, FIG. 6, 21:19-43.

110. A POSITA would have recognized *Frazer*'s event table 112 mirrors the description of a fault-remediation table in the '402 Patent. *See* '402 Patent, 8:29-46 ("fault-remediation table, where each row refers to a fault condition, a first column refers to a condition that gets manifested by that fault, and a second column that refers to the mode in which the vehicle should be driven when that condition is manifested.") *compared with Frazer*, 21:19-43, FIG. 6. In particular, *Frazer*'s **rows 140c** (annotated red) represent fault conditions, a **first column 142c** (annotated green) refers to a condition manifested by that fault, and a **second column 144c** (annotated purple) refers to the action to be taken when the conditions are manifested ("DO X"). I note that *Frazer*'s event table 112 includes five exemplary rows 140c

and similarly five instructions 144c (with each row having a corresponding corrective action/instruction), and six exemplary columns 142c. A POSITA would have understood that *Frazer's* table is merely illustrative and that many more rows and/or columns would have been included as necessary to capture all the various scenarios for faults and corresponding corrective actions.

ACTION ENGINE 110c						
CONDITIONS 142c						EVENT TABLE 112
A	B	C	CTR	S	C	INSTR 144c
1	0	0	-	0	-	DO X
0	1	0	50	0	0	NO-OP
0	0	1	-	0	1	NO-OP
0	0	0	-	0	1	DO Y
1	0	1	-	1	0	NO-OP

Frazer, FIG. 6 (excerpt, annotated). I note that here a condition column is annotated green, a fault is a row annotated red, and the column for corrective actions for each fault is annotated purple. In an *Attard-Frazer* table, rows 140c would indicate particular faults, conditions 142 would indicate conditions related to the faults (for example, a sub-assessment ϕ_i being in a particular range of values), and one or more corresponding corrective actions to be taken as a result of the fault occurring.

111. Therefore, because *Frazer's* event table 112 includes faults 140c specified by conditions 142c and actions 144c that are triggered when conditions are met, *Frazer's* event table 112 teaches a *fault-remediation table*. In particular, when a fault occurs, a corresponding corrective action (or multiple corrective actions) is taken per the table, where such a corrective action may be alerting a driver and/or transitioning from an autonomous mode to manual mode.

c) Motivation to Combine *Attard-Frazer*

112. A POSITA would have found it obvious and been motivated to modify *Attard's* fault handling (including determining a corrective action, such as a “Danger” message) with *Frazer's* teachings of organizing faults, conditions, and action(s) to take for each fault in an event table (i.e., *fault-remediation table*), which would have resulted in *determining a corrective action associated with the fault using a fault-remediation table*. Indeed, one advantage of utilizing an event table (“fault remediation table”), such as per *Frazer's* teachings, is to have pre-programmed scenarios ready to go to address any desired scenario that may occur along with the proper action to take. A POSITA would have found it obvious and been motivated to determine which corrective action to take using *Frazer's* event table to enable easy access and quick determination of actions to take in response to detected faults. Utilizing a well-known table for this operation means the vehicle does not need to come up with a corrective action on-the-fly; rather, the SDV

determines there is a fault and looks up what correction action(s) should be taken. A POSITA would have recognized formatting data into a table was a well-known and widely-used method of efficiently organizing data for retrieval, reference, and potential modification. I note that tables are a widely utilized format for organizing data both electronically in computer systems and even on paper (such as in textbooks and academic journal articles).

113. A POSITA would have specifically appreciated the if/then type of fault remediation data already present in *Attard's* vehicle would have been particularly apt for organizing into a table, concisely and efficiently cross-referencing an array of detectable conditions to quickly determine appropriate responses, improving the safety of the vehicle while reducing its memory requirements compared to an otherwise unorganized list of fault responses. Here, a table is simply an efficient way to organize the faults, conditions, and corrective action(s) to take, where a computer, e.g., *Attard's* computer 105, may quickly access the table and find the action that should be taken given the fault and conditions.

114. A POSITA would have understood *Frazer* provides an express teaching, suggestion, and motivation for the combination, stating its action engine “exhibits a significantly low latency with respect to processing information relating to respective states of the dynamic environment and taking actions in response to same.” *Frazer*, 23:64-67. A POSITA would have been motivated to utilize a solution

such as *Frazer's* event table to achieve such low latency for processing related to determining a corrective action to take. Indeed, when a driver is driving an SDV at high speed down a highway, for example, there may be little time before a particular corrective action needs to be taken (such as slowing the vehicle, switching to manual mode, alerting the driver, etc.). Thus, utilizing a fault-remediation table when driving in an SDV such as *Attard's* would have been advantageous for the driver, including by increasing safety.

115. Modifying *Attard* to utilize *Frazer's* table would have been use of a known technique of using a fault-remediation table to group data such as faults, conditions that indicate the faults, and actions to take when the fault conditions are met, and this known technique would have improved *Attard's* similar autonomous vehicle (including determining a corrective action in response to a fault) in the same way as *Frazer's* autonomous vehicle. This modification would have improved *Attard's* SDV by allowing the vehicle to essentially “pre-process” scenarios to simply look up the corrective action that should be taken by using a table instead of having to make a decision on-the-fly. For an SDV, there are many scenarios that a POSITA would have understood would have been advantageous to pre-process, such as ethical dilemmas of prioritizing the driver's safety versus a pedestrian's safety, for example. A POSITA would have understood that such difficult ethical decisions are better decided ahead of time where more time is available to arrive at a desired

corrective action instead of having to make a decision in mere seconds, for example.

In this way, using a fault-remediation table such as *Frazer's* would have been advantageous in *Attard's* SDV.

116. A POSITA would have recognized the usefulness of storing these associations at least to reduce latency as expressly taught by *Frazer*. *Frazer*, 23:64-67. The proposed combination constitutes application of a known technique (*Frazer's* event tables) to a known method (*Attard's* fault handling method) ready for improvement to yield predictable results. Based on *Attard's* teachings that faults have associated actions (*see, e.g., Attard*, 2:1-6, 14:27-33, 14:63-15:4), a POSITA would have looked to other references that describe specific ways to associate faults with actions and to store such information in computer memory, *e.g., Frazer*.

117. A POSITA would have appreciated that modifying *Attard* per *Frazer* would have had a reasonable expectation of success. For example, *Attard* and *Frazer* both teach SDVs, with *Frazer* expressly teaches using event table 112 in autonomous vehicles. *Frazer*, 19:23-30, 21:20-32 (“FIG. 6 shows a system configuration of various components, including an illustrative action engine 110c for monitoring, synchronizing, and/or controlling at least one aspect of a dynamic environment. Examples of such environments with which the system shown in FIG. 6, and particularly the action engine 110c, may be employed include, ... autonomous

or semi-autonomous vehicle.”), 21:33-51 (“The action engine 110c includes an event table 112”), *generally* 21:52-22:22.

118. *Attard* and *Frazer* teach implementing programs and functions using programming instructions executed by a processor. *Attard*, 15:12-46 (teaching computer-executable instructions, processor, memory); *Frazer*, 21:20-51 (“The event table 112 and event table registers 140c can be implemented in any suitable type of memory, including but not limited to computer readable storage media such as a volatile or nonvolatile computer memory.”). Thus, *Attard* already has hardware necessary for performing actions such as those taken by *Frazer*’s action engine 110c, such that only straightforward changes to programming instructions would have been needed to implement *Frazer*’s event table 112 in *Attard*. Modifying *Attard* would have merely required straightforward changes to programming instructions. Indeed, *Attard* already teaches computer hardware including a processor for executing instructions and memory that stores instructions. *Attard*, 2:28-41, 3:15-27, 4:32-45, 5:21-30, 5:54-57, 15:12-46 (teaching examples of memory).

119. Thus, a POSITA would have understood or found obvious that *Attard* already has the necessary computer hardware for implementing an event table and action engine 110c, such as *Frazer*’s. Specifically, as I discussed above, *Frazer*’s action engine 110c and event table 112 are expressly taught, suggested, or motivated to be used in an autonomous or semi-autonomous vehicle, which *Attard* already has.

To the extent it is argued that *Attard's* hardware is insufficient for this modification, a POSITA would have understood that it would have been straightforward to modify *Attard* to include additional memory or processing power as needed, and that this would have been a tradeoff to capture *Frazer's* advantages. Choosing a tradeoff of more powerful components at the expense of cost would have been a straightforward design choice for a POSITA. In this scenario, a POSITA would not have had to personally swap out hardware components, as that modification would be performed during a vehicle production or modification step by a technician, mechanic, or even a manufacturing robot, for example. In this example, a POSITA would merely select which components are to be used.

120. Further, a POSITA would have recognized the ease of modifying *Attard's* computer 105 (or other memory of vehicle 101) to include an event table per *Frazer* by performing straightforward modifications of programming instructions. Both *Attard* and *Frazer* are similar in that they both describe detecting faults/events based on sensor data. *Compare Attard* 1:50-52, 12:53-62 with *Frazer*, 21:52-56, 22:31-47. Thus, there would have been a reasonable expectation of success in modifying *Attard* to utilize a fault-remediation table such as taught by *Frazer*. Additionally, both *Frazer* and *Attard* teach applying their systems and methods to an autonomous or semi-autonomous vehicle, such that a POSITA would

have had a reasonable expectation of success when modifying *Attard* per *Frazer*'s teachings. See, e.g., *Frazer*, 21:19-22:47.

6. Claim 1(e): “the SDV implementing the corrective action.”

121. *Attard-Frazer* teaches determining a corrective action associated with the fault using a fault-remediation table. See Claim 1(d). Further, *Attard-Frazer*'s SDV implements the corrective action(s) based on its fault-remediation table.

The diagram shows a block labeled 'ACTION ENGINE 110c'. Inside this block is a table titled 'EVENT TABLE 112'. The table has two main sections: 'CONDITIONS 142c' and 'INSTR 144c'. The 'CONDITIONS 142c' section has six columns: A, B, C, CTR, S, and C. The 'INSTR 144c' section has one column. The table contains five rows of data. A green box highlights the first column (A) across all rows. A red box highlights the first row (1, 0, 0, -, 0, -). A purple box highlights the last column (INSTR 144c) across all rows. On the left side of the table, labels 140c-1 through 140c-5 are connected to the rows by wavy lines.

	A	B	C	CTR	S	C	INSTR 144c
140c-1	1	0	0	-	0	-	DO X
140c-2	0	1	0	50	0	0	NO-OP
140c-3	0	0	1	-	0	1	NO-OP
140c-4	0	0	0	-	0	1	DO Y
140c-5	1	0	1	-	1	0	NO-OP

Frazer, FIG. 6 (excerpt, annotated). I note that here a condition column is annotated green, a fault is a row annotated red, and the column for corrective actions for each fault is annotated purple.

122. For example, *Attard* teaches that when Φ falls below $\Phi_{\min}$, computer 105 may implement[] the corrective action, such as sending a message or performing an action (e.g., presenting a “Danger” message to the driver and/or slowing the

vehicle to a stop) where the action taken is based on the fault, i.e., when ϕ_i is below a $\phi_{\min}$. *Attard*, 1:62-2:6, 2:46-3:4, 8:10-39,14:27-33, 14:63-15:4, *generally* 7:18-9:10, 11:26-12:22 (teaching details of messages 116, e.g., a corrective action). In *Attard-Frazer*, a suitable *corrective action* (instruction 144c) for a fault would have been determined using its fault-remediation table. That is, *Attard* would have been modified per *Frazer* to utilize a fault-remediation table to organize faults, conditions of each fault, and one or more corrective actions to take for each fault. *See* Claim 1(d). After selecting the corrective action, the corrective action would have been implemented by *Attard's* vehicle 101. *Attard*, 14:63-64 (“[T]he nature of a fault may indicate an action **directed by the computer.**”). In particular, vehicle 101 includes a processor, memory, and programming instructions that would have been executed by a processor, such as programming instructions to execute the selected corrective action.

123. In this manner, modifying *Attard* per *Frazer* to use a *fault-remediation table* would have merely been providing a particular data storage arrangement, namely, an event table such as taught by *Frazer*, for selecting *Attard's* corrective action(s) to implement. A POSITA would have understood that using an event table in the *Attard-Frazer* SDV would have been a straightforward modification implemented by modifying programming instructions and that this modification would have been well within the skillset of a POSITA. Thus, when a condition of

the event table is met (e.g., fault, such as a threshold exceeded), a corresponding *corrective action* is implemented in response to the particular fault. A motivation to modify *Attard* per *Frazer's* teachings is provided above. *See*, Claim 1(d).

B. Claim 3

1. Claim 3(Pre): “The computer program product of claim 1, wherein:”

124. *See*, Claim 1.

2. Claim 3(a): “the sensor readings comprise a reading from a GPS sensor;”

125. As discussed above, *Attard* teaches vehicle 101 includes sensors 110 that perform *sensor readings*. *See* Claim 1(a). In particular, *Attard* teaches sensors 110 include *a GPS sensor* that sends GPS (global positioning system) sensor readings to computer 105. *Attard*, 4:4-11, 4:32-45, 6:4-13, 7:14-17, 10:42-52, 13:22-24, 13:56-58, 14:41-48. *Attard* teaches numerous examples of data collectors 110 collecting collected data 115. A POSITA would have understood that a camera data collector would have collected image or video data, and similarly a GPS sensor would collect data related to GPS. I also note it was commonplace for self-driving vehicles such as *Attard's* vehicle 101 to include a plurality of sensors. *See* V.E. *See* Claim 1(a). Petitioner notes claim 3 requires nothing more than mere presence of GPS sensor readings.

3. Claim 3(b): “the fault comprises a vehicle state;”

126. See Claim 1(a), 1(b). *Attard* teaches sensors to detect a vehicle state including internal and external (e.g., weather) conditions. In some cases, a fault is a result of a vehicle state. Specifically, *Attard* teaches sensors which similarly “provide indicia related to collected data 115 pertaining to a particular vehicle 101 and/or vehicle 101 sub-system, environmental attribute, or condition[,]” where “an attribute or condition such as road conditions, weather conditions, braking capabilities, ability to detect a lane, ability to maintain a speed of the vehicle 101” are all taken into consideration and are related to collected data 115. *Attard*, 10:42-52. As described regarding Fig. 2, at block 210 the vehicle’s sensors collect data, providing it to computer 105. *Attard*, 10:13-17, Figs. 1-2. Each of *Attard*’s vector components φ_i may indicate a potential fault within one sensor or a group of related sensors, if it is determined that the particular φ_i falls below a threshold. *Attard* 6:4-13 (“weather conditions, road conditions”), 7:39-46 (teaching specific content of an alert message is based on the condition/attribute of φ_i), 7:65-8:13. In particular, *Attard* teaches generating an alert message with semantic content S_i based on φ_i . See Claim 1(b).

127. Because *Attard*’s collected data 115 (*sensor readings*) detect conditions external to the vehicle (e.g., weather conditions, road attributes) and data internal to the vehicle (e.g., acceleration, speed) used to perform autonomous driving, *Attard*’s

sensor readings describe *a vehicle state* of a SDV and a *fault comprises a vehicle state*. Compare *Attard*, 1:61-2:6, 4:1-17, 6:4-13, 10:13-27 with *'402 Patent*, 5:59-6:8.

4. Claim 3(c): “determining a corrective action associated with the fault using a fault-remediation table comprises a weighted voting parameter;”

128. *Attard-Frazer* teaches *determining a corrective action associated with the fault using a fault-remediation table*. See, Claim 1(d). Further, *Attard* teaches weighted voting parameters to determine a corrective action. For example, *Attard* teaches weighting determinations of collected data 115 from sensors 110 based on factors including precipitation, road conditions, and environmental conditions to generate confidence assessments about the ability of vehicle 101 to operate autonomously. *Attard*, 6:28-35. A POSITA would have understood that each sensor determination that is weighted is *a weighted voting parameter* because the sensor determination is a parameter used to compute Φ or ϕ and by applying a weight to the parameter, it is therefore a weighted voting parameter. Thus, determining a corrective action associated with the fault using a fault-remediation table comprises a weighted voting parameter.

5. Claim 3(d): “the corrective action comprises re-routing the SDV.”

129. *Attard* teaches various corrective actions. See Claim 1(d). Specifically, *Attard* teaches performing a “limp home” operation in response to a fault, as well as

determining a safe path for the vehicle to a “safe stopping point.” *Attard*, 2:46-54, 14:27-41. A POSITA would have understood that a “limp home” operation re-routes the SDV because a driver may be heading to a location such as a store, and a limp home operation would take the SDV along a different route to a different location. Likewise, a POSITA would have understood that autonomously driving the vehicle to a safe stopping point involves re-routing the vehicle from its current position to the safe stopping point, e.g., a shoulder, an off ramp, etc.

IX. GROUND 2: CLAIM 4 IS OBVIOUS OVER *ATTARD* AND *HAMPIHOLI*

A. Claim 4

1. Claim 4(Pre): “A self-driving vehicle (SDV) comprising:

130. *See*, 1(Pre).

2. Claim 4(a): “a sensor system comprising a plurality of sensors;”

131. *See*, 1(a).

3. Claim 4(b): “vehicle controls comprising: engine throttle, steering mechanism, and braking system;”

132. *Attard* teaches its vehicle is operated partially or completely autonomously by autonomous driving module 106 in its computer 105, including specifically the operation of the vehicle’s “steering, braking, [and] speed,” as well as navigation. *Attard*, 9:63-10:12, 14:13-48. A POSITA would have recognized or at least found obvious that controlling the vehicle’s “steering” teaches controlling its

“steering mechanism,” controlling its “braking” teaches controlling its “braking system,” and controlling its “speed” teaches controlling its “engine throttle.” It is established fact that the vehicle’s speed is controlled via the throttle, which controls the fluid flow into the engine, and in a typical non-self-driving vehicle, is controlled by the driver actuating the gas pedal. *See, e.g., Takada* (EX. 1035), 1:13-25. As I discussed in the background section, SDVs typically include the same hardware components for driving as non-SDVs, with the difference between the two being the additional sensors and software added to recognize the environment in order to drive autonomously. *See* Section V.E. Thus, a POSITA would have found it obvious that *Attard*’s disclosures of autonomously controlling the steering, braking, and speed to teach the claimed *engine throttle, steering mechanism, and braking system*.

133. A POSITA would have understood or found obvious that because *Attard* teaches a vehicle operable in manual and autonomous modes and *Attard* defines an autonomous vehicle as being “operated wholly ... without human intervention, i.e., ... autonomous” and its vehicle computer making “decisions concerning vehicle speed, course, etc.,” that *Attard*’s vehicle would have included autonomous control of vehicle controls performing these functions, including changing the vehicle’s speed (engine throttle and braking) and direction (steering mechanism and navigation). *Attard* expressly envisions that its vehicle “may be operated wholly or partly without human intervention,” relying on its central

computer to “operate the vehicle, e.g. to make decisions regarding vehicle speed, course etc.” *Attard*, 1:15-24. A POSITA would have recognized that a vehicle operably performing this function would have autonomously controlled the engine throttle, steering mechanism, braking system, and navigation driver controls. In specific examples, *Attard*’s vehicle may take autonomous actions such as a “slow to a stop,” “pull over and stop,” or “limp home” operation. *Attard*, 2:46-54. Stopping requires control of the engine throttle, and braking system and pulling over requires control of the steering mechanism, while “limping home” would have additionally required controlling navigation. Thus, a POSITA would have recognized each of these autonomous operations would have required control of the engine throttle, steering mechanism, and braking system as recited in 4(b). In another example, *Attard* directly describes how the vehicle’s navigation is autonomously used for avoiding obstacles, pulling to a road shoulder, or slowing to a stop, stating that if a camera were to fail, the vehicle may “continue to a road shoulder based on stored map data, GPS data 115, and/or extrapolating from last known reliably determined lane boundaries.”. *Attard*, 14:13-48. This example from *Attard* comprises control of all four claimed driver controls – the navigation system comprising GPS data is used to continue to a road shoulder (using the steering mechanism) and stop by decreasing the engine throttle and engaging the braking system. *Id.* Though *Attard* does not explicitly use the term “engine throttle,” a POSITA would have recognized *Attard*’s

description of a vehicle autonomously controlling its speed to teach the claimed “engine throttle.”

4. **Claim 4(c): “a computer system comprising a processor coupled to a non-transitory computer readable storage medium containing program code, the program code readable and executable by a processor;”**

134. *See*, 1(Pre).

5. **Claim 4(d): “the computer system is capable of receiving a sensor reading from the system of sensors;”**

135. *See*, 1(a).

6. **Claim 4(e): “the computer system is capable of operating the vehicle controls;”**

136. *See*, 1(Pre), 4(b).

7. **Claim 4(f): “the computer system is capable of determining the operational state of the self-driving vehicle (SDV);”**

137. *See*, 1(a).

8. **Claim 4(g): “the computer system is capable of determining a vehicle fault;”**

138. *See*, 1(b).

9. **Claim 4(h): “the computer system is capable of determining a competence level of the processor;”**

139. *Attard* teaches or renders obvious determining ... whether a fault has occurred and determining whether the fault exceeds a threshold for danger. *See*, Claim 4(g). Further, *Attard* teaches determining a competence level of the processor (CPCL), Φ .

a) '402 Patent's CPCL⁴

140. The '402 Patent characterizes a CPCL as “a competence level of the SDV control processor in controlling the SDV while the SDV experiences the current operational anomaly.” *'402 Patent*, 1:41-48, 10:9-15 (“Various approaches may be used to determine this control processor competence level.”), 10:32-52.

b) *Attard's* CPCL – Capital Φ

141. *Attard's* vehicle confidence assessments 118 are generated in two coexisting forms:

(1) ϕ , a **vector**, “where each value in the vector relates to an attribute [] of the vehicle [] and/or a surrounding environment...such as such as vehicle speed, braking performance, acceleration,...weather conditions, road conditions, etc. *Attard*, 6:4-13. *Attard* teaches determining a fault has occurred due to a particular sub-assessment ϕ_i falling below an associated threshold $\phi_{\min}$, triggering message generation specific to the particular sub-assessment ϕ_i . *See*, 1(b).

(2) Φ , which may be “a **scalar** value, e.g., as a number [] in the range of 0 to 1.” *Attard*, 5:54-6:3. *Attard's* Φ is mapped as the claimed *computer processor*

⁴ For simplicity, I use the acronym CPCL to refer to the competence level of the processor/SDV, which is claimed as both *a competence level of the processor* (Claim 4) and *competence level of a control processor* (Claim 18).

competence level (CPCL) because it “indicates an overall confidence that the vehicle 101 can and/or should be operated autonomously.” *Attard*, 5:54-6:2, 1:44-50 (“The computer 105 may include instructions for determining that an autonomous driving module 106, e.g., included in the vehicle computer 105, may not be able to operate the vehicle 101 autonomously or semi-autonomously with acceptable confidence, e.g., confidence expressed numerically that is lower than a predetermined threshold.”) Thus, *Attard*’s Φ is a CPCL because it indicates whether the autonomous module and, therefore, vehicle 101 can operate autonomously.

142. Though *Attard* does not provide detailed mathematical description regarding Φ , a POSITA would have known various approaches for its calculation. As I discuss below, there were numerous known mathematical methods for converting one or more vectors into a scalar quantity, and it would have been obvious to a POSITA to utilize such a calculation to generate Φ from a plurality of sub-assessments ϕ_i . For example, a POSITA would have understood or found obvious techniques for converting *Attard*’s **vector** confidence assessments ϕ directly to a **scalar** via a well-known mathematical method (e.g., computing magnitudes of ϕ^{PL} and ϕ^{AL} and summing or averaging their values, or computing the dot product of ϕ^{PL} and ϕ^{AL}) to yield overall confidence assessment Φ (a scalar value). I note that *Attard* does not expressly teach a specific method for performing such conversion, but a POSITA would have understood or found obvious using any number of

mathematical approaches for such a calculation. I note claim 4 does not require any particular mathematical relationship between Φ (the mapped CPCL of limitation 1(h)) and ϕ . Therefore, in my opinion, any mathematical approach for calculating *Attard's* Φ would have satisfied claim 1, including approaches in which Φ is not directly calculated using ϕ whatsoever. For instance, each of Φ and ϕ may, in some embodiments, have been independently calculated from sensor data. *Attard* is not specific on how each are calculated, and the difference does not matter to the claims of the '402 Patent. A POSITA would have understood any number of approaches for calculating each of the values, potentially using simple vector mathematics. However, a POSITA would have understood that an approach using ϕ to calculate Φ would have made sense within *Attard*.

143. As discussed regarding 1(c), *Attard* teaches a plurality of $\phi_{\min}$ thresholds per sub-assessment ϕ_i , where each value of ϕ_i may influence the message generation. *Attard*, 7:62-8:39. I note that *Attard* teaches various messages can be generated, where the different messages indicate different levels of severity, such as “Danger,” “Deadly,” and “Notice,” for example. In particular, one $\phi_{\min}$ threshold is a “threshold for danger.” *See*, 1(c) (explaining that *Attard* teaches “exceeding” a threshold for danger).

10. Claim 4(i): “the computer system is capable of determining competence level of a human driver;”

a) *Hampiholi's* Competence Level of a Human Driver

144. *Hampiholi* teaches a system and method of determining a competence level of a human driver in controlling its vehicle, as measured by the severity level of distraction the driver is experiencing. Examples given of distractions experienced by drivers include not looking at the road for upcoming turns, being distracted by music, handling (e.g., providing user input to) infotainment units, being sleepy or tired, and/or other driver states. *Hampiholi*, [0001]-[0004], [0050]. Specifically, *Hampiholi* teaches that a severity rank R is determined, measuring the distraction level of the driver.

145. For example, a low-level severity rank R may indicate a short-lived driver distraction while the vehicle is not in immediate danger of collision, while a medium-level severity rank R may include a more serious driver distraction, (e.g., droopy eyes indicating sleepiness) while the vehicle is in an otherwise safe environment (e.g., no objects within a trajectory/path of the vehicle, driving at a low speed), and a high-level severity rank R may include any driver distraction while an object in the vehicle's environment is on a colliding course with the vehicle. *Hampiholi*, [0057]. In these examples, the vehicle synthesizes data about the human driver's performance at piloting the vehicle (that is, the driver's competence level) and combines that data with context reflecting the current operational state of the vehicle itself, such as objects in the vehicle's path or the vehicle's speed. The method uses this information to determine the severity rank R of the driver's distraction.

Exemplary severity ranks R are illustrated in Fig. 7 below, corresponding to detected human behaviors and road/vehicle conditions indicating the situation.

Distraction	Road/Vehicle Condition	Severity Rank (R)
Driver not looking ahead	Vehicle stopped at traffic signal	1
Parking light off	Vehicle parked in garage	1
Driver talking on the phone	Using hands free, freeway, no upcoming turns, medium speed	4
Parking light off	Vehicle parked on side of freeway	5
Driver not looking ahead	Vehicle not in reverse gear, high vehicle speed, upcoming turn within city limits	8
Driver talking on the phone	Not using hands free, upcoming turns within city limits, high speed	8

FIG. 7

Hampiholi, FIG. 7 (annotated). As is shown in Figure 7, *Hampiholi*'s severity rank R is higher for a more-distracted driver, such as a driver talking on the phone while driving at high speed in the city (rank 8), and lower for a less-distracted driver, such as a driver not looking ahead while stopped at a traffic signal (rank 1). *Hampiholi*'s severity rank R is a human driver competence level even though the severity rank R is higher for a more-distracted driver than a less-distracted driver because the severity rank still indicates the competence of the driver. A POSITA would have

been capable of using *Hampiholi's* severity rank R as an indicator of the competence of the driver's ability to safely operate the vehicle regardless of the directionality of scale being used, at most requiring mathematical treatment using known computer programming techniques to account for an inversion of the numerical scale. Whether to make the severity rank R number larger or smaller for a more-distracted driver compared to a less-distracted driver is a mere design choice that would have been obvious to try inverted, if necessary. For example, a simple computer program that sets an HDCL "H" equal to $9-R$ would have yielded $H=1$ for severity rank $R=8$ and $H=9$ for severity rank $R=1$, effectively inverting the scale with at most a few lines of computer code. This is merely one example provided to show how simple it would have been to invert the scale, and is not intended as being required for the *Hampiholi* vehicle and method to teach the HDCL of claim 4.

146. *Hampiholi's* severity rank R teaches a competence level of the human driver in controlling the SDV. For instance, if a deer were to run out in front of the vehicle, an attentive driver would have more time to react by slowing and/or swerving the vehicle than a distracted driver. Thus, the more attentive driver is the more competent driver. A distracted driver is more likely to veer out of their lane or cause a rear-end collision with a stopped vehicle. An attentive driver would be more competent at avoiding unexpected obstacles in the road or adjusting the operation of the vehicle to account for inclement weather. Also, a driver paying more attention

would allow for more possible corrective actions (e.g., transition to manual, disable one or more autonomous driving features, automatically slow to a stop) because a driver paying more attention would allow for sufficient lead time to safely transition to manual mode or disable an autonomous driving feature. For example, it was known that SDVs required sufficient lead time to transition to manual mode. *J3016*, 4. In the case where the driver is severely distracted, the sufficient lead time may be such that the transition to manual mode is not sufficient to avoid an unsafe condition, forcing the vehicle to transition to a minimal risk condition. If a driver is asleep or otherwise not paying sufficient attention (lower competence level), transitioning to manual mode would be more dangerous, and corrective actions may be limited to automatically slowing/stopping the vehicle in the minimal risk condition.

b) Motivation to Combine *Attard-Hampiholi*

147. A POSITA would have been motivated and found it obvious to combine *Attard's* SDV with the vehicle, methods, and supporting hardware disclosed by *Hampiholi* to result in a safer vehicle, able to account for unsafe driving situations arising from weather conditions (e.g., wet/icy roads) or hardware faults, per *Attard*, and/or a reduction in driver competence due to distraction, per *Hampiholi*. A POSITA would have recognized that a vehicle capable of detecting and responding to a physical state of a human, such as drowsiness or distraction would have been safer than the unmodified *Attard* vehicle. A POSITA would have recognized

Hampiholi's goal of improving driver and bystander safety as an express motivation for incorporating its methods and supporting hardware into *Attard*. *Hampiholi*, [0002]. *Attard's* automation goal would have been furthered by enabling the vehicle to detect and respond to faults in driver performance, per *Hampiholi*, using components that were already present in the *Attard* vehicle, such as cameras. *Attard*, 9:40-58. Further, these modifications would have been use of a known technique of applying various vehicle hardware and software to allow for additional self-driving functionality in the *Attard-Hampiholi* vehicle and would have improved *Attard's* and *Hampiholi's* similar vehicles in the same way – by enabling the vehicle to detect and respond to distracted driving. While this modification may add additional complexity to *Attard's* vehicle, a POSITA would have been motivated to make such a tradeoff to achieve *Hampiholi's* benefits. A POSITA would have appreciated that reducing distracted driving increases driver, passenger, and bystander safety, as expressly stated by *Hampiholi*. *Hampiholi*, [0002].

148. The combined *Attard-Hampiholi* vehicle would have desirably been capable of self-driving and implementing corrective actions when appropriate, whether due to detected reduced processor competence (per *Attard*) or due to detected reduced human competence (per *Hampiholi*). A POSITA would have had the skill, found it obvious, and been motivated to configure the combined vehicle to intelligently blend the two systems, accounting for situations in which the human

driver competence and the computer processor competence levels are both imperfect, choosing appropriate corrective actions (or no corrective action) in response to detected sensed conditions as a particular situation dictates. A POSITA would have *Hampiholi's* statement of increasing driver, passenger, and bystander safety as an express teaching, suggestion, or motivation to modify *Attard's* SDV to adjust its driving mode to respond to faults such as hardware failures or weather conditions as well as decreased driver competence. *Hampiholi*, [0002], [0017]. Such a modification is merely the combination of known prior art elements (*Hampiholi's* sensors and methods into *Attard's* already-automated vehicle) according to known methods to yield predictable results of a car operable to autonomously perform corrective actions such as slowing to a stop or pulling over in response to driver incompetence as well as weather conditions and hardware faults. For example, a POSITA may have configured the system to alert the driver to take over manual driving if *Hampiholi's* severity rank R indicated the driver was sufficiently competent (i.e., low distraction severity rank R) to prevent abuse of the autonomous system (see, e.g., *McNew*, FIG. 7A, 19:46-20:39), but configuring the system to slow to a stop if the severity rank indicated the driver was completely asleep or unconscious (eyes fully closed for a period of time). A POSITA would have had a reasonable expectation of success for the combination at least because the *Attard* vehicle already included the processor, memory, and sensor infrastructure necessary

to support *Hampiholi's* methods, and modification would have at most merely required addition of well-known inward-facing cameras and software reprogramming techniques available to a POSITA. Such cameras were well-known and widely used in the vehicles prior to the '402 Patent.

11. Claim 4(j): “the computer system is capable of determining a corrective action using the competence level of the processor and the competence level of the human driver;”

149. The *Attard* combination teaches *the computer system is capable of determining a corrective action using the competence level of the processor. See Claim 4(h). Attard* modified by *Hampiholi* teaches *the computer system is capable of determining a corrective action using the competence level of the processor and the competence level of the human driver. As further discussed regarding 4(i), Hampiholi* teaches *determining a competence level of a human driver* as measured by the severity level of distraction the driver is experiencing, such as not looking at the road for upcoming turns, being distracted by music, handling infotainment units, or being sleepy/tired. *See, 4(i) citing Hampiholi, [0001]-[0004], [0050].*

150. As also discussed with respect to Claim 4(h), *Attard* teaches sending a message 116 when Φ is below $\Phi_{\min}$. *See Claim 4(h); Attard, 7:62-65. Attard* teaches or renders obvious that $\Phi_{\min}$ is “a threshold provided by the parameter 117.” *Attard, 5:62-65, 10:53-11:4. Specifically, Attard* teaches the following. First, *Attard* teaches comparing the confidence assessments 118 (Φ) to a parameter 117.

A memory of the computer 105 may further store one or more parameters 117 for comparison to confidence assessments 118. Accordingly, a parameter 117 may define a set of confidence intervals; when a confidence assessment 118 indicates that a confidence value falls within a confidence interval at or passed a predetermined threshold, such threshold also specified by a parameter 117, then the computer 105 may include instructions for providing an alert or the like to a vehicle 101 operator.

Attard, 5:21-30. Second, *Attard* teaches parameter 117 is “associated with a particular vehicle 101 operator” and “may be determined in a variety of ways, e.g., according to operator age, level of driving experience, etc.” *Attard*, 5:33-37. Thus, *Attard* itself envisions parameter 117 may account for the driver’s ability to operate the vehicle, e.g., for the *competence level of the human driver*. A POSITA would have been motivated and found it obvious to modify *Attard*’s computer system such that $\Phi_{\min}$ is substituted with *Hampiholi*’s severity rank R or is based on severity rank R (HDCL). At least because *Hampiholi*’s severity is, like *Attard*’s parameter 117 “associated with a particular vehicle 101 operator, a POSITA would have found it obvious to modify *Attard* with *Hampiholi*’s severity rank R. *Attard*, 5:33-37. Thus, in the *Attard-Frazer-Hampiholi* combination, *Attard*’s Φ (CPCL) is either compared directly to *Hampiholi*’s severity rank R (HDCL), i.e., the modification is a simple substitution, or *Attard*’s parameter 117, which is used to determine $\Phi_{\min}$, is modified to be based on severity rank R, where the modification is use of a known technique.

For example, in my opinion, it would have been obvious to modify *Attard* such that $\Phi_{\min}$ based on *Hampiholi's* severity rank R instead of (or in addition to) the age or level of driving experience disclosed by *Attard*. This would have predictably improved *Attard's* system by providing a safer transfer protocol that is based on real-time data, per *Hampiholi's* teachings. Alternatively, instead of basing parameter 117 on severity rank R, a POSITA would have found it obvious and been motivated to substitute $\Phi_{\min}$ with R. Severity rank R, like Φ and $\Phi_{\min}$, is a scalar value. *Attard*, 5:66-6:2. Thus, it would have been an easy modification to substitute one scalar (severity rank R) for another scalar ($\Phi_{\min}$).

151. Parameter 117 is “associated with a particular vehicle 101 operator” and “may be determined in a variety of ways, e.g., according to operator age, level of driving experience, etc.” *Attard*, 5:33-37. Thus, *Attard* itself envisions parameter 117 may account for the driver’s ability to operate the vehicle.

152. A POSITA would have been motivated and found it obvious to modify *Attard's* computer system such that $\Phi_{\min}$ is supplemented with *Hampiholi's* severity rank R or is based on severity rank R (HDCL). Thus, in the *Attard-Hampiholi* combination, *Attard's* Φ (CPCL) is either compared directly to *Hampiholi's* severity rank R (HDCL), i.e., the modification is a simple substitution, or *Attard's* parameter 117, which is used to determine $\Phi_{\min}$, is modified to be based on severity rank R, where the modification is use of a known technique. As I have previously discussed,

the corrective action is or results from Φ falling below $\Phi_{\min}$ such that modifying *Attard* to modify $\Phi_{\min}$ based on severity rank R or modifying *Attard* to substitute $\Phi_{\min}$ with severity rank R, renders obvious *determining a corrective action using the competence level of the processor (Φ) and the competence level of the human driver* (severity rank R).

153. Because *Attard* teaches determining to send message 116 when Φ is below $\Phi_{\min}$, and in the combination, $\Phi_{\min}$ is substituted or modified using *Hampiholi's* severity rank R, the *Attard-Hampiholi* combination teaches or renders obvious *determining a corrective action using the competence level of the processor and the competence level of the human driver*.

a) Motivation to Combine *Attard-Hampiholi*

154. A POSITA would have been motivated and found it obvious to modify *Attard's* $\Phi_{\min}$ based on *Hampiholi's* HDCL (severity rank R) teachings such that *Attard's* determination of sending a message 116, which *determin[es] a corrective action* (Claim 4(h)), *us[es] the competence level of the processor and the competence level of the human driver*. Namely, a POSITA would have found it obvious and been motivated to modify *Attard* accordingly to improve *Attard's* handover decision making by also accounting for the driver's current state in determining a corrective action to take. As I discussed in the Background, it was

well known for various safety reasons to ensure a driver of an SDV was prepared to accept manual control of the vehicle when needed. *See* V.D.1.

155. Additionally, *Attard* provides a teaching, suggestion, or motivation to do so by teaching that parameter 117 (used to determine $\Phi_{\min}$) is “associated with a particular vehicle 101 operator.” *Attard*, 5:33-37, 10:53-11:4. For example, *Attard* teaches the parameter can be determined “according to operator age, level of driving experience etc.” However, *Attard* does not expressly teach using a parameter such as *Hampiholi*’s severity rank R. Thus, a POSITA would have found it obvious to use or substitute other driver-related information, i.e., *Hampiholi*’s severity rank R, into $\Phi_{\min}$ to provide a safer and/or more accurate method by which to determine the recommendation resulting from *Attard*’s message 116. For example, a POSITA would have found it obvious that a driving-experience-related parameter 117 for a less-experienced driver would have a lower associated threshold ($\Phi_{\min}$) to reduce the likelihood Φ is below $\Phi_{\min}$ so vehicle 101 is more likely to be driven autonomously.

156. A POSITA would have recognized the advantages of using a more dynamic $\Phi_{\min}$ to determine whether to recommend a switch to manual even if such a modification required the tradeoff of more computing power or hardware to determine *Hampiholi*’s severity rank R as a POSITA would have appreciated the added safety benefits to be worth any added cost. Thus, based on these teachings, a POSITA would have found it obvious to include *Hampiholi*’s driver-related

parameter (severity rank R) to increase the safety of *Attard's* vehicle 101 by ensuring the driver is prepared for the handover. This is at least because accounting for the driver's state was well-known in handover processes. *See* V.D.1 (*citing Scofield, Caveney*).

157. This modification would have required only straightforward programming changes to *Attard's* computer 105 to determine $\Phi_{\min}$ based on the determined HDCL (per *Hampiholi*), thus combining known techniques according to known programming methods, yielding the predictable result of an SDV using both an HDCL and CPCL in *determining a corrective action*. *Hampiholi's* severity rank R , like *Attard's* Φ , is taught as being a scalar value. *Hampiholi*, [0066], FIG. 7; *Attard*, 5:66-6:3. Thus, the software change would have been a simple reprogramming to compare two scalar values and to take an action based on the result of the comparison. Adding (or substituting) an additional scalar for comparison against *Attard's* Φ would have been within the skill of a POSITA and would have used hardware already present in the combination, leading to a reasonable expectation of success. A POSITA would have appreciated that there would have been an increase in the accuracy and appropriateness of the corrective action determined when additional information (the driver's distraction level) is accounted for in the process of *determining a corrective action*. Particularly, the diversity of the type of information being considered (driver's distraction level as

opposed to more abstract data, e.g., driver's age) would have led a POSITA to appreciate the desirability of combining *Hampiholi's* HDCL.

158. Additionally, to the extent it is argued such a modification would have required hardware/software modifications to compute *Hampiholi's* severity rank R, a POSITA would have had a reasonable expectation of success in doing so as well. First, *Attard* already teaches in vehicle sensors for analyzing the operator.

A data collector 110 may further include biometric sensors 110 and/or other devices that may be used for identifying an operator of a vehicle 101. For example, a data collector 110 may be a fingerprint sensor, a retina scanner, or other sensor 110 providing biometric data 105 that may be used to identify a vehicle 101 operator and/or characteristics of a vehicle 101 operator, e.g., gender, age, health conditions, etc. Alternatively or additionally, a data collector 110 may include a portable hardware device, e.g., including a processor and a memory storing firmware executable by the processor, for identifying a vehicle 101 operator. For example, such portable hardware device could include an ability to wirelessly communicate, e.g., using Bluetooth or the like, with the computer 105 to identify a vehicle 101 operator.

Attard, 4:18-31. Thus, it would have been straightforward to leverage *Attard's* biometric sensors to compute severity rank R and/or a POSITA would have been motivated to include additional sensors to modify the driver, per *Hampiholi*, because *Attard* already expressly contemplates similar sensors. Second, because such driver

monitoring systems were well known before the '402 Patent, a POSITA would have had a reasonable expectation of success in modifying *Attard* based on *Hampiholi's* teachings. *See* V.D.1.

159. Thus, the *Attard-Hampiholi* vehicle would have a computer system capable of using *Attard's* CPCL and *Hampiholi's* HDCL to determine a corrective action, as claimed.

12. Claim 4(k): “the computer system is capable of implementing the corrective action; and”

160. *See*, 1(d)-1(e). *Attard* teaches a computer system capable of implementing corrective actions such as ceasing autonomous operations. *Attard*, 13:45-49, 2:46-54.

13. Claim 4(l): “the computer system is capable of issuing an alert indicating the corrective action.”

161. *See*, 1(d)-1(e). *Attard* teaches issuing an alert indicating a corrective action. *Attard's* message 116 is an *alert indicating a corrective action*. For example, *Attard* teaches messages indicating “immediate manual control is recommended” for reasons such as “mechanical,” “environmental or weather conditions,” and “traffic conditions.” *Attard*, 2:61-3:4. Further, these messages can be formed with a “requested action” such as a “driver intervention.” *Attard*, 8:36-37.

162. As discussed above, *Attard* teaches implementing corrective action(s).
See Claim 1(d), 4(l). Petitioner notes a fault-remediation table is not recited in Claims 4 or 6, so *Frazer's* teachings are not utilized here.

X. GROUND 3: CLAIM 6 IS OBVIOUS OVER *ATTARD*, *HAMPIHOLI*, *MCNEW*, AND *SCOFIELD*

A. Claim 6

1. Claim 6(Pre): “The SDV of claim 4, further comprising:”

163. *See* 4(Pre) (*Attard-Hampiholi* SDV).

2. Claim 6(a): “the sensor system comprises sensors that detect a physical state of the human driver;”

164. *McNew* teaches “managing vehicle control states of a semi-autonomous vehicle while simultaneously managing a driver state of a driver, which can include driver steering interaction.” *McNew*, 1:17-21. *McNew's* driver states include “steering states such as DRIVER_IS_STEERING, HANDS_ON, and HANDS_FREE.” *McNew*, 4:6-18. Each of these states are *a physical state of a human driver* because they track the driver’s *physical* interaction with a steering wheel. In particular, whether a driver’s hands are on the steering wheel is tracked, e.g., using a “steering wheel grip sensor [that] can detect whether the driver’s hands are in contact with the steering wheel and can include one or more tactile, pressure, or capacitive sensors.” *Id.*

a) Motivation to Combine *Attard-Hampiholi-McNew*

165. A POSITA would have found it obvious and been motivated to modify *Attard-Hampiholi* with *McNew*'s teachings of steering wheel sensors to monitor a physical state of the human driver. As I discuss herein, *McNew*'s physical state of a human driver enhances the *Attard-Hampiholi* SDV by monitoring whether a driver is paying attention to driving by monitoring whether the driver has his/her hands on the steering wheel. Making sure a driver is paying attention to the road means a driver can be ready to take over manual control when needed, for example if a sensor fails or road conditions become poor. Such a modification would have improved *Attard*'s fault handling system to make decisions based on additional information, such as the current state of the driver as taught by *McNew*. Utilizing additional information would have allowed the *Attard-Hampiholi-McNew* SDV to make more informed decisions by taking into consideration not just the state of the vehicle but also the state of the driver. In this way, *Attard-Hampiholi-McNew* will take corrective actions that are more tailored to the situation precisely because the driver's physical state (e.g., gripping a steering wheel or hands are not on the steering wheel) is considered when determining if a fault has occurred and/or determining what corrective action to take. As I discuss below, one exemplary corrective action is transferring autonomous controls to manual control. *See* Claim 6(e).

166. While *Attard* teaches determining how to handle faults in SDVs, *Attard* does not teach driver-related faults. For example, *Attard* does not teach monitoring

whether a user is gripping a steering wheel or maintaining eye gaze focused toward the roadway. While *Hampiholi* teaches driver-related faults, *Hampiholi* does not expressly teach a fault related to input from a steering mechanism sensor, which is required by Claim 6(b). A POSITA would have understood that driver-related faults still need to be considered in SDVs and, as such, would have been motivated to turn to references teaching such, e.g., *McNew*. Taking this information into consideration would have provided a more robust and comprehensive analysis of the driving situation. For example, *McNew* teaches monitoring driver-related faults such as whether a driver's hands are on the steering wheel. *McNew*, 4:6-29, 3:26-52, 5:4-15. In the case where a driver's hands are not on the steering wheel, the driver may not be ready to take over manual control of the vehicle in that moment. By tracking the human driver's physical state, the SDV is thus aware of both the vehicle's status and the human driver's status.

167. Such a combination is merely the combination of known prior art elements according to known methods to yield predictable results, i.e., the combination of *McNew*'s detection of driver steering state with *Attard*'s fault handling system to yield the predictable result of *Attard*'s fault handling system to take a corrective action further based on a detected physical state of the driver. Such a use of a known technique of monitoring the physical state of a driver including taking sensor readings of input from a steering mechanism sensor would have been

use of a known technique from *McNew* that would have improved *Attard-Hampiholi* in the same way as *McNew*. A POSITA would have had a reasonable expectation of success at least because monitoring driver state was well-known in the art before the '402 Patent and further because such would have required only straightforward changes to the *Attard*'s software, e.g., to detect driver input via a steering mechanism state. I note that modifying software instructions would have been a straightforward modification well-within the skillset of a POSITA. As I discussed above for Claim 4, *Hampiholi* teaches determining a competence level of a human driver and the modification for Claim 4 would have included utilizing any necessary hardware, such as cameras. Here, a well-known steering wheel sensor, such as taught by *McNew*, would have been utilized to monitor the physical state of the driver. Thus, to the extent the vehicle needs to be modified for additional hardware, this modification would have been straightforward, using known components, and a POSITA would not have had to personally install (that is, would not have had to bodily incorporate) such a sensor because this would have been accomplished during vehicle production and/or by an automotive technician.

3. Claim 6(b): “the sensor readings comprise an input from a steering mechanism sensor;”

168. *McNew* teaches monitoring a driver's behavior and level of attention and also monitoring input from a steering mechanism sensor. *McNew*, 4:6-29 (“steering wheel grip **sensor**”), 3:26-52 (“desired driver state (e.g., driver must steer,

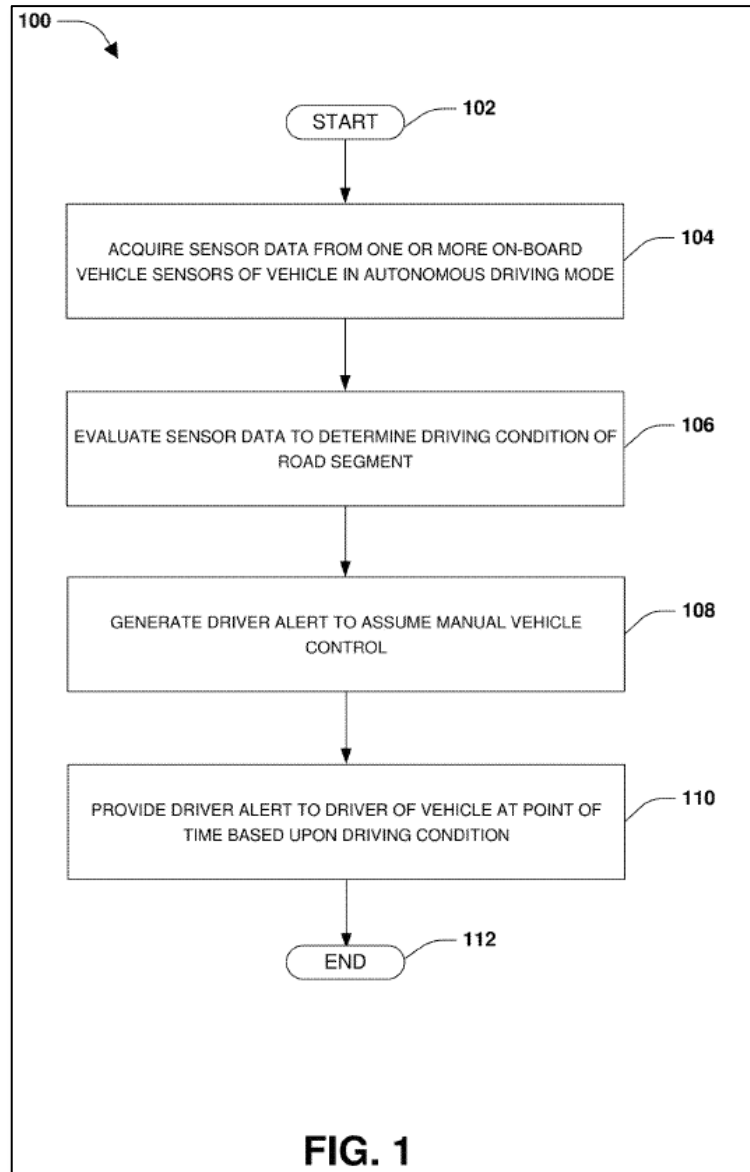
driver must have hands on steering wheel, or driver must look at road.”)), 5:4-15 (“If the driver currently has hands off the steering wheel, the SAMM can issue a warning to the driver via a human-machine interface (HMI) to place his or her hands back on the steering wheel.”), 7:61-64 (“A steering wheel torque sensor 220 can detect if the driver is actively steering the vehicle...”). A motivation to modify *Attard-Hampiholi* per *McNew* is discussed above and incorporated by reference herein. See Claim 6(a).

4. Claim 6(c): “the computer system determines the competence level of the processor using active learning data, said active learning data including information from other SDVs;”

a) *Scofield’s* Teachings

169. *Scofield* teaches “notifying a driver to assume manual vehicle control” of an autonomous vehicle using “driving condition data.” *Scofield*, 3:9-22. The driving condition data “may correspond to an aggregation of vehicle sensor data from one or more vehicles while the one or more vehicles” were traveling a road segment. *Scofield*, 3:22-30, 3:12-22 (describing autonomous vehicles sending sensor data to a remote communication device). In more detail, *Scofield* teaches the driving condition data can be that “vehicles may have reported, to the remote computing device, information regarding braking patterns, speed, deceleration, vehicles being driven in reverse, and/or other information indicative of a traffic obstruction.” *Id.* Because the driving condition data is data from other autonomous vehicles, it is *active learning data including information from other SDVs*.

170. The driving condition data, along with vehicle sensor data, is “evaluated to determine a driving condition of the expressway onramp road segment that is to be traveled by the vehicle,” and “responsive to determining that the driving condition exceeds a complexity threshold for autonomous driving decision making functionality, a driver alert to assume manual vehicle control may be generated.” *Scofield*, 3:53-56, 4:4-8, FIG. 1 (steps 106 and 108). *Scofield’s* FIG. 1 method is shown below:



Scofield, FIG. 1.

171. *Scofield* provides a number of examples of what the complexity threshold could be:

[T]he complexity threshold may correspond to a number of pedestrians in a crosswalk, a conditions and/or parameters that autonomous driving decision making functionality is unable to interpret (e.g., an airplane

flying towards the vehicle during an emergency landing), conditions and/or parameters that are computationally too expensive to calculate within an adequate time for resolving a driving action before reaching the road segment (e.g., autonomous driving decision making functionality may be unable to timely resolve a driving decision before reaching the expressway onramp), an inability to resolve a driving decision that provides a safe or desirable result (e.g., the ethical decision corresponding to the car, unable to stop in time, that can either swerve out of a pedestrian's way into oncoming traffic or onto a sidewalk with other pedestrians), etc.

Scofield, 4:4-22.

172. Because the driving condition is evaluated against “a complexity threshold for autonomous driving decision making,” it is a *competence level of the processor*. That is, like the '402 Patent's CPCL, which is compared against a minimum competence level threshold to determine whether to drive manually, *Scofield's* driving condition is compared against the complexity threshold to determine whether to send a manual vehicle notification such that *Scofield's* driving condition is likewise a CPCL. '402 Patent, 14:41-44. Therefore, because *Scofield* teaches the driving condition (*competence level of the processor*) is based on the driving condition data (*active learning data*), *Scofield* teaches Claim 6(e).

b) Motivation to Combine *Attard-Hampiholi-McNew-Scofield*

173. A POSITA would have found it obvious and been motivated to modify *Attard's* Φ computation (*competence level of the processor*) with *Scofield's* teachings of determining whether to autonomously operate based on *active learning data*. This would have predictably improved *Attard's* Φ computation to account for information from other vehicles, which may not be available to *Attard's* vehicle's sensors 110 but would still be useful in determining a recommendation to cease autonomous operations. For example, so modified, the *Attard-Hampiholi-McNew* system could account for situations based on data that may be undetectable by *Attard's* sensors 110, e.g., "a vehicle changing into a reverse gear. *Scofield*, 3:33-34. This would have improved *Attard's* Φ computation to account for additional data to determine whether actions should be taken.

174. Such a combination is merely the combination of known prior art elements (*Attard's* Φ and *Scofield's* driving condition based on active learning data) according to known methods to yield predictable results where the only difference between prior art and claimed invention is lack of the combination of the known elements in a single reference. When combined, each element would perform the same function separately as when combined, with *Scofield's* driving condition determination being used to augment *Attard's* Φ computation to determine whether self-driving should be carried out based further on data from other vehicles. A similar scenario is expressly envisioned by *Attard* in which *Attard's* Φ accounts for

an upcoming road closure. *Attard*, 10:28-31. Thus, a POSITA would have appreciated the benefits provided by *Scofield's* teachings, which also relate to improving decision making for a vehicle based on future events the vehicle will encounter. As such, a POSITA would have been motivated and found it obvious to modify the *Attard-Hampiholi-McNew* computer program product/SDV further with *Scofield's* teachings.

175. A POSITA would have recognized the results of the combination to be predictable because both *Attard* and *Scofield's* CPCL computations are directed to determining whether to operate an SDV in autonomous or manual mode. Given *Attard* already teaches V2V methods, modifying *Attard* with *Scofield's active learning data* teachings would have yielded predictable results and a reasonable expectation of success. Such a use of a known technique would have improved *Attard* and *Scofield's* similar vehicles and computer program products in the same way by enabling *Attard's* Φ computation to take into account data from other vehicles to the extent such is not taught by *Attard* already.

176. Further still, *Attard* contemplates incorporating weather reports and other data from a server 125 into its confidence assessment calculations (*Attard*, 6:61-7:5); however, *Attard* does not teach the server 125 can receive the weather data from other vehicles. *Scofield* teaches such (*see, e.g., Scofield*, 3:17-22), and for this additional reason there would have been a reasonable expectation of success.

Further, the standard message set for sending weather data between vehicles was standardized before the '402 Patent. *Harding* (Ex. 1037), 79, 77 (discussing ambient air temperature, wiper status, and rain sensors). Lastly, *Attard* and *Scofield* both teach implementing their methods in computer programs. *Attard*, 15:12-46; *Scofield*, 7:1-25, 8:5-17. Thus, modifying *Attard-Hampiholi-McNew* per *Scofield* would have required only straightforward modifications to programming instructions, which was well-within the skillset of a POSITA. For example, it would have been straightforward to incorporate *Scofield's* driving condition data (*active learning data*) teachings into *Attard's* Φ computation and/or as another vector component of ϕ^{PL} or even as a separate ϕ vector entirely.

5. Claim 6(d): “the computer system determines the competence level of the human driver using the sensor readings;”

177. *See* 4(i).

6. Claim 6(e): “the corrective action is to transfer vehicle controls to the human driver;”

178. As discussed above, *Attard* teaches implementing corrective action(s). *See* Claim 1(d). Petitioner notes a fault-remediation table is not recited in Claims 4 or 6, so *Frazer's* teachings are not utilized here.

a) *Attard* Teaches Alerting a Human Driver to Take Over Immediately

179. *Attard* teaches *corrective action[s]* including providing a message to a human driver including audio and/or visual alerts. *See* Claim 1(d). *Attard* also teaches the alerts can include an “urgency” component, for example, indicating a need for the driver to take over manual control immediately. For example, *Attard* teaches messages 116 (“e.g., an alert”) can “convey a level of urgency or importance to a vehicle 101 operator, e.g., by using prosody techniques to include emotional content in a voice alert, a visual avatar having an appearance tailored to a level of urgency, etc.” *Attard*, 2:28-46. In particular, *Attard* teaches alerting the driver with a high level of urgency to take over manual control immediately. *Attard*, 2:55-61 (“an alert may inform the vehicle 101 occupant of a need to resume partial or complete manual control of the vehicle 101.”), 2:62-3:4 (“to indicate a level of urgency, e.g., immediate manual control is recommended.”), 7:39-61 (“a warning for a vehicle 101 occupant to take over steering, to institute manual braking, to take complete control of the vehicle 101.”).

180. As I discussed above for Claim 1(b), *Attard* teaches several exemplary levels of severity, including “Deadly,” “Danger,” “Warning,” “Caution,” and “Notice,” where “Deadly” indicates the highest level of severity and “Notice” indicates the lowest level of severity. Thus, if sub-assessment ϕ_i falls below $\phi_{\min}$, the severity of the fault is determined, which in some cases means the fault has *exceeded a threshold for danger*. For example, severity levels of “Danger” and “Deadly”

exceed a threshold for danger. A POSITA would have understood that the value of ϕ_i when compared to one or more thresholds $\phi_{\min}$ thus determines the severity level, and an appropriate corrective action is taken. *See Attard*, 7:18-9:10. In at least some cases, an appropriate corrective action is warning the driver to “take over steering,” “take over complete control of the vehicle,” “immediate manual control is recommended, manual control may be recommended within the next minute,” and other suitable time frames. *Attard*, 2:55-3:4, 7:39-61. In one example, *Attard* teaches corrective actions include “the first vehicle 101 disabling and/or ceasing one or more autonomous operations, e.g., steering control, speed control, adaptive cruise control, lane maintenance, etc.” *Attard*, 3:9-13. A POSITA would have understood that such operations are for driving autonomously and that disabling and/or ceasing the one or more autonomous operations would have been transferring driver controls to manual mode.

181. To the extent it is argued that *Attard* merely warns the driver but does not actually transfer driver controls to manual control, *McNew* teaches it.

b) *McNew* Teaches Transferring Driver Controls to Manual Control

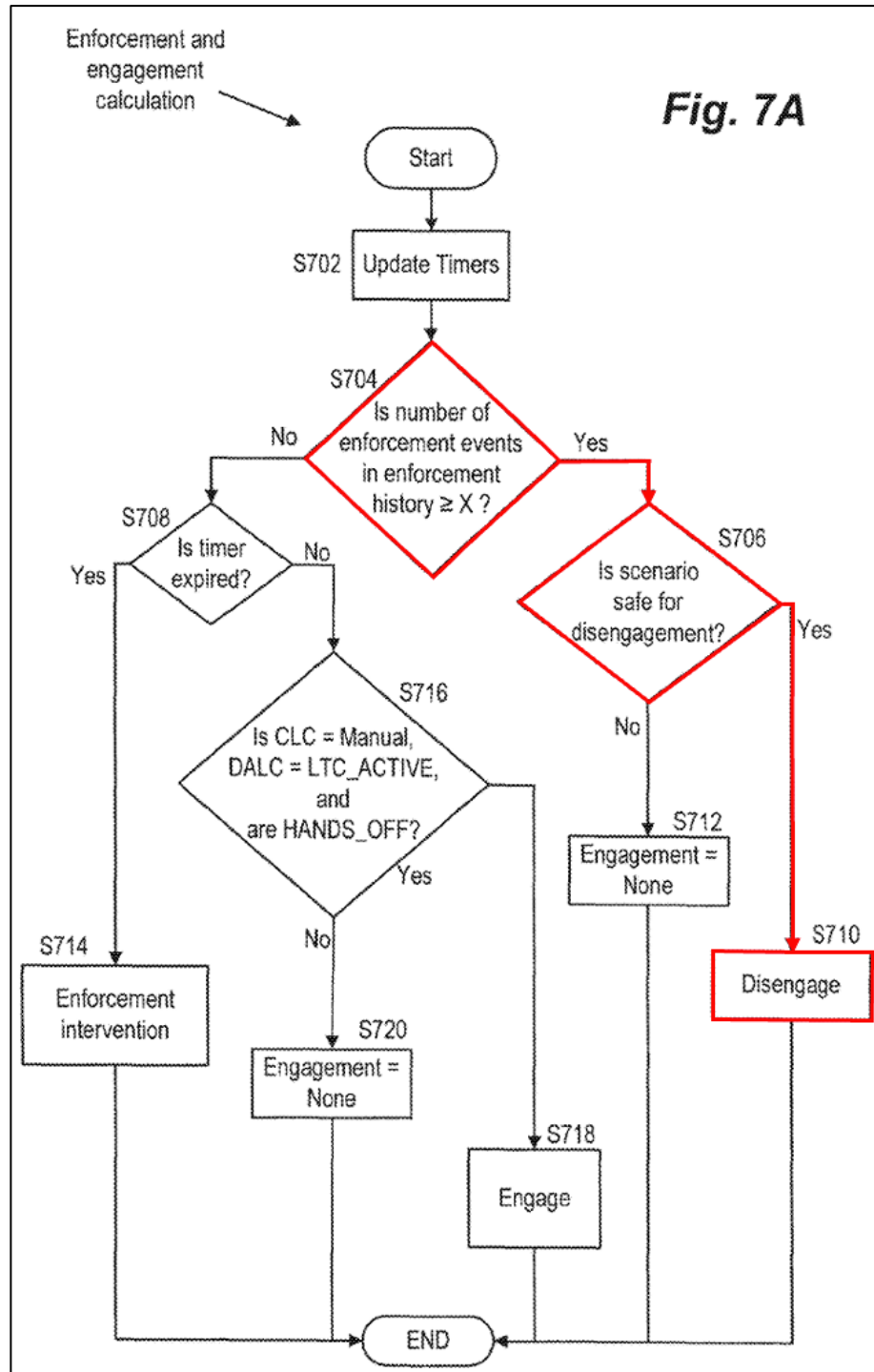
182. *McNew* teaches managing vehicle control states of a semi-autonomous vehicle (e.g., semi-autonomous, manual) while also managing a driver state (e.g., whether the driver is paying attention to the road). *McNew*, 1:17-21. *McNew*’s vehicle has a semi-autonomous mode manager (SAMM) to manage the control

states, including control states of a lane trace control (LTC) system. *McNew*, 3:15-21. The LTC system includes several states, including MANUAL (where the LTC system is on and sensing, but the driver is in control) and OFF (where the LTC system is off). *McNew*, 3:59-4:5. To enhance safety of the semi-autonomous driving system, *McNew* teaches monitoring driver states such as driver attention and taking actions such as warning the driver or reducing vehicle speed if the driver is not paying sufficient attention. *McNew*, 1:17-30, 1:59-65, 6:15-28.

183. In one example, if a driver continues ignoring warnings, *McNew* teaches disengaging the semi-autonomous⁵ driving system as long as the current driving scenario is “safe enough.” *McNew*, 20:7-31, 4:3-5, 8:41-44. Specifically, *McNew*’s system determines if the semi-autonomous mode should be disengaged due to a factor such as driver inattention (Step S704), determines if it is safe enough to disengage the semi-autonomous mode (Step S706), and disengages the semi-automatic driving system by “shutting down the semi-automatic driving

⁵ *McNew* refers to its system as both “semi-autonomous” and “semi-automatic.” *McNew*, 1:7-13, 1:59-65, 6:15-28 (referring to both “semi-autonomous” and “semi-automatic” driving system), 20:7-31. A POSITA would have recognized *McNew* uses these terms synonymously because *McNew* does not provide a distinction between the two terms. I note that “semi-autonomous” is used herein for simplicity.

system...[where] the LTC system transitions through the CO-STEER and **MANUAL** settings before being turned off.” (Step S710). *Id.* Fig. 7A below depicts **Steps 704, 706, and 710** where the end result is disengaging the vehicle’s semi-autonomous system and transferring the driver controls to manual control:



McNew, Fig. 7A (annotated) Here, annotated Fig. 7A depicts a scenario where the result of steps S704 and S706 are both “yes,” leading to disengaging autonomous operations at step S710.

c) Motivation to Combine *Attard-Hampiholi-Scofield-McNew*

184. A POSITA would have been motivated and found it obvious to include transferring driver controls to manual control as a corrective action in *Attard* in response to particular faults per *McNew*'s teachings. Such a modification would have enhanced driver safety and increased driver confidence in using an SDV. A POSITA would have understood that in at least some situations, the best option is to disengage autonomous mode and allow the driver to take over. In particular, *McNew* teaches disengaging autonomous mode when it is safe to do so, thus facilitating a safe transition from autonomous control to manual control. Thus, modifying *Attard-Frazer* per *McNew* would have yielded an SDV where a corrective action is taken to alert a driver to immediately take over (in at least some scenarios, such as when a "Deadly" or "Danger" message is warranted, such as when one or more key sensors for autonomous driving are malfunctioning or severe weather occurs that renders the vehicle incapable of safely driving autonomously), and the vehicle transitions from autonomous mode to manual mode as a corrective action.

185. Indeed, a POSITA would have been motivated at least because *Attard* includes a specific suggestion to do so, i.e., via *Attard*'s repeated disclosures of recommending transferring driver controls to manual. See, e.g., *Attard*, 2:55-3:4. Modifying *Attard-Hampiholi-Scofield* in this way would have simply been use of a known technique of taking a particular corrective action (e.g., transition from

autonomous/semi-autonomous mode to manual control) in response to a fault and would have improved *Attard-Hampiholi-Scofield's* similar autonomous/semi-autonomous vehicle in the same way as *McNew's*.

186. Further, modifying *Attard-Hampiholi-Scofield* per *McNew's* teachings would thus have allowed *Attard-Hampiholi-Scofield-McNew's* vehicle to advantageously both (1) alert a driver of a need to transition from autonomous/semi-autonomous mode to manual mode and (2) actually perform the transition to manual mode. A POSITA would have understood that in at least some scenarios where it is unsafe to continue autonomous operations, it would have been advantageous to both warn the driver and actually perform the transition to manual mode. Indeed, if only a warning is issued but the vehicle does not actually transition out of autonomous mode into manual mode, such would have been unsafe for the driver. By assuring that the driver is ready to take over manual control, per *McNew*, vehicle safety would have been increased when performing this transition to manual control. Another advantage provided by the combination would have been the increased safety and security provided by alerting the driver to assume control in situations in which the computer deems itself to be insufficiently competent at self-driving.

187. A POSITA would have been motivated and found it obvious to include transferring driver controls to manual control as a possible corrective action for numerous reasons. These reasons include enhanced driver safety, increased driver

confidence in using an SDV by knowing that the driver can take over if necessary, and enhancing safety for other vehicles on the roadway (indeed, an SDV driving “blindly” would endanger both the driver and others on the road). Further, while some faults may cause the autonomous mode to be unsafe to utilize, the vehicle may still be operable in a manual mode, allowing a driver to continue driving in manual mode. For example, if one or more sensors needed to perform autonomous driving experience a fault but the vehicle is otherwise safe to drive, transitioning from autonomous/semi-autonomous mode to manual mode would have allowed a driver to continue to drive to their destination. Similarly, even if no hardware fault exists, but if adverse weather or road conditions are severe enough to prevent continuing driving in autonomous mode safely, alerting the driver and transitioning to manual mode would have allowed the human driver to take over and continue driving to the destination. This modification would thus have advantageously enhanced the safety and capabilities of the SDV.

188. A POSITA would have understood that modifying *Attard-Hampiholi-Scofield* to include a corrective action such as transferring driver controls to manual control would have had a reasonable expectation of success. *Attard* and *McNew* teach similar SDVs SDV hardware (processor, memory) and programming instructions. Modifying *Attard-Hampiholi-Scofield* per *McNew*’s teachings would have required only straightforward changes to programming instructions. In

particular, a POSITA would have understood that the necessary hardware was already present in the *Attard-Frazer* SDV. Thus, the only necessary modification is altering the *Attard-Frazer* programming instructions per *McNew's* teachings. Indeed, *McNew* teaches implementing its system in computer program instructions, making the modification to *Attard-Hampiholi-Scofield* straightforward. Modifying programming instructions would have been well-within the skillset of a POSITA. For example, the straightforward changes would have included modifying *Attard's* corrective actions to include transferring driver controls to manual control as a corrective action. This was well known and commonplace in the art as I discussed above. *See* Section V.B. Additionally, *Attard* expressly contemplates transition to manual control and teaches vehicle 101 is manually drivable, such that a POSITA would not have had to modify vehicle 101 to be able to drive using manual control. *Attard*, 2:55-3:4; In particular, I note the SDV already is capable of driving manually, such that modifying *Attard-Frazer* per *McNew* would not have required installing driver control mechanisms such as a steering wheel or brake pedal that are needed for a driver to drive in manual mode.

7. Claim 6(f): “the alert indicates take over immediately.”

189. *See* 6(e).

XI. GROUND 4: CLAIM 8 IS OBVIOUS OVER *ATTARD*, *HAMPIHOLI*, *MCNEW*, *SCOFIELD*, AND *GRIMM*

A. Claim 8

1. Claim 8(Pre): “The SDV of claim 4, further comprising:

190. *See* 4(Pre).

2. Claim 8(a): “the sensor system comprises sensors that detect a physical state of the human driver;”

191. *See* 6(a).

3. Claim 8(b): “the sensor readings comprise an input from a steering mechanism sensor;”

192. *See* 6(b).

4. Claim 8(c): “the computer system determines the corrective action using weighted voting, wherein a weighted voting parameter is determined based on active learning data, said active learning data including information from other SDVs;”

193. *Scofield* teaches determining the competence level of the processor based on active learning data including information from other SDVs. *See*, 6(c). Per 4(j), the *corrective action is determined using the competence level of the processor* such that a CPCL that *us[es] weighted voting...based on active learning data* (i.e., *Attard’s* Φ modified by *Scofield*) teaches *determining a corrective action using weighted voting*. That is, since the CPCL is determined using a weighted voting parameter, and the CPCL is used in determining the corrective action, the corrective action uses the weighted active learning data because it is in the CPCL. That being

said, the *Attard-Scofield* Φ does not clearly disclose *weighted voting*; however, *Grimm* teaches such *weighted voting...based on active learning data*, and it would have been obvious to modify the *Attard-Scofield* Φ further based on *Grimm*'s teachings with a reasonable expectation of success as I opine below.

a) *Grimm*'s Weighted Voting

194. *Grimm* teaches "crowd-sourced data from vehicles to determine traffic conditions and events." *Grimm*, 1:9-10, 3:44-52 (disclosing autonomous vehicle w_j systems). *Grimm* teaches a vehicle 10 that includes "a vehicle dynamics module 20 for determining vehicle dynamic conditions," an "object detection module 30" that "identifies objections in the vicinity of the vehicle 10," a "system status module 40" and a V2V module 50, which are "comprised of at least a processor and a memory module, where the processors are configured with software designed to perform data collection and computations." *Grimm*, 2:57-4:2, FIG. 1.

195. Vehicles determine "threats" that are communicated to a server 170. *Grimm*, 5:41-46. For example, vehicles 10 can detect threats such as "a bad pothole, a patch of slippery road, a tree or other object on the road surface" and can communicate data regarding the threat to a server 170. *Grimm*, 4:21-33. Per *Grimm*, "threats or hazardous conditions may only be determined by evaluating multiple parameters" such as "determining that a particular surrounding vehicle is driving in

a dangerous manner.” *Grimm*, 5:56-59. *Grimm* teaches computing a “threat level TL_i of a particular vehicle i ” by:

$$TL_i = \sum_{j=1}^m w_j p_j^i$$

where “ w_j is a weighting value associated with a specific property j , and p_j^i is the property (such as braking, acceleration, or speed) for the vehicle i .” *Grimm*, 5:59-65. *Grimm* further teaches property p_j^i is a function of vehicle parameters. *Grimm*, 5:65-6:4, i.e.,:

$$p_j^i = f(x_i^1 x_i^2 \dots, x_i^n)$$

where “ $x_i^1 x_i^2 \dots, x_i^n$ are vehicle parameters obtained from...the vehicle dynamics module 20, the object detection module 30, the system status module 40, and the V2V communications module 50.” *Grimm*, 5:65-6:4, Eq. 2. Based on Equations 1 and 2, a dangerously driving vehicle can be determined by weighting the properties thereof such that a “‘watch’ report could be issued to the server 170 if the threat level exceeds a first threshold” and a “‘warning’ report could be issued to the server 170 if the threat level of a vehicle exceeds a second, higher threshold.” *Grimm*, 6:5-17. Thus, *Grimm*’s threat level equation, which weights vehicle properties, teaches *weighted voting*.

b) *Grimm*’s Active Learning Data

196. *Grimm* teaches the threat level equation “could be used to calculate a threat level of a location on a roadway, based on properties of **multiple vehicles** (such as how many vehicles are braking unexpectedly on a freeway).” *Grimm*, 6:18-30, 4:46-50 (describing vehicles communicating braking data). Thus, *Grimm* teaches using data from other vehicles to compute the threat level equation, i.e., in its *weighted voting*. *Grimm* teaches weighting voting data from other vehicles, teaching this limitation or rendering it obvious. *Grimm* teaches a *weighted voting parameter*, i.e., the $w_j p_j^i$ parameter, where the property p_j^i is the property of another vehicle such that this parameter is *determined based on active learning data including information from other SDVs*.

197. *Grimm*’s teachings are similar to those of the ’402 Patent. With respect to weighted voting, the ’402 Patent describes the following:

In one or more embodiments of the present invention, active learning is employed so that the system as a whole learns from the experiences of many SDVs and drivers, in different geographies and among cohorts.

Geographies may include cities, rural areas, and the like.

’402 Patent, 9:7-12. Likewise, *Grimm*’s threat level equation enables the vehicle to learn from the erratic driving behavior of other vehicles as the server 170 can “determine the existence of more conditions, and with greater accuracy, by aggregating data from many vehicles,” which information can be passed to the vehicles 10 to take corrective actions. *Grimm*, 4:50-56.

198. A POSITA would have found it obvious to implement this weighted voting technique to enable the modified *Attard* vehicle to attribute relatively more importance to very critical data from other SDVs (such as a large crowd in an upcoming crosswalk) than the amount of importance attributed to other available data that is less relevant to safe operation of the vehicle, such as minor potholes, dips, or bumps in the road. *Compare Scofield*, 1:40-60 with *Attard*, 4: 8-17. Thus, in the combined vehicle, the *computer system determines corrective actions* (per *Attard*) *using weighted voting* (per *Grimm*), wherein *a weighted parameter is determined on active learning data from other SDVs* (such as the number of objects within an upcoming stretch of road, per *Scofield* and *Grimm*).

c) Motivation to Combine *Attard-Hampiholi-Scofield-Grimm*

199. A POSITA would have been motivated and found it obvious to modify *Attard's* Φ computation further per *Grimm's* teachings of weighting inputs (properties *p*) to determine whether to take an action, thereby yielding the predictable result of Φ being computed by weighting the various inputs (e.g., sensor determinations). *Attard* expressly contemplates weighting sensor determinations and V2V communications such that a POSITA would have been motivated to turn to references teaching such, i.e., *Grimm. Attard*, 6:28-35 (weighting), 4:46-5:20 (V2V). So modified, *Attard's* step of *determining the corrective action using the competence level of the processor*, which involves computing Φ , would include *weighted voting*,

i.e., by weighting the sensor determinations used to compute Φ , per *Grimm*, which is also expressly envisioned by *Attard*, disclosing the following:

By assessing such collected data 115, and possibly weighting various determinations, e.g., a determination of a sensor data collector 110 accuracy and one or more determinations relating to external and/or environmental conditions, e.g., presence or absence of precipitation, road conditions, etc., one or more confidence assessments 118 may be generated providing one or more indicia of the ability of the vehicle 101 to operate autonomously.

Attard, 6:28-35.

200. As mentioned, *Attard* provides an express teaching, suggestion, and motivation for combining with *Grimm* by teaching “weighting various determinations” for computing Φ . *Attard*, 6:28-35. Accordingly, to the extent such *weighted voting* is not taught by *Attard* itself, a POSITA would have found it obvious and been motivated to turn to such references that teach weighted voting, i.e., *Grimm* for teachings on how to implement *Attard*’s “weighting various determinations.” Using the known technique of weighted voting would have improved *Attard-Hampiholi-Scofield*’s similar system in the same way as *Grimm*’s, i.e., by enabling the *Attard* vehicle 101 to “avoid[] dangerous situations.” *Grimm*, 10:53-55. Further, by providing a more accurate and/or granular determination to be made by weighting variables. Again, weighting such variables was common in decision making, as evidenced at least by *An*. *An*, 5:66-6:17, Eq. 7.

201. A POSITA would have had a reasonable expectation of success at least because (a) weighting inputs was well-known prior to the '402 Patent, and (b) modifying *Attard* would have required only straightforward programming modifications to multiply *Attard's* determinations by weights, per *Grimm's* teachings. Both *Attard* and *Grimm* teach executing their methods using processors that execute program code. *Compare Attard*, 15:12-46 with *Grimm* 3:63-4:12.

202. Furthermore, a POSITA would have been motivated and found it obvious to modify *Attard-Hampiholi-Scofield* per *Grimm* to utilize *active learning data* from other vehicles to receive more accurate weather reports, traffic reports, or other information for a vehicle traveling down a roadway. *Grimm*, 4:53-56, 10:44-65. *Grimm* teaches several advantages including more “accurate, timely and relevant safety-related advisories—thereby avoiding dangerous situations.” *Grimm*, 10:52-56. Sending such advisories was well-known in the art such that a POSITA would have had a reasonable expectation of success in modifying the *Attard-Hampiholi* system further based on *Grimm's* teachings. *See, e.g., Harding*, 77-79.

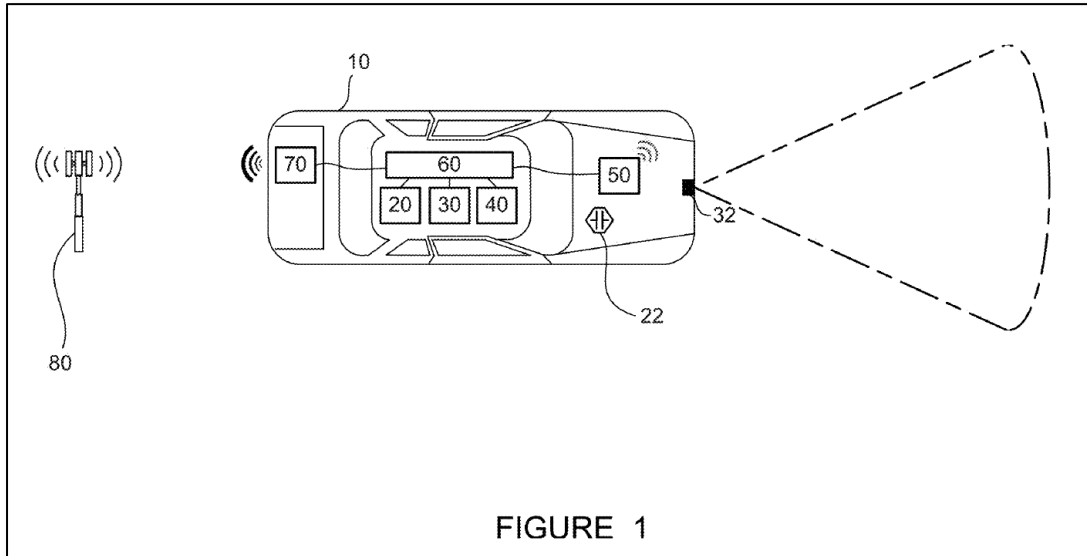
203. Modifying *Attard-Hampiholi* per *Grimm* to gather *active learning data* regarding traffic conditions from other vehicles would have been use of *Grimm's* known technique and would have improved the *Attard-Hampiholi-Scofield* system in the same way as *Grimm's* system. Indeed, modifying *Attard's* server 125 functionality per *Grimm's* teachings or simply substituting *Grimm's* server 170 and

its functionality for *Attard's* server 125 would have obtained predictable results of more accurate traffic reporting. Thus, the modified *Attard* would have seen the same benefits of more “accurate, timely and relevant safety-related advisories—thereby avoiding dangerous situations” as the vehicles in *Grimm*. *Grimm*, 10:52-56.

204. A POSITA would have had a reasonable expectation of success when making this modification. Indeed, *Attard* teaches natively receiving weather and traffic information from server 125 and *Attard's* vehicle 101 already has sensors 110 to capture weather- and traffic-related data. *Attard*, 3:45-55, 9:11-58, 10:28-52, 2:10-27, 2:55-3:4, 4:32-45, 6:4-13, 6:61-7:5; *see* Claim 1(a). Thus, the modification would have merely required straightforward changes to programming instructions of the vehicle and potentially adding additional sensors to capture additional weather-related or traffic-related data. Such a modification would have been simple and straightforward because to the extent not expressly taught in *Attard*, *Attard* clearly contemplates sensors to detect traffic and weather conditions. *Attard*, 4:1-17. Combining prior art sensors with a vehicle according to known methods would have yielded predictable results of *Attard's* vehicle capturing weather/traffic data and sending such to server 125. To the extent *Attard's* server 125 would also need to be modified, such would have been straightforward. Either *Attard's* server functionality would have been replaced/modified to include *Grimm's* server functionality or a simple substitution of using *Grimm's* server 170 instead of *Attard's* server 125

would have obtained the predictable results of *Grimm*'s functionality. *Attard*, 6:61-7:5, 9:11-39. That is, such a modification or substitution would have predictably yielded in the *Attard* system being capable of sourcing weather/traffic information from other vehicles per *Grimm*. To elaborate further, a POSITA would have found it obvious and been motivated to substitute *Attard*'s server 125 with *Grimm*'s server at least because *Grimm*'s server system is configured for "large numbers" such that "the server 170 can determine the existence of more conditions, and with greater accuracy, by aggregating data from many vehicles." *Grimm*, 4:53-56.

205. Further underscoring the reasonable expectation of success, *Grimm* teaches a processor and memory with program instructions stored in memory. *Grimm*, 3:44-4:12, 11:33-39, 13:24-27. *Grimm*'s vehicle 10 including processor and memory as part of one or more of vehicle dynamics module 20, object detection module 30, system status module 40, V2V communications module 50, and/or data collection module 60:



Grimm, Fig. 1, 3:63-4:12.

206. As discussed above, *Attard-Hampiholi-Scofield* also teaches similar vehicle-based computing system with processor and program instructions stored in memory. *See* Claim 1(Pre), 1(a), 1(d), 6(c). Thus, modifying *Attard-Hampiholi-Scofield's* functionality per *Grimm* would have required only straightforward changes to programming instructions that would have been well-within the skillset of a POSITA. That is, the modification would have required a simple software change such that either (a) the *Attard-Hampiholi-Scofield* SDV could receive weather/traffic data directly from other vehicles and/or (b) *Attard's* server 125 transmits and receives weather/traffic data to/from vehicles.

5. Claim 8(d): “the computer system determines the competence level of the human driver using the sensor readings;”

207. *See* 6(d).

6. Claim 8(e): “the corrective action comprises the computer system using the engine throttle.”

208. *Attard’s* description of a vehicle autonomously controlling its speed teaches the claimed “*corrective action comprises using the engine throttle.*” See, 4(b).

XII. GROUND 5: CLAIMS 9-11 ARE OBVIOUS OVER ATTARD, HAMPIHOLI, AND GRIMM

A. Claim 9

1. Claim 9(Pre): “A computer program product for controlling a driving mode of a self-driving vehicle (SDV), the computer program product comprising a non-transitory computer readable storage medium having program code embodied therewith, the program code readable and executable by a processor to perform a method comprising:”

209. See, 1(pre).

2. Claim 9(a): “determining a competence level of a human driver, wherein the competence level describes a competence level of the human driver in controlling the SDV;”

210. See, 4(i). *Hampiholi’s* severity rank R *describes a competence level of the human driver in controlling the Attard-Hampiholi SDV* because it indicates how distracted the driver is, i.e., their competence in controlling the vehicle. It was well-known that a driver’s distraction impacts their ability/competence to drive a vehicle. Thus, a measure of distractedness of a driver *describes a competence level of the driver in controlling a vehicle.*

3. Claim 9(b): “receiving sensor readings from a system of sensors about the competence level of the human driver,

wherein the SDV is operable to provide autonomous control of driver controls comprising: engine throttle, steering mechanism, braking system, and navigation;”

211. *See*, 1(a), 4(b), 4(i), 4(j).

4. Claim 9(c): “determining a competence level of a processor;”

212. *See*, 4(h).

5. Claim 9(d): “determining a corrective action;”

213. *See*, 1(e), 4(j).

6. Claim 9(e): “the SDV implementing the corrective action wherein:”

214. *See*, 1(e), 4(j).

7. Claim 9(e)(i): “the sensor readings comprise information about a current weather condition of a roadway on which the SDV is currently traveling;”

215. As discussed above, *Attard* teaches or renders obvious an SDV currently *traveling on a roadway*, taking *sensor readings*, and sending said sensor readings to computer 105. *See* Claim 1(a). *Attard* teaches determining based on sensor readings whether a fault has occurred. *See* Claim 1(b).

216. Further, *Attard* teaches or renders obvious the *sensor readings* *comprise information about a current weather condition of a roadway on which vehicle 101 (“the SDV”) is currently traveling*. In particular, *Attard* teaches various weather conditions (e.g., ice, snow, rain) may cause a fault. *Attard*, 2:10-21, 2:61-3:4, 4:1-17, 4:32-56 (“collected data 115 could include data 115 concerning ...

detection of road attributes such as those mentioned above, weather conditions, etc.”), 6:4-13 (“weather conditions, road conditions”), 6:61-7:5, 7:51-57, 10:42-52.

A POSITA would have understood these weather conditions, which are detected by *Attard*’s sensors 110 that are on the vehicle 101, to be *a current weather condition of a roadway on which the SDV is currently travelling* because they are detected by the vehicle and, thus, are *current* to the road the vehicle 101 is traveling.

217. In one example, *Attard* teaches weather conditions may cause a fault by lowering a confidence assessment below a threshold even if there is no problem with a sensor 110 (that is, the fault is not due to hardware malfunction). That is, the fault comprises an effect of the current weather condition itself. *Attard*, 7:14-17 (“Note that lower confidence assessments 118 may or may not reflect a hardware fault; for example, environmental conditions (e.g., wet or icy roads) may lower a related confidence assessment 118 even though no hardware failure is implied.”). Additionally, a POSITA would have found it obvious that *Attard* also teaches hardware faults that are due to weather conditions. For example, *Attard* teaches that “[r]easons for lower confidence could include degradation of data collection devices 110 such as sensors, e.g., caused by weather conditions.” *Attard*, 2:10-15. Degradation of sensors is a hardware fault, and as I previously discussed, low confidence (i.e., a low $\Phi_{\min}$) can indicate a fault. See Section VIII.A.3.

218. Thus, *Attard* teaches a particular sub-assessment ϕ_i corresponding to a weather condition on the roadway on which the SDV is traveling (wet or icy roads) that may result in a fault, and particularly a fault that may “exceed a threshold for danger.” This is because *Attard* teaches “weather conditions” can be a “value in the vector” of autonomous attribute assessments, i.e., the weather conditions are a ϕ_i . *Attard*, 6:4-13. Since ϕ_i being $<$ its $\phi_{\min}$, then the weather condition represents a fault. Faults can exceed thresholds for danger as I discussed above. *See* Section VIII.A.4.

8. Claim 9(e)(ii): “determining a corrective action comprises determining whether a fault has occurred and whether the fault exceeds a threshold for danger;”

219. *See*, 1(b), 1(c), 1(d).

9. Claim 9(e)(iii): “the sensor readings comprise a reading from a GPS sensor;”

220. As discussed above, *Attard* teaches vehicle 101 includes sensors 110 that perform *sensor readings*. *See* Claim 1(a). In particular, *Attard* teaches sensors 110 include *a GPS sensor* that sends GPS (global positioning system) sensor readings to computer 105. *Attard*, 4:4-11, (teaching vehicle 101 includes data collectors 110 such as global positioning system (GPS) equipment), 4:32-45, 6:4-13 (teaching navigation, which a POSITA would have understood would have utilized vehicle 101’s GPS in at least some cases), 7:14-17, 10:42-52, 13:22-24 (teaching a first vehicle losing its ability to determine a vehicle 101 location, e.g., GPS coordinates), 13:56-58 (teaching using GPS data to generate a virtual map for

vehicle 101), 14:41-48 (teaching vehicle 101 using stored map data and GPS data for navigation). *See* Claim 1(a). In the Petition, Petitioner notes claim 9 requires nothing more than mere presence of GPS sensor readings.

10. Claim 9(e)(iv): “determining whether the fault exceeds the threshold for danger comprises weighted voting;”

a) ’402 Patent’s Weighted Voting

221. The ’402 Patent describes weighted voting with inputs and where an “input’s weight (w) is the number of ‘votes’ associated with the input.” ’402 Patent, 8:60-9:3.⁶

b) Attard’s Weighting Teachings

222. *Attard* teaches determining a *competence level of the processor* Φ . *See* Claims 1(c), 4(h). *Attard* also teaches weighting sensor determinations for computing Φ , i.e., *weighted voting*. For example, *Attard* teaches weighting determinations of collected data 115 from sensors 110 based on factors including precipitation, road conditions, and environmental conditions to generate confidence assessments about the ability of vehicle 101 to operate autonomously. *Attard*, 6:28-35. As I mentioned above, weighting sensor readings was well known in the art.

⁶ While the ’402 Patent also describes a quota is sometimes utilized in a weighted voting system, “quota” is not recited in Claim 9. ’402 Patent, 8:60-9:3, Claim 9.

Furthermore, weighting sensor values to determine whether a vehicle should be driven autonomously (e.g., to determine a control processor competence level) was well known. For example, *An* (Ex. 1008) teaches computing an “autonomous drive state risk index” that indicates “whether basic autonomous driving is possible,” and that weights sensor readings, including “GPS reception error, a lane recognition error, an obstacle recognition error...” *An*, 5:66-6:17, Eq. 7; *see also*, *Chandra* (Ex. 1034), 2:25-3:19 (describing a weighted voting system for vehicles).

223. To the extent *Attard* does not teach *weighted voting*, *Grimm* teaches such.

c) *Grimm's Teachings*

224. *Grimm* teaches “crowd-sourced data from vehicles to determine traffic conditions and events.” *Grimm*, 1:9-10, 3:44-52 (disclosing autonomous vehicle systems). *Grimm* teaches a vehicle 10 that includes “a vehicle dynamics module 20 for determining vehicle dynamic conditions,” an “object detection module 30” that “identifies objects in the vicinity of the vehicle 10,” a “system status module 40” and a V2V module 50, which are “comprised of at least a processor and a memory module, where the processors are configured with software designed to perform data collection and computations[.]” *Grimm*, 2:57-4:2, FIG. 1.

225. Vehicles determining “threats” that are communicated to a server 170. *Grimm*, 5:41-46. For example, vehicles 10 can detect threats such as “a bad pothole,

a patch of slippery road, a tree or other object on the road surface” and can communicate data regarding the threat to a server 170. *Grimm*, 4:21-33. Per *Grimm*, “threats or hazardous conditions may only be determined by evaluating multiple parameters” such as “determining that a particular surrounding vehicle is driving in a dangerous manner.” *Grimm*, 5:56-59. *Grimm* teaches computing a “threat level TL_i of a particular vehicle i ” by:

$$TL_i = \sum_{j=1}^m w_j p_j^i$$

where “ w_j is a weighting value associated with a specific property j , and p_j^i is the property (such as braking, acceleration, or speed) for the vehicle i .” *Grimm*, 5:59-65. *Grimm* further teaches property p_j^i is a function of vehicle parameters, i.e.,:

$$p_j^i = f(x_i^1 x_i^2 \dots, x_i^n)$$

where “ $x_i^1 x_i^2 \dots, x_i^n$ are vehicle parameters obtained from...the vehicle dynamics module 20, the object detection module 30, the system status module 40, and the V2V communications module 50.” *Grimm*, 5:65-6:4, Eq. 2. Based on Equations 1 and 2, a dangerously driving vehicle can be determined by weighting the properties thereof such that a “watch report could be issued to the server 170 if the threat level exceeds a first threshold” and a “‘warning report’ could be issued to the server 170 if the threat level of a vehicle exceeds a second, higher threshold.” *Grimm*, 6:5-17.

Thus, *Grimm's* threat level equation, which weights vehicle properties, teaches *weighted voting*.

d) Motivation to Combine *Attard-Hampiholi-Grimm*

226. A POSITA would have been motivated and found it obvious to modify *Attard's* Φ computation, per *Grimm's* teachings of weighting inputs (properties p) to determine whether to take an action, thereby yielding the predictable result of Φ being computed by weighting the various inputs (e.g., sensor determinations). As I discussed above, *Attard* expressly contemplates weighting sensor determinations and V2V communications such that a POSITA would have been motivated to turn to references teaching such, i.e., *Grimm*. See ¶ 199. So modified, *Attard's* step of *determining whether the fault exceeds the threshold for danger*, which involves comparing ϕ to $\phi_{\min}$, would include *weighted voting*, i.e., by weighting the sensor determinations used to compute ϕ , per *Grimm*, which is also expressly envisioned by *Attard*, disclosing the following:

By assessing such collected data 115, and possibly weighting various determinations, e.g., a determination of a sensor data collector 110 accuracy and one or more determinations relating to external and/or environmental conditions, e.g., presence or absence of precipitation, road conditions, etc., one or more confidence assessments 118 may be generated providing one or more indicia of the ability of the vehicle 101 to operate autonomously.

Attard, 6:28-35.

227. Alternatively, or additionally, it would have been obvious to modify *Attard's* Φ computation to weight the sensor determinations used to compute Φ , per *Grimm*. That is, a POSITA would have found it obvious to weight sensor determinations of other vehicles, per *Grimm*, in computing Φ to determine whether to drive autonomously. For example, based on *Grimm's* teachings, a POSITA would have found it obvious to weight the erratic driving behavior of a nearby vehicle in the Φ computation, potentially leading to a recommendation to drive manually so the human driver could decide how to respond to the erratic driving behavior. *Attard's* Φ computation triggers the comparison of ϕ to $\phi_{\min}$ such that using *weighted voting* in Φ also teaches Claim 9(e)(iv) because the act of comparing ϕ to $\phi_{\min}$ involves first computing Φ and comparing it to $\Phi_{\min}$.

228. As mentioned, *Attard* provides an express teaching, suggestion, and motivation for combining with *Grimm* by teaching “weighting various determinations” for computing Φ . *Attard*, 6:28-35. Using the known technique of weighted voting would have improved *Attard-Frazer-Hampiholi's* similar system in the same way as *Grimm's*, i.e., by enabling the *Attard* vehicle 101 to “avoid[] dangerous situations.” *Grimm*, 10:53-55. Further, a more accurate and/or granular determination to be made by weighting variables. Again, weighting such variables was common in decision making, as evidenced at least by *An. An*, 5:66-6:17, Eq. 7.

229. A POSITA would have had a reasonable expectation of success at least because (a) weighting inputs was well-known prior to the '402 Patent, and (b) modifying *Attard* would have required only straightforward programming modifications to multiply *Attard*'s determinations by weights, per *Grimm*'s teachings. Both *Attard* and *Grimm* teach executing their methods using processors that execute program code. Compare *Attard*, 15:12-46 with *Grimm* 3:63-4:12. Additional motivation to combine *Attard-Frazer-Hampiholi-Grimm* is discussed below and incorporated by reference herein. See Claim 9(e)(v).

11. Claim 9(e)(v): “a weighted voting parameter comprises active learning data, said active learning data including information from other SDVs.”

230. *Attard* teaches vehicle-to-vehicle communications and receiving weather data from server 125. *Attard*, 2:41-61, 6:61-7:5, 9:11-39. *Grimm* teaches a *weighted voting parameter comprises active learning data...including information from other SDVs*. See, 8(d).

a) *Grimm*'s Active Learning Data

231. *Grimm* teaches the threat level equation “could be used to calculate a threat level of a location on a roadway, based on properties of **multiple vehicles** (such as how many vehicles are braking unexpectedly on a freeway).” *Grimm*, 6:18-30, 4:46-50 (describing vehicles communicating braking data). Thus, *Grimm* teaches using data from other vehicles to compute the threat level equation, i.e., in its

weighted voting system. Grimm teaches weighting voting data from other vehicles, teaching this limitation or rendering it obvious. Grimm teaches a weighted voting parameter, i.e., the $w_j p_j^i$ parameter, where the property p_j^i is the property of another vehicle such that this parameter comprises active learning data including information from other SDVs.

232. *Grimm's teachings are similar to those of the '402 Patent. With respect to weighted voting, the '402 Patent describes the following:*

In one or more embodiments of the present invention, active learning is employed so that the system as a whole learns from the experiences of many SDVs and drivers, in different geographies and among cohorts.

Geographies may include cities, rural areas, and the like.

'402 Patent, 9:7-12. Likewise, Grimm's threat level equation enables the vehicle to learn from the erratic driving behavior of other vehicles as the server 170 can "determine the existence of more conditions, and with greater accuracy, by aggregating data from many vehicles," which information can be passed to the vehicles 10 to take corrective actions. Grimm, 4:50-56.

b) Motivation to Combine *Attard-Hampiholi-Grimm*

233. A POSITA would have been motivated and found it obvious to modify *Attard-Frazer-Hampiholi* per *Grimm* to utilize *active learning data* from other vehicles to receive more accurate weather reports, traffic reports, or other information for a vehicle traveling down a roadway. *Grimm, 4:53-56, 10:44-65.*

Grimm teaches several advantages including more “accurate, timely and relevant safety-related advisories—thereby avoiding dangerous situations.” *Grimm*, 10:52-56. Sending such advisories was well-known in the art such that a POSITA would have had a reasonable expectation of success in modifying the *Attard-Hampiholi* system further based on *Grimm*’s teachings. *See generally, Harding*; ¶ 202.

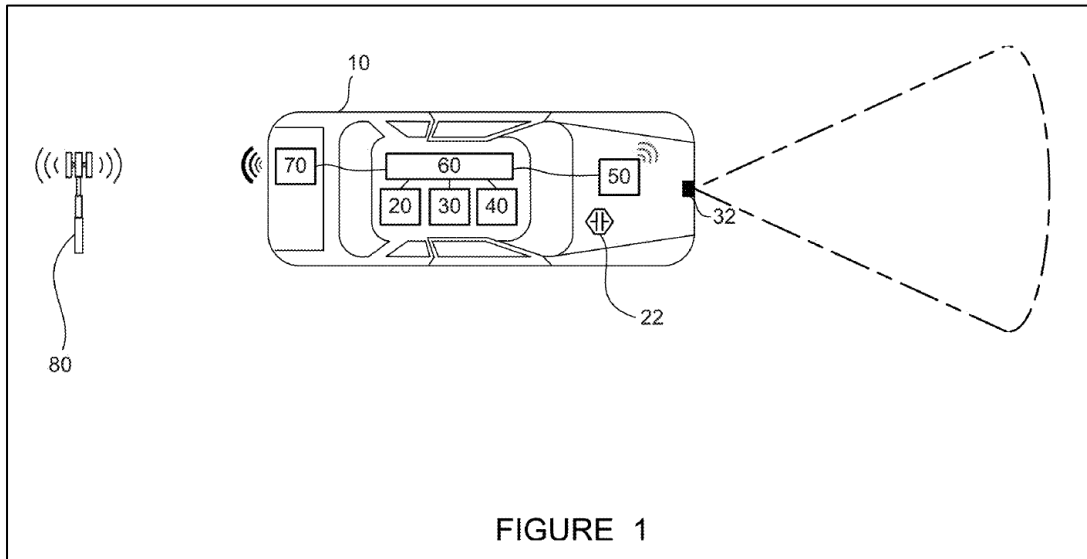
234. Modifying *Attard-Hampiholi* per *Grimm* to gather *active learning data* regarding traffic conditions from other vehicles would have been use of *Grimm*’s known technique and would have improved the *Attard-Frazer-Hampiholi-Grimm* system in the same way as *Grimm*’s system. Indeed, modifying *Attard*’s server 125 functionality per *Grimm*’s teachings or simply substituting *Grimm*’s server 170 and its functionality for *Attard*’s server 125 would have obtained predictable results of more accurate traffic reporting. Thus, the modified *Attard* would have seen the same benefits of more “accurate, timely and relevant safety-related advisories—thereby avoiding dangerous situations” as the vehicles in *Grimm*. *Grimm*, 10:52-56.

235. A POSITA would have had a reasonable expectation of success when making this modification. Indeed, *Attard* teaches natively receiving weather and traffic information from server 125 and *Attard*’s vehicle 101 already has sensors 110 to capture weather- and traffic-related data. *Attard*, 3:45-55, 9:11-58, 10:28-52, 2:10-27, 2:55-3:4, 4:32-45, 6:4-13, 6:61-7:5; *see* Claim 1(a). Thus, the modification would have merely required straightforward changes to programming instructions

of the vehicle and potentially adding additional sensors to capture additional weather-related or traffic-related data. Such a modification would have been simple and straightforward because to the extent not expressly taught in *Attard*, *Attard* clearly contemplates sensors to detect traffic and weather conditions. *Attard*, 4:1-17. Combining prior art sensors with a vehicle according to known methods would have yielded predictable results of *Attard*'s vehicle capturing weather/traffic data and sending such to server 125. To the extent *Attard*'s server 125 would also need to be modified, such would have been straightforward. Either *Attard*'s server functionality would have been replaced/modified to include *Grimm*'s server functionality or a simple substitution of using *Grimm*'s server 170 instead of *Attard*'s server 125 would have obtained the predictable results of *Grimm*'s functionality. *Attard*, 6:61-7:5, 9:11-39. That is, such a modification or substitution would have predictably yielded the *Attard* system being capable of sourcing weather/traffic information from other vehicles per *Grimm*. To elaborate further, a POSITA would have found it obvious and been motivated to substitute *Attard*'s server 125 with *Grimm*'s server at least because *Grimm*'s server system is configured for "large numbers" such that "the server 170 can determine the existence of more conditions, and with greater accuracy, by aggregating data from many vehicles." *Grimm*, 4:53-56.

236. Further underscoring the reasonable expectation of success, *Grimm* teaches a processor and memory with program instructions stored in memory.

Grimm, 3:44-4:12, 11:33-39, 13:24-27. *Grimm*'s vehicle 10 including processor and memory as part of one or more of vehicle dynamics module 20, object detection module 30, system status module 40, V2V communications module 50, and/or data collection module 60:



Grimm, Fig. 1, 3:63-4:12.

237. As discussed above, *Attard-Frazer-Hampiholi* also teaches similar vehicle-based computing system with processor and program instructions stored in memory. *See* Claim 1(Pre), 1(a), 1(d). Thus, modifying *Attard-Frazer-Hampiholi*'s functionality per *Grimm* would have required only straightforward changes to programming instructions that would have been well-within the skillset of a POSITA. That is, the modification would have required a simple software change such that either (a) the *Attard-Hampiholi* SDV could receive weather/traffic data

directly from other vehicles and/or (b) *Attard's* server 125 transmits and receives weather/traffic data to/from vehicles.

B. Claim 10

1. Claim 10(Pre): “The computer program product of claim 9, wherein:”

See, 9(Pre).

2. Claim 10(a): “the current weather condition comprises reduced visibility of the roadway;”

238. *Grimm* teaches “[t]ransient hazardous driving conditions may be caused by weather conditions...and may include poor visibility.” *Grimm*, 7:53-63.

3. Claim 10(b): “the processor determines whether a fault has occurred using active learning data, said active learning data including information from other SDVs.”

239. *Grimm* teaches obtaining data from other vehicles (*active learning data*) to determine the reduced visibility (*a fault*). Specifically, “[a]t box 210, data is collected from many participative sensing vehicles...If reduced visibility or wet/icy road conditions also exist in the heavy traffic area...advisories of the braking activity ahead may well be warranted for vehicles approaching the braking zone.” *Grimm*, 6:33-49, 7:58-63 (disclosing transient hazardous driving conditions including “poor visibility”).

a) Motivation to Combine *Grimm* and *Attard*

240. A motivation to combine *Attard* with *Grimm* is set forth above and incorporated herein. *See*, Claim 9(iv)-(v). While *Attard* teaches weather conditions,

Attard does not expressly teach a weather condition of *reduced visibility*. A POSITA would have been motivated and found it obvious to modify *Attard's* teachings with *Grimm's* teachings that a weather condition is reduced visibility. Namely, a POSITA would have found it obvious to modify *Attard's* system to include any number of weather conditions, including reduced visibility, to improve the safety of *Attard's* system. As I have discussed, *Attard* contemplates a number of weather conditions, including icy, snowy, and wet road conditions, and a POSITA would have found it obvious to modify *Attard* to detect other weather/hazardous conditions such as reduced visibility (e.g., due to fog) to improve the safety of the *Attard* system. See ¶ 216.

241. Such a combination is merely the application of a known technique (*Grimm's* visibility determination using information from other vehicles) to a known method (*Attard's* fault detection method) ready for improvement to yield predictable results. *Attard* teaches a base method upon which the claimed invention could be seen as an improvement, i.e., the inclusion of poor visibility as a fault that is detected by other SDVs. *Grimm* teaches this improvement. A POSITA would have recognized that modifying *Attard* with *Grimm* would have yielded predictable results and been met with a reasonable expectation of success. That is, the modification would have predictably resulted in *Attard's* vehicle 101 being able to also detect reduced visibility and to determine faults/take actions based on that

detection in a similar manner to what is already taught by *Attard* in handling ice and snow. *Attard* already includes the infrastructure that *Grimm* relies on to determine the poor visibility. For example, both *Attard* and *Grimm* include a server (server 125 in *Attard* and server 170 in *Grimm*) that transmit weather information to vehicles. *Attard*, 6:62-65; *Grimm*, 1:47-67. Further, both *Attard* and *Grimm* are configured for V2V communications. *Attard*, 4:46–5:13, FIG. 1; *Grimm*, 3:44-52.

C. Claim 11

1. **Claim 11(Pre): “The computer program product of claim 9, wherein:”**

242. *See*, 9(Pre).

2. **Claim 11(a): “the sensor readings comprise a reading from a GPS sensor;”**

243. *See*, 3(a).

3. **Claim 11(b): “determining whether the fault exceeds the threshold for danger comprises weighted voting;”**

244. *See*, 9(e)(iv).

4. **Claim 11(c): “a weighted voting parameter comprises active learning data, said active learning data including information from other SDVs.”**

245. *See*, 9(e)(v).

XIII. GROUND 6: CLAIM 13 IS OBVIOUS OVER *ATTARD*, *HAMPIHOLI*, *GRIMM*, AND *FRAZER*

A. Claim 13

1. **Claim 13(Pre): “The computer program product of claim 9, wherein:”**

246. *See*, 9(Pre).

2. **Claim 13(a): “the sensor readings comprise a reading from a GPS sensor;”**

247. *See*, 3(a).

3. **Claim 13(b): “determining the corrective action comprises using active learning data, said active learning data including information from other SDVs;”**

248. Per Claim 9(e)(ii), *determining a corrective action* comprises *determining whether the fault exceeds a threshold for danger*. Further, per Claim 9(e)(iv)-(v), *determining whether the fault exceeds a threshold for danger* comprises *weighted voting*, and *a weighted voting parameter* comprises *active learning data...including information from other SDVs*. In the Claim 9 mapping, *Attard* in view of *Grimm* teaches limitations 9(e)(ii) and 9(e)(iv)-(v). *See* Claim 9. Because (1) the step of *determining a corrective action* includes *determining whether the fault exceeds a threshold for danger*; (2) *determining whether the fault exceeds a threshold for danger* comprises *weighted voting*, and (3) *a weighted voting parameter* includes *active learning data*, then *determining the corrective action* comprises *using active learning data*, i.e., the *active learning data* of the *weighted voting parameter*.

249. To state another way, since the modified *Attard* system uses a weighted voting parameter, per *Grimm*, in the step of determining whether a fault exceeds a threshold for danger (comparing ϕ to $\phi_{\min}$), and this step itself is part of determining

the corrective action, the modified *Attard* system teaches or renders obvious Claim 13(b) for the reasons set forth above with respect to Claim 9.

4. Claim 13(c): “the corrective action comprises querying a database for the proper action to take.”

250. *Frazer* teaches a fault-remediation table, which is stored in memory. A POSITA would have understood or found obvious that a fault-remediation table is a type of database that is queried for a “proper action to take.”

XIV. GROUND 7: CLAIM 14 IS OBVIOUS OVER *ATTARD*, *HAMPIHOLI*, *GRIMM*, AND *DOLGOV*

A. Claim 14

1. Claim 14(Pre): “The computer program product of claim 9, wherein:”

251. *See*, 9(Pre).

2. Claim 14(a): “the sensor readings comprise a reading from a GPS sensor, a reading from a radar sensor, and a reading from a vehicle maintenance sensor;”

a) *Attard*’s Teachings

252. *Attard* teaches a reading from a GPS sensor. *See*, 3(a). *Attard* further teaches sensors 110 includes a *radar sensor* for maintaining a distance from another vehicle. *Attard*, 1:65-2:6, 4:8-17, 4:67-5:3. In the Petition, Petitioner notes claim 14 requires nothing more than mere presence of GPS and radar sensor readings. In my opinion, *Attard* teaches such GPS and radar sensor readings. In addition, a POSITA (and *Attard*) would understand that Tire Pressure Monitoring Systems have been

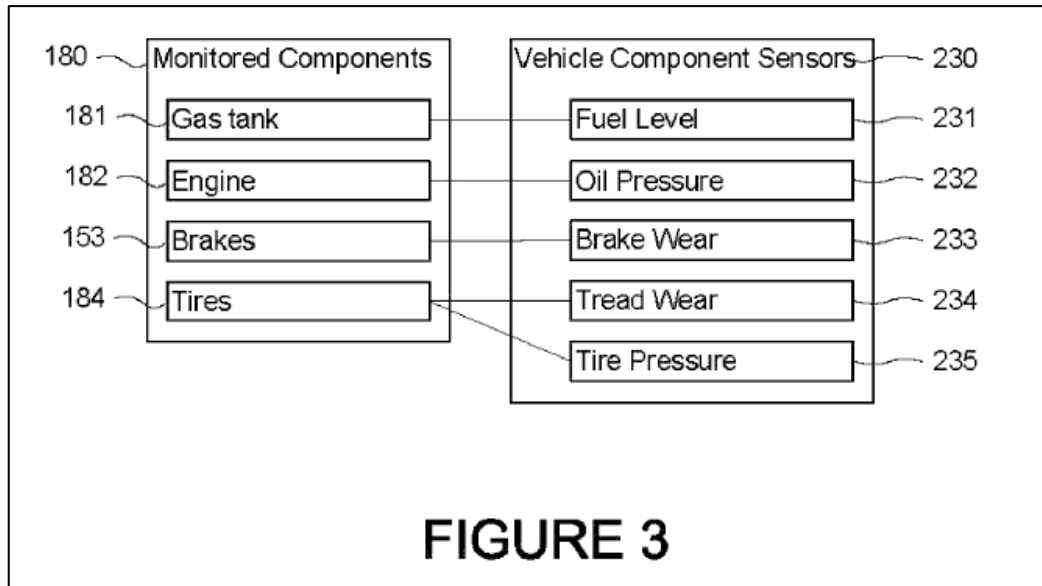
mandatory on all passenger vehicles sold in the United States since 2008. These are vehicle maintenance sensors as disclosed in the '402 patent.

b) The '402 Patent's Sensors

253. The '402 Patent describes sensors such as sensors 153 that detect “tire tread,” “tire pressure,” and a “faulty braking system.” *'402 Patent*, 5:59-6:8. As detailed below, *Dolgov* teaches such sensors.

c) *Dolgov's* Teachings

254. *Dolgov* teaches “autonomously moving a vehicle...wherein sensors detect whether a component is damaged and a processor maneuvers the vehicle differently based on the presence of damage and in order to mitigate further damage to the component.” *Dolgov*, 2:65-3:3. *Dolgov's* sensors include “vehicle component sensors 230 [that] provide information about the physical characteristics of the vehicle components” such as “brake wear sensor 233 [that] may monitor the amount of wear on brakes” and “tread wear sensors 234 [that] may monitor the treads of the tires.” *Dolgov*, 4:39-50. As shown in *Dolgov's* FIG. 3 that I reproduce below, *Dolgov* teaches other *vehicle maintenance sensors* including “fuel level sensor 231 [that] may monitor the amount of gasoline held;” “oil pressure sensor 232 [that] may monitor the amount of oil pressure in engine 182;” and “air pressure sensor 235 [that] may monitor the amount of pressure in tires 184.” *Dolgov*, 4:39-49.



Dolgov, FIG. 3.

255. Thus, because *Dolgov*'s sensors 230, like the '402 Patent, include tire tread and brake wear sensors, *Dolgov* teaches *vehicle maintenance sensors*. I note that tire tread and brake wear sensors were well known as being *maintenance sensors*. See, e.g., *Cullinane*, 7:50-59. A motivation to combine *Attard-Dolgov* is set forth below in 14(b).

3. Claim 14(b): “the fault comprises a maintenance fault;”

256. *Dolgov*'s sensors 230 “detect wear and other types of damage” such as “excessive wear” on the brakes 153. *Dolgov*, 8:22-35. A POSITA would have understood excessive brake wear to be a *maintenance fault*. Such damage to brakes has been known to be a maintenance fault for as long as automotive vehicles have been around. Therefore, *Dolgov*, teaches Claim 14(b).

a) Motivation to Combine *Attard-Dolgov*

257. A POSITA would have found it obvious and been motivated to modify *Attard* based on *Dolgov's* teachings of *vehicle maintenance sensors* to detect a *maintenance fault*. Such a combination is merely the combination of known prior art elements according to known methods to yield the predictable results of *Attard's* fault handling system further detecting vehicle maintenance faults, such as the brake wear and low tire tread maintenance faults taught by *Dolgov*. A POSITA would have appreciated the additional safety benefits provided by modifying *Attard* to also detect maintenance-related faults as such faults are a concern for all vehicles, including SDVs. *Rajamani*, pp. 558 (throttle and brake faults). Additionally, *Attard* provides a teaching, suggestion, and motivation to do so by providing the “actuation layer” that “execute[s] commanded vehicle 101 operations.” *Attard*, 2:15-24. Further, *Attard* teaches sensors for conditions/faults internal to the vehicle (*see* Claim 1(a)), such that modifying *Attard* would merely be combining prior art elements (*Dolgov's* sensors 230) according to known methods to yield the predictable result of determining a fault that comprises a maintenance fault.

258. Further, such a modification is merely the use of a known technique (*Dolgov's* teachings of sensors 230 to detect maintenance faults) to improve similar products (*Attard's* computer program product and vehicle) in the same way. There would have been a reasonable expectation of success at least because such

maintenance sensors were well known in the art. *See, e.g., Cullinane*, 7:50-59. It would have been a straightforward modification to add such vehicle maintenance sensors to *Attard's* vehicle 101 along with any straightforward modifications to programming instructions, for example, modifying *Attard's* ϕ vectors to incorporate sensor data from the maintenance sensors. In fact, *Attard* expressly contemplates assessing the braking capability of vehicle 101. *Attard*, 6:4-9, 10:44-52. Thus, a POSITA would have expected a reasonable expectation of success in modifying *Attard* for this additional reason.

4. Claim 14(c): “the corrective action comprises re-routing the SDV.”

259. *See*, 3(d).

XV. GROUND 8: CLAIMS 15-16, 18-20 ARE OBVIOUS OVER *ATTARD*, *HAMPIHOLI*, AND *MCNEW*

A. Claim 15

1. Claim 15(Pre): “A computer program product for controlling a driving mode of a self-driving vehicle (SDV), the computer program product comprising a non-transitory computer readable storage medium having program code embodied therewith, the program code readable and executable by a processor to perform a method comprising:

260. *See*, 1(Pre).

2. Claim 15(a): “determining a competence level of a human driver using information about a human driver's control of the SDV;”

261. *See*, Claim 4(i).

3. **Claim 15(b): “receiving a sensor reading from a system of sensors, wherein the system of sensors comprises a GPS sensor, a radar sensor, and a camera;”**

262. *See* Claim 1(a), Claim 3(a) (*GPS*), Claim 14(a) (*radar*).

4. **Claim 15(c): “determining a vehicle fault using the sensor reading;”**

263. *See* Claim 1(b).

5. **Claim 15(d): “determining a corrective action;”**

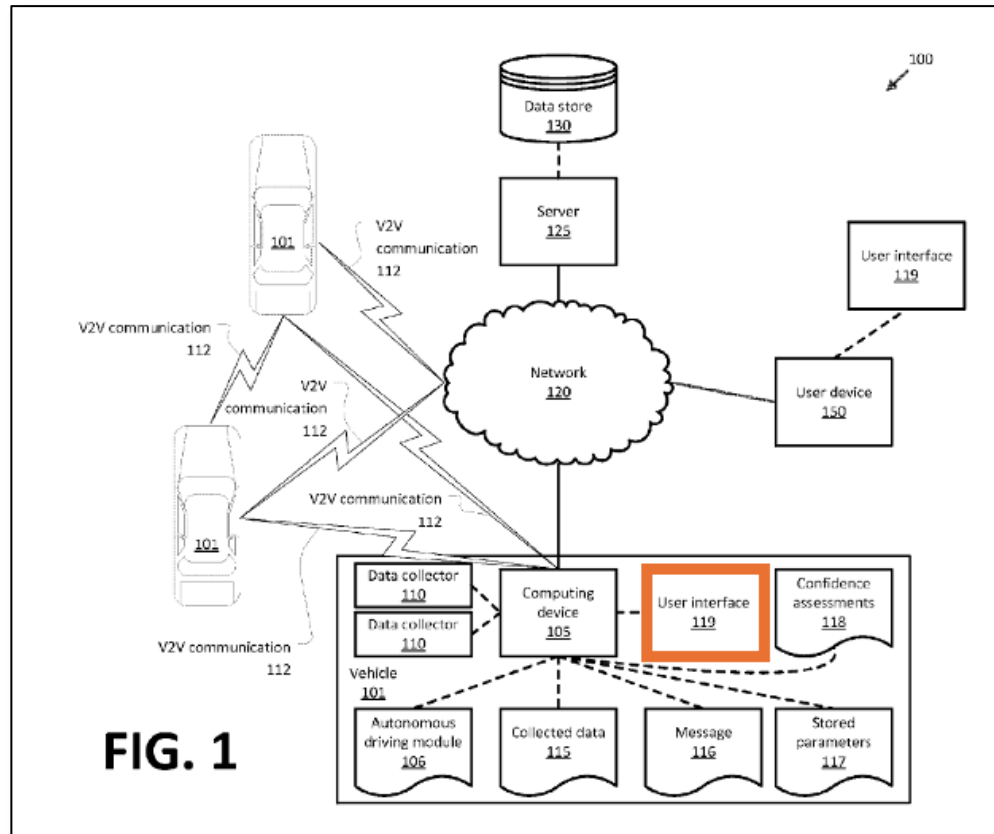
264. *See* Claim 1(d).

6. **Claim 15(e): “sending a control signal to a control system of the SDV corresponding to the corrective action.”**

265. *Attard-Hampiholi* in further view of *McNew* teaches *sending a control signal to a control system of the SDV corresponding to the corrective action*. As previously discussed, *Attard* teaches *corrective action[s]* such as “an action or actions to take concerning vehicle 101 operations” and/or message 116, which is sent when Φ is below $\Phi_{\min}$. *See* Claim 1(d)-(e); *Attard*, 7:62-63, 3:5-3:13, 13:33-49, 14:63-15:4. Other *corrective action[s]* taught by *Attard* and implemented by *Attard*’s vehicle 101 (SDV) include “ceasing one or more autonomous operations, e.g., steering control, speed control, adaptive cruise control, lane maintenance, etc.,” and “pulling to a road shoulder and slowing to a stop, continuing to a highway exit before stopping, continuing navigation based on available data 115” and a “‘limp home’ operation.” *Attard*, 3:5-13, 14:27-31, 2:46-54. Each of these actions requires a control signal to be sent to the control system of the SDV.

a) *Attard's Control System*

266. Per Claim 16, the *control system comprises an engine throttle, a steering mechanism, a display, and a braking system*. *Attard* teaches such; namely, *Attard's* vehicle 101 includes *engine throttle, a steering mechanism, and a braking system*. See Claim 4(b); *Attard*, 9:63-10:2 (“[A]ll vehicle 101 operations, e.g., **steering, braking speed**, etc. could be controlled by the module 160 in the computer 105.”). In addition, claim 21 recites “sending a control signal comprises sending to a display an alert that corresponds to the entry.” ’402 *Patent*, 24:52-54. *Attard* further teaches *a display*, i.e., user interface 119, which “may include a graphical user interface (GUI) or the like that may display alerts, messages, etc.” *Attard*, 7:33-38, 3:49-55 (“[A]ffective user interface 119 that generally includes a human machine interface (HMI), such as an interactive voice response (IVR) system, a graphical user interface (GUI) including a touchscreen or the like, etc.”)



Attard, FIG. 1. Therefore, *Attard* teaches the claimed *control system*.

267. *Attard* further teaches that computer 105 instructs interface 119 to formulate message 116. *Attard*, 7:22-23 (“[T]he computer 105 may include instructions for providing a message 116, e.g., an alert, via the affective interface 119”). *Attard* does not expressly teach computer 105 *sending a control signal to the interface 119 (control system)*. However, *McNew* teaches such.

b) *McNew*’s Control Signal

268. *McNew* teaches “processing circuitry can send **control signals** to a HMI [human-machine interface] 226 to display requests or warnings to the driver.” *McNew*, 6:63-66. *McNew* further explains the HMI “can include one or more visual

warning devices within the vehicle” and “can also issue auditory warnings.” *McNew*, 5:9-43. *McNew*’s semi-autonomous mode manager (SAMM) “implements enforcement actions...to force the driver to comply with previously issued warnings,” and [i]f the driver has not complied with the predetermined number of warnings...the SAMM can issue **control signals** to shut off the semi-automatic driving system.” 5:62-64, 6:1-5 (“[T]he SAMM can send control signals to enforce the desired driving state by altering among other things the vehicle control”), 6:20-24, FIG. 1. For example, *McNew* teaches “the SAMM can send speed enforcement control signals to lower the ACC speed to a level that may be uncomfortable to the driver or pump the breaks [*sic*] in order to encourage the driver to acknowledge the warning.” *McNew*, 8:10-14. Thus, like *Attard*, *McNew* teaches taking an action (sending messages, shutting off the semi-automatic system, etc.) in response to a fault (the driver not responding to the warning) where such actions are initiated by *sending a control signal*. *McNew*, 6:20-24, 20:21-31, 20:55-62 (“[A] control signal is sent to one or more actuators for steering, brakes, speed control and the like to implement an enforcement intervention”), 7:55-62, 23:64-67 (disclosing an I/O interface for outputting control signals).

c) Motivation to Combine *Attard-Hampiholi-McNew*

269. A POSITA would have found it obvious and been motivated to modify *Attard*’s fault handling system with *McNew*’s teachings of sending a control signal

corresponding to a corrective action. In my opinion, this modification is simply an obvious implementation detail for *Attard's* system, i.e., such that *Attard's* computer 105 can instruct the actions, e.g., sending message 116 and/or the cessation of autonomous operations. So modified, *Attard's* vehicle 101 and its computer 105 would have sent *a control signal* to user interface 119 (*control system*) *corresponding to the corrective action* (e.g., corresponding to message 116).

270. Such a modification is merely an implementation detail and the combination of known prior art elements according to known methods to yield predictable results, i.e., the predictable result of *Attard's* computer 105 signaling interface 119 to send message 116. It was well known for a computer to signal a UI to display a message. *See, e.g., Sato* (EX. 1038), 9:20-30 (disclosing an alerting unit of an ECU that outputs a control signal to a display unit), FIG. 1). Separately, *Attard's* fault handling system and *McNew's* control signaling teachings would work the same as when combined. That is, *Attard's* fault handling system would still operate to detect fault and take actions based on the faults, while *McNew's* control signaling teachings would still operate to signal an HMI (e.g., *Attard's* HMI interface 119) and/or braking/steering systems to implement actions, such as implementing a limp home operation. *Attard*, 3:49-55, 2:46-54. This use of a known technique of sending a signal to an electronic system to cause an action to be taken would have improved *Attard* and *McNew's* similar vehicle systems in the same way,

i.e., by providing *Attard's* computer 105 with a method to communicate instructions to other system components (display, braking, steering, etc.).

271. There would have been a reasonable expectation of success in making the combination at least because generating a control signal indicative of an action was well known in the art as I explained above. More specifically, it was well known to send a *control signal* to a display (e.g., GUI, HMI) to cause the display to render a message or alert. Further still, such a change would have only required a simple, straightforward modification to *Attard* such that computer 105 *send[s] a control signal* to interface 119 when computer 105 determines a message 116 is to be sent, i.e., when Φ is below $\Phi_{\min}$. *Attard*, 7:62-63. Again, such is merely an implementation detail that would have been well within the skill level of a POSITA at the time of the '402 Patent. A POSITA would have understood that this modification would have required merely straightforward changes to programming instructions since hardware such as *Attard's* processor and memory would already have been capable of transmitting/receiving electronic signals, e.g., wirelessly and/or via a bus or other wired connection. Indeed, *Attard* already teaches computer 105 receiving signals from hardware devices. *Attard*, 5:38-43.

B. Claim 16: “The computer program product of claim 15, wherein the control system comprises: an engine throttle, a steering mechanism, a display, and a braking system.”

272. *See*, Claim 15(e).

C. Claim 18

- 1. Claim 18(Pre): “The computer program product of claim 15 further comprising:”**

273. *See*, Claim 15(Pre).

- 2. Claim 18(a): “determining a current condition of a roadway;”**

274. *Attard* teaches sensors 110 determine road conditions. *Attard*, 4:42-56 (“For example, collected data 115 could include data 115 concerning a vehicle 101 speed, acceleration, braking, **detection of road attributes such as those mentioned above, weather conditions**, etc.”), 4:11-17 (detecting potholes, bumps, etc.). A POSITA would have understood *Attard*’s disclosures of detecting road attributes using sensors 110 on vehicle 101 to teach *determining a current condition of a roadway* that the vehicle 101 is driving on. *Attard*’s condition of the road is a *current condition* because it is being detected by *Attard*’s SDV, which is traveling on the roadway. For example, a POSITA would have understood that if *Attard*’s sensors 110 detected an icy road condition, that *condition* would be *current* to *Attard*’s vehicle 101 and to the *roadway* the vehicle 101 is travelling. Therefore, *Attard* teaches Claim 18(a).

- 3. Claim 18(b): “determining a competence level of a control processor, wherein determining the competence level of the control processor comprises determining whether the control processor is competent to control the SDV while the SDV encounters the current condition of the roadway.”**

275. *Attard's Φ is a competence level of a control processor. See Claim 4(h).*

Φ incorporates the road/weather conditions. *Attard*, 6:4-13 (describing Φ as including vector values related to weather and road conditions.) Accordingly, because (a) *Attard's Φ* incorporates the road/weather conditions and (b) *Attard's Φ* “indicates an overall confidence that the vehicle 101 can and/or should be operated autonomously,” *determining Attard's CPCL, Φ , determin[es] whether the control processor is competent to control the SDV while the SDV encounters the current condition of the roadway. Attard*, 5:60-62. In fact, *Attard* provides an express example of this noting that “environmental conditions (e.g., wet or icy roads) may lower a related confidence 118 even though no hardware fault is implied.” *Attard*, 7:15-17. Therefore, *Attard* teaches Claim 18(b).

D. Claim 19: “The computer program product of claim 18, wherein determining the current condition of the roadway comprises determining a weather condition of the roadway.”

276. *Attard* teaches Claim 19. See Claim 18(a); *Attard*, 2:10-12, 4:42-45, 6:4-13, 7:14-17 (wet and icy roads), 7:51-57. Each of the examples in the cited portions of *Attard* is a weather condition of the roadway, which as I explained above, is a current condition of the roadway because it is detected by *Attard's* sensors 110 on vehicle 101 currently travelling on the roadway. See ¶ 274.

- E. Claim 20: “The computer program product of claim 18, wherein the control system comprises: an engine throttle, a steering mechanism, a display, and a braking system.”**

277. *See*, Claim 16, Claim 4(b).

XVI. GROUND 9: CLAIMS 17, 21-22, 24 ARE OBVIOUS OVER *ATTARD*, *HAMPIHOLI*, *MCNEW*, AND *FRAZER*

A. Claim 17

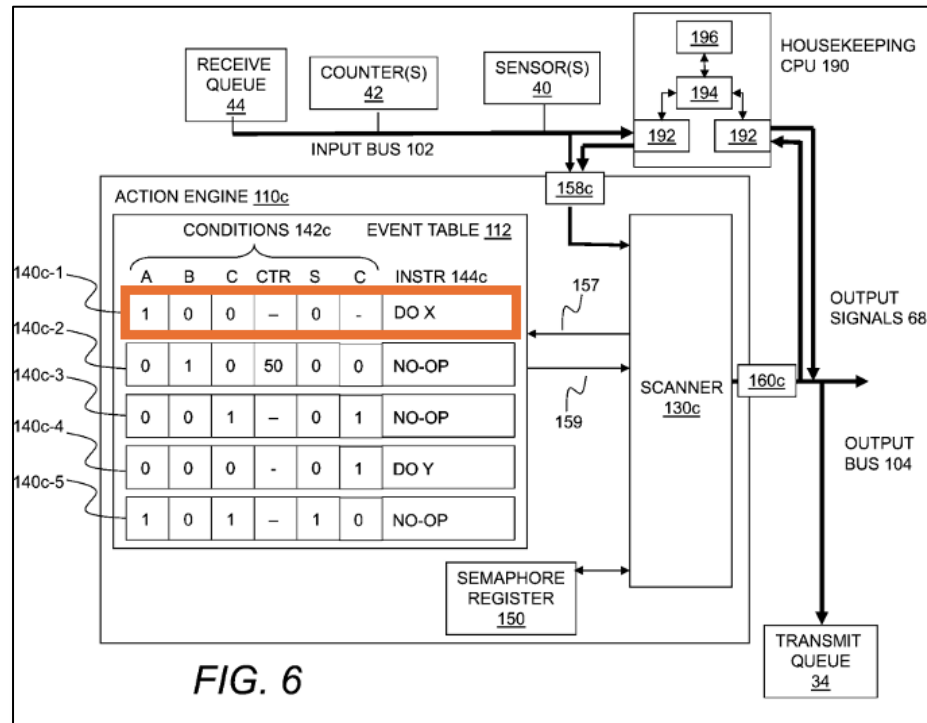
- 1. Claim 17(Pre) “The computer program product of claim 15,”**

278. *See*, Claim 15(Pre).

- 2. Claim 17(a) “wherein determining a corrective action comprises looking up an entry in a fault remediation table and”**

279. *Attard-Hampiholi-McNew* in view of *Frazer* teaches 17(a). *See*, Claim 1(d). *Attard*, modified by *Frazer*, uses *Frazer*’s event table 112 (*fault remediation table*) to structure the correlation between *Attard*’s faults and the corrective actions to take in response to the faults. *See* Claim 1(d). Therefore, the *Attard-Frazer* combination *determin[es] a corrective action by looking up an entry in a fault remediation table* (e.g., the row or instruction 144c in *Frazer*’s table 112 corresponding to the fault). In my opinion, either *Frazer*’s row (condition 140c-1) or instruction 144c-1 (which is included in register 140c-1) satisfies the claimed *entry* as both are accessed (*look[ed] up*) to *determin[e] a corrective action*. Specifically, the register 140c-1 is accessed to determine if a fault occurs and, if so, its associated instruction 144c (*corrective action*) is looked up. *Frazer*, 22:9-15

("[T]he scanner 130c accesses the corresponding action(s) 144c stored in the event table register 140c, and executes the action(s) 144c so as to control one or more aspects of the dynamic environment.").



Frazer, FIG. 6 (depicting an illustrative *entry*).

3. Claim 17(b) “wherein sending a control signal comprises sending to a display an alert that corresponds to the entry.”

280. See Claim 15(e). *Attard* modified by *McNew*’s control signal teachings teaches sending to a display (*Attard*’s interface 119) an alert (message 116) that corresponds to the entry (the action/instruction in *Frazer*’s fault-remediation table). That is, in the *Attard-Hampiholi-McNew-Frazer* system, *Attard*’s computer 105 would send[] a control signal (per *McNew*) to a display (*Attard*’s interface 119) an alert (e.g., *Attard*’s message 116) that corresponds to the entry where *Attard*’s

message 116 (or an instruction/trigger to generate message 116) would be stored in

Frazer's instruction 144c as a *corrective action*.

- B. Claim 21: “The computer program product of claim 18 wherein determining a corrective action comprises looking up an entry in a fault remediation table and wherein sending a control signal comprises sending to a display an alert that corresponds to the entry.”**

281. *See*, Claim 17.

- C. Claim 22: “The computer program product of claim 21, wherein determining the current condition of the roadway comprises determining a weather condition of the roadway.”**

282. *See*, Claim 19.

- D. Claim 24: “The computer program product of claim 21, wherein the weather condition of the roadway is selected from the group consisting of: rain, snow, sleet, hail, fog, smoke, wet roadway, icy roadway, reduced visibility, temperature exceeding a predetermined threshold, temperature below a predetermined threshold.”**

283. Petitioner notes the term *the weather condition of the roadway* lacks antecedent basis. Regardless, *Attard* teaches a *weather condition of the roadway* that is an *icy roadway*, thereby teaching Claim 24. *Attard*, 7:14-17 (“[E]nvironmental conditions (e.g., wet or **icy roads**) may lower a related confidence assessment 118 even though no specific hardware failure is implied.”).

XVII. GROUND 10: CLAIM 23 IS OBVIOUS OVER *ATTARD, HAMPIHOLI, MCNEW, FRAZER, AND ZHU*

A. Claim 23: “The computer program product of claim 22, wherein determining the weather condition of the roadway comprises receiving a sensor reading from a camera.”

1. *Attard’s* Teachings

284. As discussed with respect to Claim 1(a) and 9(e)(i), respectively, *Attard* teaches *a sensor reading from a camera and determining the weather condition of the roadway*. *Attard* teaches sensors 110 “detect[] conditions outside the vehicle” such as “cameras or other image capture devices...to detect road attributes.” *Attard*, 4:8-17. *Attard* also teaches data 115 can relate to “weather conditions.” *Attard*, 4:39-45.

285. While *Attard* does not provide an express teaching that the camera sensors 110 *determine the weather of the roadway*, a POSITA would have found it obvious that *Attard* teaches such based on *Attard’s* teachings of using camera sensors 110 to detect external conditions and the fact that it was well known in the art before the ’402 Patent to use camera sensors to determine weather conditions on the roadway. For example, *Dannheim et al.* taught weather detection in vehicles using cameras to detect rain, snow, and fog. *Dannheim* (Ex. 1039), p.186. To the extent it is argued *Attard* does not teach such, *Zhu* does.

2. *Zhu's Teachings*

286. *Zhu* teaches an autonomous vehicle that includes “a camera and may receive image data collected for the environment of the vehicle” *Zhu*, [0117]. Per *Zhu*, “it may be possible to identify rain in the images as well.” *Id.*, [0118] (disclosing fog as being visible in the images), [0126] (water tracks in images), [0130] (fog), [0132]-[0133] (sunny), Therefore, *Zhu* teaches *determining the weather condition of the roadway* (e.g., rain or fog) *comprises receiving sensor reading from a camera*.

3. **Motivation to Combine *Attard-Hampiholi-McNew-Frazer* with *Zhu*.**

287. A POSITA would have been motivated and found it obvious to modify the *Attard-Hampiholi-McNew-Frazer* combination further with *Zhu's* teachings of identifying rain/fog via images captured by a camera. *Attard* teaches both cameras and determining weather conditions using sensor data. *Attard*, 4:8-17, 4:42-45. However, *Attard* does not expressly teach which sensors are used to determine the weather data. *Zhu*, however, expressly teaches the use of camera sensors for determining weather conditions in an autonomous vehicle. *Zhu*, [0117]-[0118], [0126], [0130], [0132]-[0133]. Thus, at least *Attard* provides an express motivation to incorporate *Zhu's* teachings because *Attard* teaches determining weather conditions but lacks the specificity on how to do so. For example, a POSITA upon reading *Attard's* disclosure of sensors detecting weather conditions would have been

motivated to turn to references that teach specific sensors for a vehicle that detect weather conditions, e.g., *Zhu*.

288. Because the *Attard* SDV includes cameras, a POSITA would have had a reasonable expectation of success in combining *Zhu*'s teachings of using autonomous vehicle cameras to determine weather conditions. As I mentioned above, this was well known in the art before the '402 Patent. *See* ¶ 285. Additionally, such a modification would have required only straightforward changes to programming instructions. *Zhu* teaches implementing its system in computer program instructions, making the modification straightforward. *Zhu*, [0058], [0074]. These straightforward changes would have involved, e.g., modifying the *Attard* software instructions to detect rain/fog from images, per *Zhu*. To the extent it is argued *Attard*'s camera sensors 110 are not suitable for detecting rain/fog in images, a POSITA would have found it obvious and been motivated to substitute *Attard*'s camera sensors 110 with *Zhu*'s camera sensors to achieve the benefit of being able to detect weather conditions. Any increase in cost would have been a recognized tradeoff to improve the safety of *Attard*'s system.

XVIII. CONCLUSION

289. 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: May 5th, 2025

By: 

CHRISTOPHER K. WILSON

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Connected Vehicle & Telematics Consultant – Testifying Expert

I have been developing vehicle telematics and safety systems since 1991, mostly for safety and Advanced Driver Assistance Applications (ADAS). I participated in the early development of key connected vehicle telematics and safety technologies, including radar, positioning, communications, and mapping, worked with many automakers, suppliers, and government agencies, and was involved in the deployment and assessment of many telematics systems from Automatic Collision Notification to systems for Stability Control and Driver Assistance. I also helped set requirements and requirement testing methodologies for many ADAS systems.

I currently work as a consultant for Connected and Automated Vehicle applications (vehicle and infrastructure), and map databases. I am also an expert witness and have written over 100 reports regarding intellectual property and vehicle injury matters and testified over 25 times. I am an industry insider with a gift for explaining complicated ideas in a convincing and easy to understand manner.

Expertise in:

- Vehicle Safety & Safety Systems Assessment
- Navigation, Telematics, Data Science
- Radar, camera, & Lidar sensors
- Vehicle & infrastructure interaction
- Fleet Management Systems
- Remote diagnostics, Sensor & Software Management (OTA updates)
- Vehicle data collection, analysis & applications
- Positioning, communications & mapping technology
- Vehicle & traffic technology and deployment
- Accident Reconstruction

AREAS OF EXPERTISE (with representative dates)

Vehicle Telematics and Safety Systems

- Developed one of the first Automatic Collision Notification systems based on airbag deployment and biomechanical studies. Worked with first responders & ER physicians. 1994.
- Developed systems for the collection and processing of vehicle information for traffic assessment. 1995-2011.
- Algorithms for skid protection and dynamic vehicle control, braking & speed systems. 1999.
- Developed predictive safety systems based on map information, speed control. 1998.
- Developed metrics for regulatory evaluation of active safety systems including Forward Collision Warning, Blind Spot Monitoring, Stop Sign Warning, Curve Speed Warning. 2002.
- Usage Based Insurance scoring algorithms for multiple data sources. 2014.
- Telemetry analysis (missiles, spacecraft, ground vehicles). 1981-Present.

Sensors

Radar

- Designed and operated Over-The-Horizon radar. 1984.
- Synthetic Aperture Radar assessment and evaluation. 1989.
- Evaluation of radar algorithms for F16 radar systems (MTI). 1987.

- Automotive radar development for ACC & FCW systems. 1995.
- Assessed various radar-based safety systems. 2002-2017.

Image sensors & algorithms (camera and video)

- Image recognition & processing algorithms for various reconnaissance assets. 1986.
- 3D scene reconstruction from imagery, photogrammetry. 1987, 2017.
- Assessment of image based FCW, AEB and lane following systems. 2002-2016.
- Photogrammetry for HD mapping applications. 2018.

Lidar

- Evaluated and utilized Lidar systems for Forward Collision Warning. 2003.
- Developed Lidar processing applications for mapping. 2008-2018

Communications

- Developed Vehicle-to-vehicle technologies (DSRC). 1999-2016.
- Extensive use and evaluation of cellular communications for vehicles. 1995-2018.
- Use of paging network for emergency services. 1993.
- Developed various vehicle telematics and infotainment systems. 1993-2016
- Evaluation and development of satellite communications systems. 1984-2016.

Positioning

- Evaluation and use of GPS and many high precision enhancements. 1984-2018
- Requirements specification for GPS III and Galileo. 2004.
- Developed precision location techniques for vehicles. 1996-2018.

Maps

- Responsible for 2nd generation map concepts and specifications for industry (HD Maps). 2000.
- Functional safety for map databases. 2016-2018.
- Developed high precision maps for automated vehicles. 1999-2018.
- Developed tools for incremental updates and quality management. 2000-2018.

Vehicle Diagnostics

- Remote diagnostics of powertrains for warranty and repair planning. 2001.
- Monitored infotainment systems to assess driver preferences and system functionality. 2002.
- Diagnostics of driving style for safety and efficiency evaluations. 2012.
- Telemetry diagnostics of air and space vehicles. 1985.

Cooperative Systems

Insurance- Developed methods and tools for peer comparisons to assess driver risk. 2015.

Transportation Operations- Understanding vehicle movements and implications for traffic and signals based on vehicle probes. 1994-2018.

Outreach

- I was the primary instigator and public advocate for vehicle-to-vehicle communications and grew this effort from “can’t be done” to deployment based on my advocacy.
- I have raised money for 4 startups selling a technical vision.
- Park docent leading trips on various nature topics.

PROFESSIONAL EXPERIENCE

Consultant, Intellectual Property and Connected Vehicles.	2012 - Present
Mapper.ai , San Francisco, CA	2018 - 2019
Strategy & Bus Dev. Consultant (<i>Developing camera based mapping systems</i>)	
ATG Risk Solutions , Seattle, WA	2016 - 2016
VP Bus Dev. (<i>Developing telematics-based risk assessment for Insurance</i>)	
Vehicle Data Science Corporation , Redwood City, CA	2013 - 2016
CEO (<i>Start-up building kinematic maps for automated vehicle applications.</i>)	
TomTom BV , Redwood City, CA	2008 - 2011
Director of Program & Product Mgmt., Advanced Driver Assistance Systems (2009 – 2011)	
Director of R&D (2008 – 2009)	
DaimlerChrysler Research and Technology North America Inc. , Palo Alto, CA	1996 - 2008
Vice President, ITS Strategy & Programs (2002 – 2008)	
Group Manager, Telematics & Safety (1998 – 2002)	
Senior Research Scientist (1996-1998)	
Information Access Inc. , San Francisco, CA	1995 - 1996
Director of Product Development (1995-1996)	
TRW Inc. , Sunnyvale, CA	1986 - 1995
Program Manager (1991 - 1995)	
Senior Systems Engineer (1986 - 1991)	
GTE Government Systems Inc. , Mt. View, CA	1983 - 1986
Systems Engineer (1983 - 1986)	

EDUCATION/TRAINING

PhD Candidate (1982), Astrophysics, University of California, San Diego
BA (1981), Physics, Princeton University, Princeton, NJ
Advanced courses in business, strategy, & technology @ Harvard, Stanford, Berkeley, MIT
Training in **Software Forensics** (copyright infringement, software theft).
Accident Reconstruction. Certificate from Society of Automotive Engineers. ACTAR certified.
Currently seeking AA degree in Philosophy (San Mateo Community College).

PROFESSIONAL ASSOCIATIONS

Member, Institute of Navigation (ION); Society of Automotive Engineers (SAE); Institute of Electrical and Electronics Engineers, Senior Member (IEEE); California Association of Accident Reconstruction Specialists (CA2RS); Accreditation Commission for Accident Reconstruction (ACTAR) #3846, National Association of Professional Accident Reconstruction Specialists.

PATENTS AND PUBLICATIONS

10 US patents in vehicle positioning and vehicle data processing and analytics and numerous foreign patents.

McGraw-Hill *AccessScience* article on "Intelligent Vehicles and Infrastructure", 2017

Chapter on Probe Data in Springer-Verlag's *Handbook of Intelligent Vehicles*, 2012

Widely quoted in publications such as Scientific American and Telematics Update

Many presentations to industry groups, often as a representative of the automotive industry.

LITIGATION EXPERIENCE

25+ depositions, 40+ IPRs, 100+ expert reports, majority patent related (*partial listing*).

- Expert for Hyundai (Finnegan) in remote diagnostics case. Prepared technology tutorial and multiple IPR declarations. Case settled, 2014.
- Expert for Honda (Jones Day) in remote diagnostics case. Multiple IPR declarations. 2014.
- Expert for Toyota in Telematics/ navigation case. IPR declaration. 2015.
- Expert for BMW on remote data processing case. 2015.
- Expert for BMW (DLA Piper) in vehicle safety technology case (radar, occupant sensing). Invalidity and non-infringement reports, deposition testimony. 2015.
- Expert for Wavetronix (Workman Nydegger) in traffic radar case. IPR declaration, deposition. 2016.
- Expert for BMW (DLA Piper) on remote infotainment systems. 2017.
- Expert for Domino's (DLA Piper, Australia) on fleet monitoring systems. 2017.
- Expert for BMW (DLA Piper) on digital radio systems. 2017.
- Expert for Unified Patents on location-based services. 2017.
- Expert for Velocity v. FCA on vehicle management system. 2018.
- Expert for Unified Patents on map data management and display system. 2018.
- Expert for Blue Dot Systems against Omnitrac's on Fleet Management Trade Secrets. 2018
- Expert on vehicle safety for negligence in personal injury matter. 2019.
- Expert for BMW (DLA Piper) on location-based services patent. 2019.
- Expert for Unified Patents on pairing vehicles with remote devices. 2019.
- Expert for DEI (Cooley) v. ADS in vehicle remote starter patents. 2019.
- Expert for Unified Patents on navigation systems. 2020.
- Expert for BMW (DLA Piper) on connected vehicle systems. 2020.
- Expert for Equipmentsshare.com (DLA Piper) on rental equipment remote starter patents. 2021.
- Expert for Unified Patents on pairing vehicles with remote devices. 2021.
- Expert for Tesla (Arnold&Porter) on vehicle charging infrastructure. 2022.
- Expert for Unified Patents on infrastructure-based tracking systems. 2022.
- Expert for multiple pedestrian Automatic Emergency Braking liability related matters. 2023.
- Expert against Omnitrac's on Fleet management systems (King and Spalding). 2023.
- Expert in Patt v VW, liability matter related to seatbelt pretensioners. 2023.
- Expert for Honeywell in matter concerning aircraft docking systems (Crowell & Moring). 2024.
- Expert for Motive Technologies v Omnitrac's for driver scoring patents (King & Spalding). 2024.