

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. IPR2025-01035
of U.S. Patent No. 12,037,004
(Claims 10-24, 27)

DECLARATION OF CHRISTOPHER WILSON

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8. *Claim 15(b): “vehicle controls comprising: an engine throttle, a steering mechanism, a turn signal, and a braking system;” 146*
9. *Claim 15(c): “a non-transitory computer readable storage medium comprising:” 147*
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CLAIM LISTING APPENDIX
U.S. Patent No. 12,037,004 for Claims 10-24 and 27

Claim Designation	Claim Language
Claim 10(Pre)	A self-driving vehicle (SDV) comprising:
Claim 10(a)	a sensor system having a plurality of sensors, comprising:
Claim 10(a)(i)	a first camera;
Claim 10(a)(ii)	a second camera;
Claim 10(a)(iii)	a sensor configured to detect input from a steering wheel;
Claim 10(a)(iv)	a GPS sensor;
Claim 10(a)(v)	a thermometer; and
Claim 10(a)(vi)	a speedometer;
Claim 10(b)	a display that is capable of displaying:
Claim 10(b)(i)	a reading from the GPS sensor;
Claim 10(b)(ii)	a reading from the thermometer; and
Claim 10(b)(iii)	a reading from the speedometer;
Claim 10(c)	vehicle controls comprising: an engine throttle, a steering mechanism, and a braking system;
Claim 10(d)	a non-transitory computer readable storage medium comprising
Claim 10(d)(i)	a first plurality of weights, and the first plurality of weights comprising first active learning data from a first cohort of other SDVs;
Claim 10(e)	the non-transitory computer readable storage medium comprises
Claim 10(e)(i)	a second plurality of weights, and the second plurality of weights comprising second active learning data from the first cohort of other SDVs;
Claim 10(f)	the non-transitory computer readable storage medium comprises a fault remediation table comprising a first quota, a second quota, a first corrective action, and a second corrective action;
Claim 10(g)	a computer system comprising a processor coupled to the non-transitory computer readable storage medium and program code, the program code readable and executable by the processor, wherein the computer system is capable of performing operations comprising:

Claim Designation	Claim Language
Claim 10(g)(i)	receiving a first plurality of inputs comprising readings from the first camera and the sensor configured to detect input from the steering wheel;
Claim 10(g)(ii)	receiving a second plurality of inputs comprising readings from the second camera and the speedometer;
Claim 10(g)(iii)	determining a first weighted voting result comprising multiplying a first input from among the first plurality of inputs by a weight from among the first plurality of weights;
Claim 10(g)(iv)	determining a second weighted voting result comprising multiplying a second input from among the second plurality of inputs by a weight from among the second plurality of weights;
Claim 10(g)(v)	determining a competence level of a human driver using the first weighted voting result;
Claim 10(g)(vi)	autonomously maintaining a buffer of space from other vehicles around the SDV using the vehicle controls and the second weighted voting result;
Claim 10(g)(vii)	determining that a first fault has occurred when the competence level of the human driver is below the first quota; and
Claim 10(g)(viii)	taking the first corrective action when the first fault has occurred.
Claim 11(a)	The SDV of claim 10, further comprising: the computer system is further capable of performing operations comprising:
Claim 11(b)	recording a number of times the first fault has occurred;
Claim 11(c)	determining that a second fault has occurred when the number of times the first fault has occurred exceeds the second quota; and
Claim 11(d)	taking the second corrective action when the second fault has occurred.
Claim 12(a)	The SDV of claim 11, further comprising: the computer system is further capable of performing operations comprising:
Claim 12(b)	taking the first corrective action comprising sounding a warning sound and displaying an icon on a display screen; and
Claim 12(c)	taking the second corrective action comprising decreasing a speed of the SDV and transferring driver controls to manual control.

Claim Designation	Claim Language
Claim 13(a)	The SDV of claim 10, further comprising: the computer system is further capable of performing operations comprising:
Claim 13(b)	recording a duration of time during which the first fault has occurred;
Claim 13(c)	determining that a second fault has occurred when the duration of time during which the first fault has occurred exceeds the second quota; and
Claim 13(d)	taking the second corrective action when the second fault has occurred.
Claim 14(a)	The SDV of claim 13, further comprising: the computer system is further capable of performing operations comprising:
Claim 14(b)	taking the first corrective action comprising sounding a warning sound and displaying an icon on a display screen; and
Claim 14(c)	taking the second corrective action comprising decreasing a speed of the SDV and transferring driver controls to manual control.
Claim 15(Pre)	A self-driving vehicle (SDV) comprising:
Claim 15(a)	a sensor system having a plurality of sensors, comprising:
Claim 15(a)(i)	a first camera;
Claim 15(a)(ii)	a second camera;
Claim 15(a)(iii)	a sensor configured to detect input from a steering wheel;
Claim 15(a)(iv)	a GPS sensor; and
Claim 15(a)(v)	a speedometer;
Claim 15(b)	vehicle controls comprising: an engine throttle, a steering mechanism, a turn signal, and a braking system;
Claim 15(c)	a non-transitory computer readable storage medium comprising:
Claim 15(c)(i)	a first plurality of weights;
Claim 15(c)(i)	a second plurality of weights; and
Claim 15(c)(iii)	a fault remediation table comprising:
Claim 15(c)(iii)(1)	a first fault state;
Claim 15(c)(iii)(2)	a first corrective action associated with the first fault state;
Claim 15(c)(iii)(3)	a second fault state;

Claim Designation	Claim Language
Claim 15(c)(iii)(4)	a second corrective action associated with the second fault state;
Claim 15(c)(iii)(5)	a third fault state; and
Claim 15(c)(iii)(6)	a third corrective action associated with the third fault state;
Claim 15(d)	a computer system comprising a processor coupled to the non-transitory computer readable storage medium and program code, the program code readable and executable by the processor, wherein the computer system is capable of:
Claim 15(d)(i)	receiving a sensor reading from the system of sensors;
Claim 15(d)(ii)	operating the vehicle controls;
Claim 15(d)(iii)	receiving a first plurality of inputs, comprising readings from the first camera and the sensor configured to detect input from the steering wheel;
Claim 15(d)(iv)	receiving a second plurality of inputs, comprising readings from the second camera;
Claim 15(d)(v)	generating a human driver profile;
Claim 15(d)(vi)	generating a control processor profile;
Claim 15(d)(vii)	taking the first corrective action when the first fault state has occurred;
Claim 15(d)(viii)	taking the second corrective action when the second fault state has occurred; and
Claim 15(d)(ix)	taking the third corrective action when the third fault state has occurred.
Claim 16(a)	The SDV of claim 15, further comprising: the computer system is further capable of:
Claim 16(b)	generating the human driver profile comprising using a human driver competence level;
Claim 16(c)	generating the control processor profile comprising determining whether the computer system is currently operating in a first autonomous mode, a second autonomous mode, or a manual mode;
Claim 16(d)	while operating in the first autonomous mode, autonomously maintaining a buffer of space from other vehicles around the SDV using the vehicle controls, without requiring the human driver to control the vehicle controls;

Claim Designation	Claim Language
Claim 16(e)	while operating in the second autonomous mode, autonomously controlling the engine throttle and the breaking system while the human driver controls the turn signal; and
Claim 16(f)	while operating in the manual mode, allowing the human driver to control the vehicle controls.
Claim 17(a)	The SDV of claim 16, further comprising: the first plurality of weights comprises first active learning data from a first cohort of other SDVs;
Claim 17(b)	the second plurality of weights comprises second active learning data from a second cohort of other SDVs;
Claim 17(c)	the computer system is further capable of:
Claim 17(d)	generating a first weighted voting result comprising multiplying an input from among the first plurality of inputs by a weight from among the first plurality of weights; and
Claim 17(e)	generating a second weighted voting result comprising multiplying an input from among the second plurality of inputs by a weight from among the second plurality of weights.
Claim 18(a)	The SDV of claim 17, further comprising: the computer system is further capable of:
Claim 18(b)	determining a length of time during which the sensor configured to detect input from the steering wheel has not detected an input from the human driver;
Claim 18(c)	determining that the first fault state has occurred when the length of time exceeds a first threshold;
Claim 18(d)	taking the first corrective action comprising sounding a warning sound and displaying an image on a display screen;
Claim 18(e)	determining that the second fault state has occurred when the length of time exceeds a second threshold;
Claim 18(f)	taking the second corrective action comprising switching to the manual mode;
Claim 18(g)	determining, using the second weighted voting result, whether the SDV is currently traveling on a first roadway type or a second roadway type;

Claim Designation	Claim Language
Claim 18(h)	determining that the third fault state has occurred when the computer system is operating in the second autonomous mode and the SDV is currently traveling on the second roadway type; and
Claim 18(i)	taking the third corrective action comprising switching to the manual mode.
Claim 19(a)	The SDV of claim 18, further comprising: the first roadway type comprises a public highway; and
Claim 19(b)	the second roadway type comprises a public street.
Claim 20(a)	The SDV of claim 15, further comprising: the first plurality of weights comprises first active learning data from a first cohort of other SDVs;
Claim 20(b)	the second plurality of weights comprises second active learning data from a second cohort of other SDVs;
Claim 20(c)	the computer system is further capable of:
Claim 20(d)	generating a first weighted voting result comprising multiplying an input from among the first plurality of inputs by a weight from among the first plurality of weights; and
Claim 20(e)	generating a second weighted voting result comprising multiplying an input from among the second plurality of inputs by a weight from among the second plurality of weights.
Claim 21(a)	The SDV of claim 20, further comprising: a display that is capable of displaying a position of another vehicle relative to the SDV;
Claim 21(b)	the computer system is further capable of:
Claim 21(c)	determining the position of another vehicle relative to the SDV using the second weighted voting result; and
Claim 21(d)	autonomously maintaining a buffer of space from other vehicles around the SDV using the vehicle controls and the second weighted voting result.
Claim 22(a)	The SDV of claim 21, further comprising: the computer system is further capable of:
Claim 22(b)	determining a length of time during which the sensor configured to detect input from a steering wheel has not detected input from the human driver;

Claim Designation	Claim Language
Claim 22(c)	determining that the first fault state has occurred when the length of time exceeds a first threshold;
Claim 22(d)	taking the first corrective action comprising sounding a warning sound and displaying an alert on a display screen; and
Claim 22(e)	determining that the second fault state has occurred when a number of times the first fault state has occurred exceeds a second threshold.
Claim 23(a)	The SDV of claim 22, further comprising: the computer system is further capable of:
Claim 23(b)	determining, using the control processor profile, whether the computer system is currently operating in a first autonomous mode, a second autonomous mode, or a manual mode;
Claim 23(c)	while operating in the first autonomous mode, autonomously maintaining a buffer of space from other vehicles around the SDV using the vehicle controls and the second weighted voting result, without requiring the human driver to control the vehicle controls;
Claim 23(d)	while operating in the second autonomous mode, autonomously controlling the engine throttle and the breaking system while the human driver controls the turn signal;
Claim 23(e)	while operating in the manual mode, allowing the human driver to control the vehicle controls; and
Claim 23(f)	taking the second corrective action comprising the computer system switching from the first autonomous mode to the manual mode.
Claim 24(a)	The SDV of claim 23, further comprising: the computer system is further capable of:
Claim 24(b)	generating the human driver profile comprises using active learning data from a current human driver of the SDV;
Claim 24(c)	determining that the third fault state has occurred using the human driver profile; and
Claim 24(d)	taking the third corrective action comprising disabling the first autonomous mode.
Claim 27(a)	The SDV of claim 23, further comprising: the computer system is further capable of:

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Claim Designation	Claim Language
Claim 27(b)	determining the third fault state has occurred comprising determining a current weather condition of a roadway on which the SDV is currently traveling; and
Claim 27(c)	taking the third corrective action comprising switching from the first autonomous mode to the manual mode.

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 Adaptive 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 discussed in this declaration in forming my opinions.

14. For this work, I have been asked to review U.S. Patent No. 12,037,004 (“the ’004 Patent”) (Ex. 1001) including the specification and claims, and the ’004 Patent’s prosecution history (“’004 File History”) (Ex. 1002). In developing my

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opinions relating to the '004 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. 12,037,004 (“ <i>the '004 Patent</i> ”)
Exhibit 1002	File History for U.S. Patent No. 12,037,004
Exhibit 1004	U.S. Patent No. 9,406,177 to Attard et al. (“ <i>Attard</i> ”)
Exhibit 1005	U.S. Patent No. 9,494,926 to Frazer et al. (“ <i>Frazer</i> ”)
Exhibit 1006	U.S. Patent No. 10,377,303 to McNew et al. (“ <i>McNew</i> ”)
Exhibit 1007	U.S. Patent Application Publication No. 2016/0267335 to Hampiholi (“ <i>Hampiholi</i> ”)
Exhibit 1008	U.S. Patent No. 9,063,543 to An et al. (“ <i>An</i> ”)
Exhibit 1009	Intentionally Left Blank
Exhibit 1010	Intentionally Left Blank
Exhibit 1011	Intentionally Left Blank
Exhibit 1012	U.S. Patent Application Publication No. 2007/0268158 to Gunderson et al. (“ <i>Gunderson</i> ”)
Exhibit 1013	U.S. Patent Application Publication No. 2007/0219720 (“ <i>Trepagnier</i> ”)
Exhibit 1014	Gereon Meyer and Sven Beiker. <i>Road Vehicle Automation</i> . Springer. 2014. (“ <i>Meyer</i> ”)
Exhibit 1015	Jeff Wit et al. “Autonomous Ground Vehicle Path Tracking.” <i>Journal of Robotic Systems</i> 21(8), 439-449 (2004). (“ <i>Wit</i> ”)
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. (“ <i>Bimbraw</i> ”)
Exhibit 1017	Xavier Mosquet et al. <i>Revolution in the Driver’s Seat</i> . The Boston Consulting Group. April 2015. (“ <i>Mosquet</i> ”)
Exhibit 1018	Steven E. Muldoon et al. “10.3: Vehicle Fault Diagnostics Using a Sensor Fusion Approach.” <i>IEEE</i> 2002. (“ <i>Muldoon</i> ”)
Exhibit 1019	U.S. Patent No. 8,825,258 (“ <i>Cullinane</i> ”)
Exhibit 1020	U.S. Patent No. 9,798,323 (“ <i>Tsimhoni-323</i> ”)
Exhibit 1021	U.S. Patent No. 9,884,631 (“ <i>James</i> ”)
Exhibit 1022	U.S. Patent No. 11,040,725 (“ <i>Scofield</i> ”)
Exhibit 1023	U.S. Patent No. 9,483,059 (“ <i>Caveney</i> ”)
Exhibit 1024	U.S. Patent No. 9,365,213 (“ <i>Stenneth</i> ”)

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Exhibit 1025	International Publication No. WO 2006/047297 (“ <i>Allard</i> ”)
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. (“ <i>Rajamani</i> ”)
Exhibit 1027	U.S. Patent Application Publication No. 2013/0063336 (“ <i>Sugimoto</i> ”)
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. (“ <i>McNaughton</i> ”)
Exhibit 1029	A. de la Escalera. “Traffic sign recognition and analysis for intelligent vehicles.” Image and Vision Computing 21 (2003) 247-258. (“ <i>Escalera</i> ”)
Exhibit 1030	“Surface Vehicle Information Report J3016.” SAE International. January 2014. (“ <i>J3016</i> ”)
Exhibit 1031	U.S. Patent No. 9,430,944 to Grimm, et al. (“ <i>Grimm</i> ”)
Exhibit 1032	Intentionally Left Blank
Exhibit 1033	Intentionally Left Blank
Exhibit 1034	U.S. Patent No. 8,378,849 (“ <i>Chandra</i> ”)
Exhibit 1035	U.S. Patent No. 5,779,593 (“ <i>Takada</i> ”)
Exhibit 1036	U.S. Patent Application Publication No. 2013/0131907 (“ <i>Green</i> ”)
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. (“ <i>Harding</i> ”).
Exhibit 1038	Intentionally Left Blank
Exhibit 1039	Intentionally Left Blank
Exhibit 1040	U.S. Patent No. 10,139,824 to Sako et al. (“ <i>Sako</i> ”)
Exhibit 1041	Intentionally Left Blank
Exhibit 1042	Intentionally Left Blank
Exhibit 1043	U.S. Patent No. 8,305,444 to Hada (“ <i>Hada</i> ”)
Exhibit 1044	Intentionally Left Blank
Exhibit 1045	U.S. Patent Application Publication No. 2015/0158495 to Duncan et al. (“ <i>Duncan</i> ”)
Exhibit 1046	U.S. Patent No. 9,159,301 (“ <i>Yamada</i> ”)

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Exhibit 1047	U.S. Patent Application Publication No. 2015/0166069 (“ <i>Engelman</i> ”)
Exhibit 1048	U.S. Patent No. 9,604,652 (“ <i>Strauss</i> ”)
Exhibit 1049	U.S. Patent Application Publication No. 2016/0107655 to Desnoyer et al. (“ <i>Desnoyer</i> ”)
Exhibit 1050	Intentionally Left Blank
Exhibit 1051	California Vehicle Code 22108. https://leginfo.ca.gov/faces/codes_displaySection.xhtml?lawCode=VEH&sectionNum=22108 . Enacted by Stats. 1959, Ch. 3. (“ <i>22108</i> ”)
Exhibit 1052	Gorelick Law Offices. https://www.gorelick-law.com/california-vehicle-code-22108-vc-failure-to-signal-and-dui-arrests . (“ <i>Gorelick</i> ”)
Exhibit 1053	Green Car Congress. https://web.archive.org/web/20121128045732/https://www.greencarcongress.com/2012/11/mb-20121122.html . 28 November 2012. (“ <i>GCC</i> ”)
Exhibit 1054	Tesla Model S Owner’s Manual (“ <i>Model S Manual</i> ”)
Exhibit 1055	Mercedes-Benz. https://web.archive.org/web/20121122040727/https://emercedesbenz.com/autos/mercedes-benz/s-class/top-20-mercedes-benz-assistance-programs/ . November 2012. (“ <i>Mercedes2013</i> ”)
Exhibit 1056	Lingyun Xiao & Feng Gao (2010) “A comprehensive review of the development of adaptive cruise control systems”, Vehicle System Dynamics, 48:10, 1167-1192, DOI: 10.1080/00423110903365910 (“ <i>Xiao</i> ”)
Exhibit 1057	Mercedes S-Class Operator’s Manual (“ <i>Mercedes S-Class Manual</i> ”)

15. I have considered these materials from the viewpoint of a POSITA as of the priority date of the ’004 Patent. For the purposes of this declaration, I have been asked to assume that the priority date of the ’004 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 ’004 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 ’004 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 ’004 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 '004 Patent, the prior art cited herein, and the ordinary skill factors described in this section, a POSITA in the field of the '004 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 '004 Patent* (Ex. 1001), 1:24-25 (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 '004 Patent (September 2015) as "[t]he timeline of autonomous cars begins in 1926 with world's first radio controlled car 'Linriccan Wonder'." *Bimbrow* (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 '004 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 '004 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.*

35. A key differentiator of SDVs is the conditions under which they may operate autonomously, and the amount of supervision required from the driver. That is, how quickly the driver may need to step in or intervene if the autonomous systems

are not sufficiently capable. Production vehicles have been able to “drive” themselves for short periods, maintaining their lane and a buffer of space around themselves, since at least 2005 with the availability of Adaptive Cruise Control. The ‘004 patent provides little indication of the conditions under which the alleged SDV can (and cannot) operate. *’004 Patent*, 1:29-31, 15:64-16:4, 28:38-40.

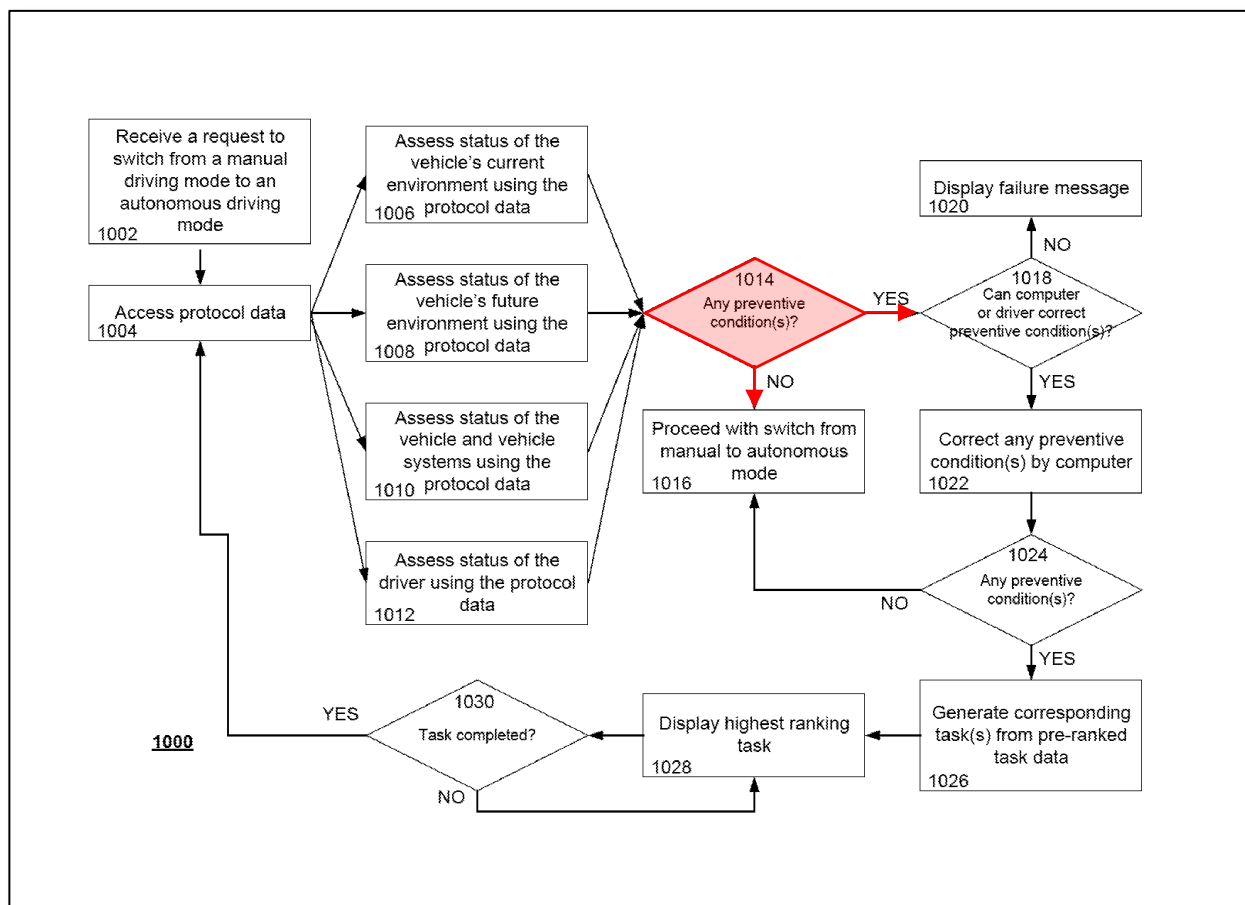
B. Faults

36. 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).

37. Prior to the ‘004 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.”

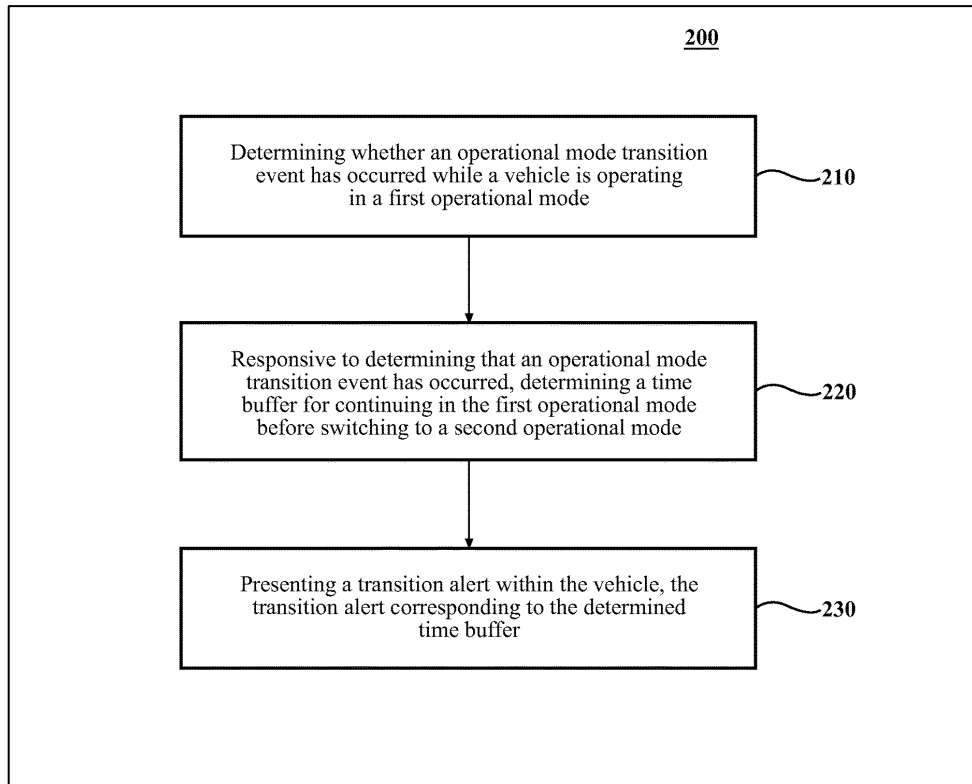
Cullinane, 16:38-43; *see also*, *Tsimhoni-323* (Ex. 1020), Abstract (describing “[a]n automated vehicle [that] includes a control system configured to selectively transfer the automated vehicle from an automated control mode to a manual control mode based on a transfer-of-control criterion.” This “criterion 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 ’004 Patent). ’004 Patent, 5:57-6:6.



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 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.

38. *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:

¹ All emphases and annotations added unless noted otherwise.



James, FIG. 2.

39. 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).

40. 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.”).

41. 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

42. *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.”).

43. 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

44. One of the primary features of SDVs is ensuring driver safety. *See* ¶ 31. Therefore, it was known prior to the '004 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....”).

45. 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. 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

46. The term “Self Driving Vehicle” (“SDV”) is a term of art that includes a large range of capabilities. The automated vehicle industry (and regulators) have tried to develop a set of definitions for levels of automated vehicles *J3016* (Ex. 1030), 2-5; *James*, 3:1-4:43, 5:13-52, 6:31-64, 10:37-11:53). An SDV may correspond to at least the automated driving levels 2 to 5. While there can be subtle differences between and within the levels (and there have been some changes in the standard), the 004 patent is generally concerned with “level 2” automation as there is a clear disclosure that the driver may be required to take over on short notice. (*See, for example ’004 Patent*, 8:32-40; driver must take over while vehicle is

hydroplaning). Level 2 automation includes, at the bottom end, systems that have both lateral and longitudinal control of the vehicle. These can maintain a buffer space around the vehicle, at least for a short period of time on “good” roads. More sophisticated systems (still within the level 2 category) can operate on additional (“worse”) roads and for longer periods of time. The common attribute of level 2 systems is that the driver supervises the operation and must be ready to “take over” on short notice. It is my opinion that “SDV”, as used in the ’004 Patent, corresponds to “level 2” automation, but would also include levels 3-5 where disclosed in the prior art.

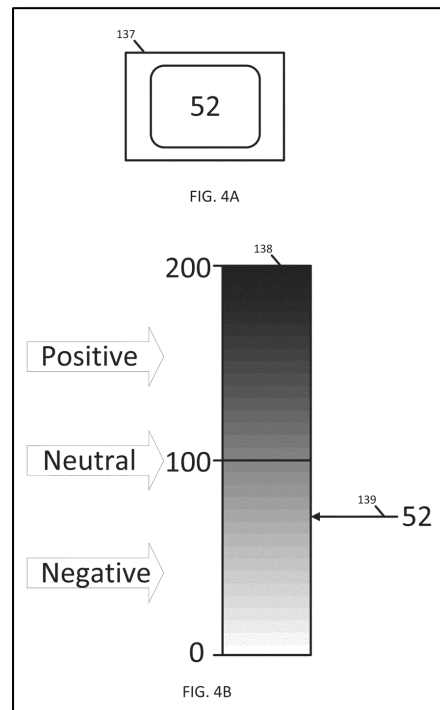
47. It was well-known prior to the ’004 Patent to demonstrate to the driver how capable their SDV is of driving autonomously.

48. 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

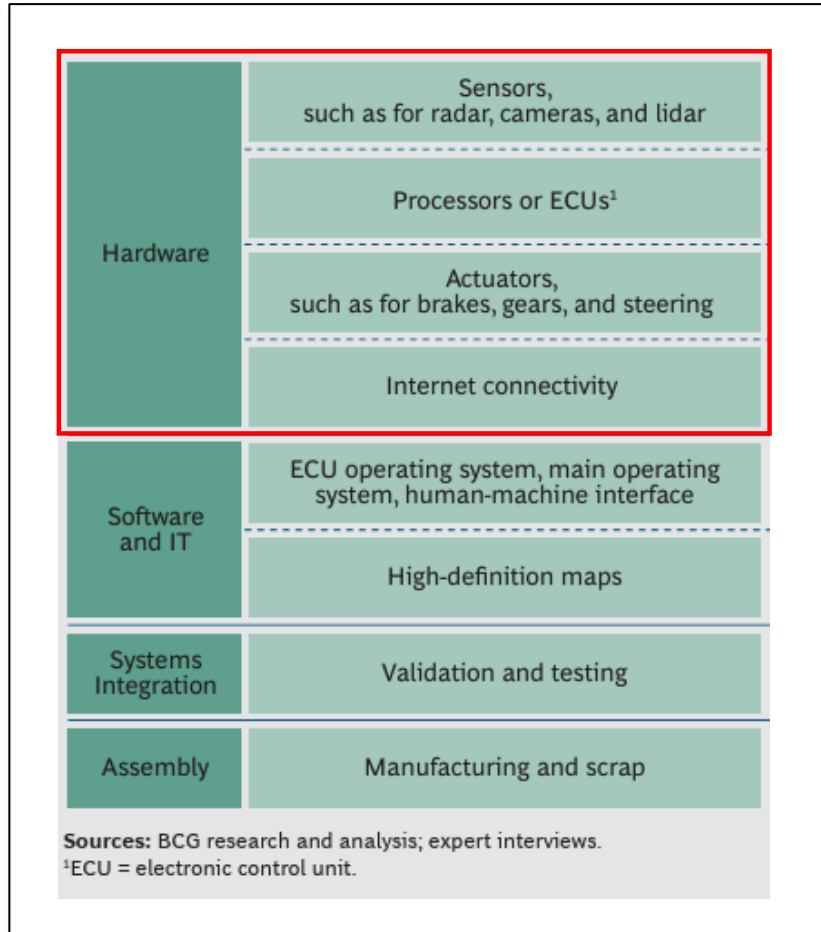
49. It was widely known that systemic infrastructure was utilized to support safe and functional SDVs. For example, *Meyer* teaches that information gathered by an SDV itself “will be supplemented by information from other vehicles (V2V communication), infrastructure (V2I communication) or a back-end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

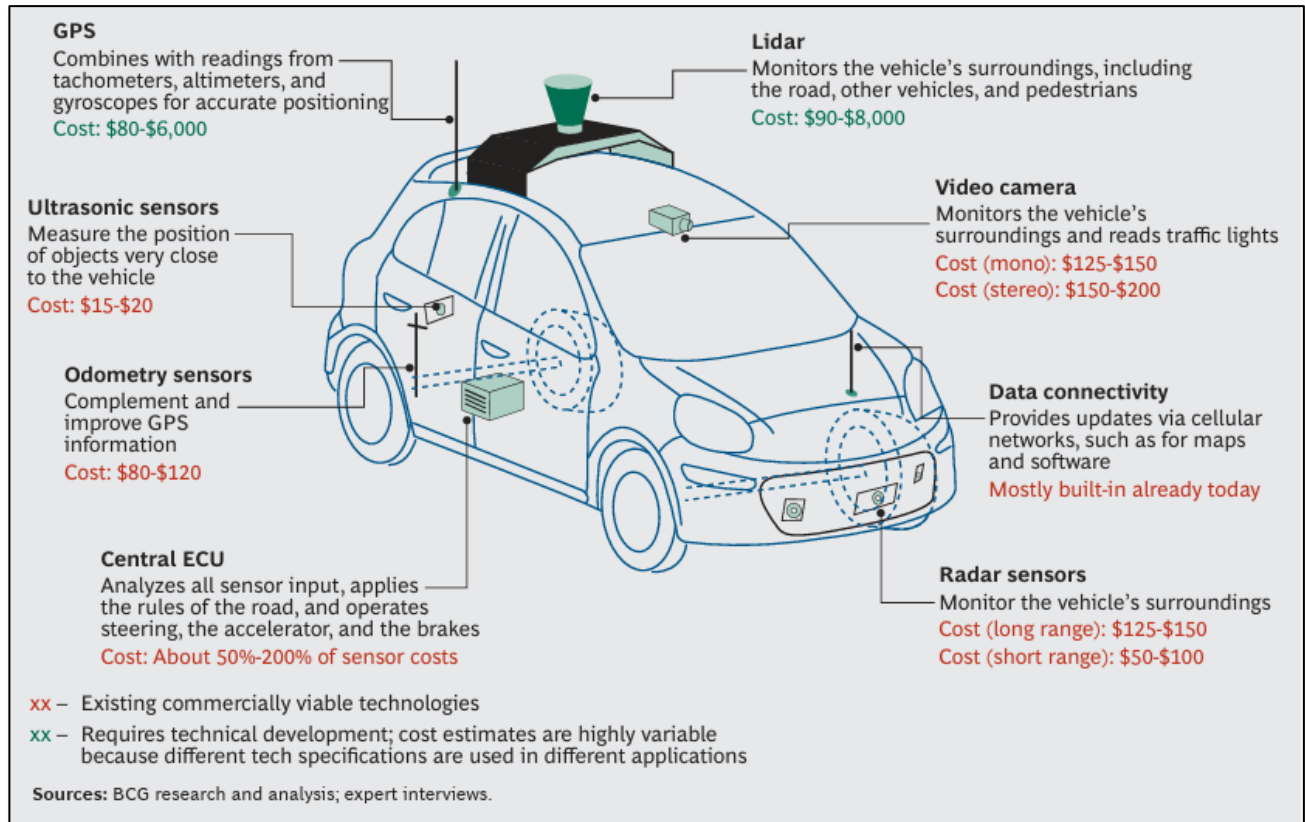
Mosquet, p. 14.

1. SDV Hardware

50. 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).

51. 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

52. 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:

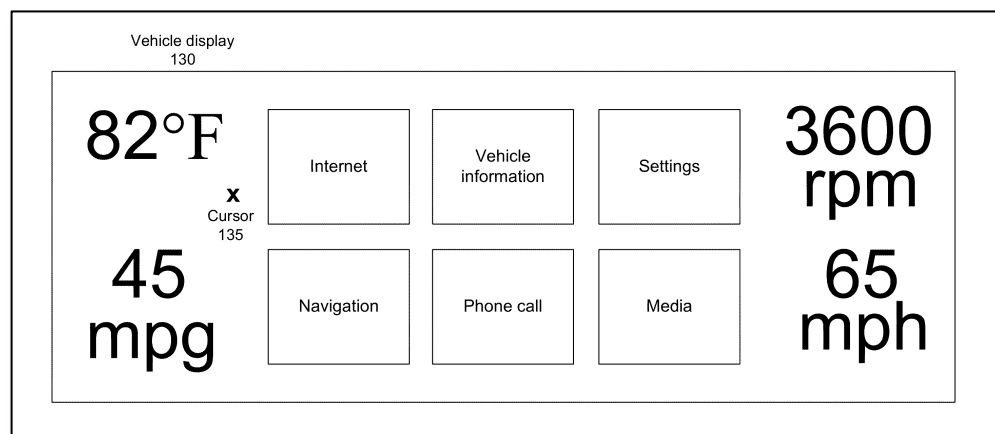
TABLE I COMPLETE SET OF SENSORS	
SENSOR FAULT	INFORMATION LOST
STEERING ANGLE SENSOR	Steering angle
YAW-RATE SENSOR	Yaw rate
MAGNETOMETER	Lateral displacement of car with respect to magnetic markers on the road
LATERAL ACCELEROMETER	Lateral acceleration of car
RADIO	Lead and previous vehicle's velocity 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 platooning autonomous vehicles.) “The information lost due to a fault in any of these sensors is also indicated in the table.”
Id.

b) Displays

53. 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.

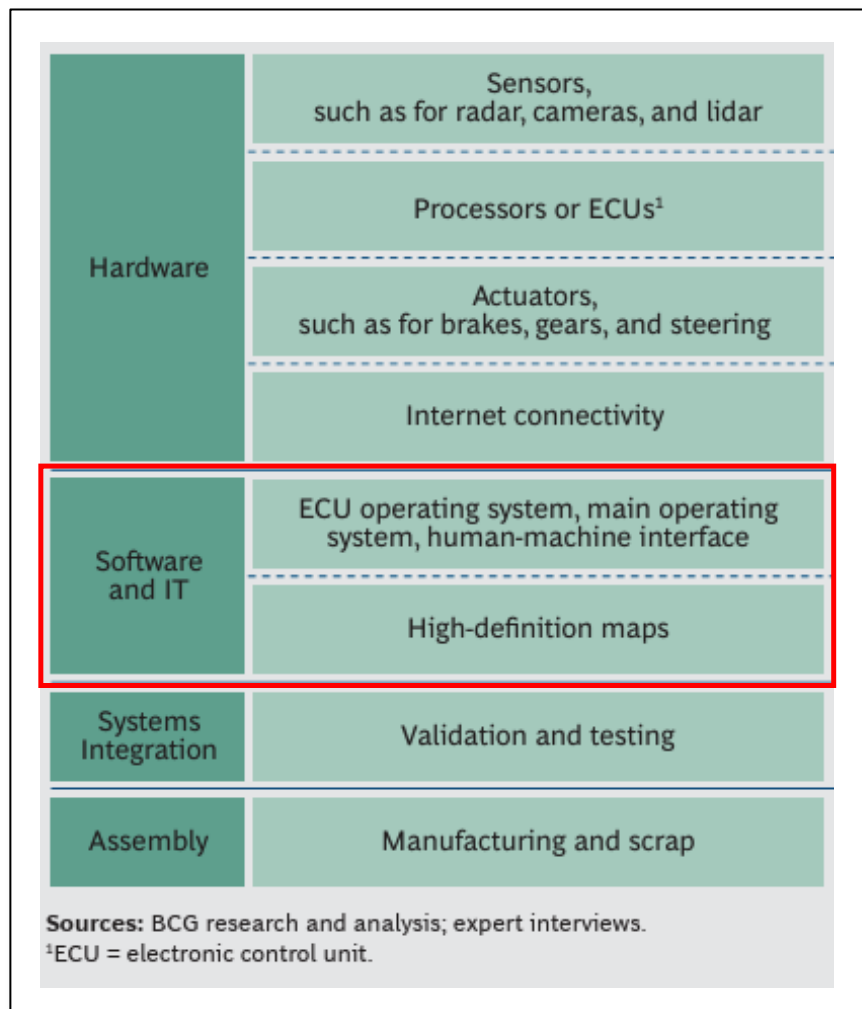
c) Braking and Steering

54. 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*

55. 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).

56. 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.

57. 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.*

58. 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. SHOWING OF ANALOGOUS, PRIOR ART

59. I have been informed by counsel that the prior art is analogous to the claimed invention of the '004 Patent. The prior art is from the same field of endeavor of the '004 patent, namely vehicles. '004 Patent, 1:24-25, 8:50-57; *Attard* (Ex. 1004), 1:15-24, 9:63-67; *Frazer* (Ex. 1005), 1:19-23, 21:20-22:22; *McNew* (Ex. 1006), 1:17-30, 3:5-52, FIG. 1; *Hampiholi* (Ex. 1007), [0050]-[0051], [0057]-[0058]; *Gunderson* (Ex. 1012), [0002]-[0004], [0025]; *Grimm* (Ex. 1031), 1:9-19, 2:57-59, 3:44-52, FIG. 1; *Sako* (Ex. 1040), 1:55-2:3, 9:63-67; *Hada* (Ex. 1043), 1:5-10; *Duncan* (Ex. 1045), [0023]; *Yamada* (Ex. 1046), 1:5-56; *Engelman* (Ex. 1047), [0004]; *Strauss* (Ex. 1048), 1:8-15.

60. The prior art is also reasonably pertinent to at least one problem facing the '004 Patent's inventors, namely at least one of:

(A) evaluating a computer's ability to autonomously operate a vehicle and determining actions to take when faults are detected; *'004 Patent*, 1:24-57, 8:11-16; *Attard*, 1:15-24, 2:28-54; *McNew*, 20:7-31, 4:3-5, 8:41-44; *Sako*, 34:15-35:21; *Grimm*, 3:44-62; *Engelman*, [0022];

(B) autonomously controlling a device's operational mode; *'004 Patent*, 1:24-57, 3:15-22; *Frazer*, 19:23-25, 21:20-22:22, FIG. 6; *Sako*, 1:24-57, 34:15-35:21; *Engelman*, [0004], [0022];

(C) selecting appropriate corrective actions for a given driving situation; *'004 Patent*, 7:57-8:16, 9:11-35, 10:30-60; *McNew*, 20:7-31, 4:3-5, 8:41-44; *Frazer*, 19:23-25, 21:20-22:22, FIG. 6; *Sako*, 34:15-35:21; *Grimm*, 5:65-6:4; *Strauss*, 5:67-6:4;

(D) adjusting an operation of a vehicle based on driver competence; *'004 Patent*, 8:50-58; *Hampiholi*, [0001]-[0004], [0057]; *Duncan*, [0007-0008];

(E) adapting to weather conditions to increase vehicle safety; *'004 Patent*, 7:42-56, 13:61-14:25, 15:33-50; *Grimm*, 1:31-44, 7:53-8:6; and/or

(F) improving vehicle safety. *'004 Patent*, 9:11-17; *Gunderson*, [0062]; *Grimm*, 1:9-19, 1:55-67; *Yamada*, 1:5-15; *Strauss*, 5:18-41; *Hada*, 1:5-36, 3:17-21, 3:55-61, 5:23-36; *Duncan*, [0007-0008].

VII. GROUNDS OF UNPATENTABILITY

61. I have been informed by Counsel that the references used in the Proposed Grounds of Unpatentability are prior art and analogous art to the '004 Patent. *See* Section VI. Below is a table listing the Proposed Grounds of Unpatentability.

Proposed Grounds of Unpatentability
<u>Ground 1:</u> Claims 10-14 are obvious under §103(a) over <i>Hampiholi, Attard, McNew, Yamada, Gunderson, Grimm, and Frazer</i>
<u>Ground 2:</u> Claim 15 is obvious under §103(a) over <i>Hampiholi, Attard, McNew, Gunderson, Grimm, Frazer, Duncan, and Engelman</i>
<u>Ground 3:</u> Claims 16-17 are obvious under §103(a) over <i>Hampiholi, Attard, McNew, Gunderson, Grimm, Frazer, Duncan, Engelman, and Strauss</i>
<u>Ground 4:</u> Claims 18-20 are obvious under §103(a) over <i>Hampiholi, Attard, McNew, Gunderson, Grimm, Frazer, Duncan, Engelman, Strauss, and Sako</i>
<u>Ground 5:</u> Claims 21-24, 27 are obvious under §103(a) over <i>Hampiholi, Attard, McNew, Gunderson, Grimm, Frazer, Duncan, Engelman, Strauss, Sako, and Hada</i>

VIII. GROUND 1: CLAIMS 10-14 ARE OBVIOUS OVER HAMPIHOLI, ATTARD, MCNEW, YAMADA, GUNDERSON, GRIMM, AND FRAZER

A. Claim 10

1. Claim 10(Pre): “A self-driving vehicle (SDV) comprising:”

62. Claim 10 is rendered obvious over a combined *Hampiholi-Attard self-driving vehicle* (SDV)², operating according to *Hampiholi*’s disclosure and modified to incorporate *Attard*’s self-driving modes, functions, features, and confidence assessments, as well as any hardware and software necessary to provide an operable SDV practicing the techniques taught by both *Hampiholi* and *Attard*. The combined *Hampiholi-Attard* vehicle would have desirably been capable of self-driving and implementing corrective actions when appropriate, whether due to detected reduced human competence (per *Hampiholi*) or due to detected reduced processor competence (per *Attard*). 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

² I use the “*Hampiholi-Attard* SDV” as shorthand to refer to the mapped combinations.

corrective actions (or no corrective action) in response to detected sensed conditions as a particular situation dictates.

63. The '004 Patent describes SDVs as vehicles “able to autonomously drive themselves through private and/or public spaces” and during some, but not all, weather conditions. *'004 Patent*, 1:29-31, 15:64-16:4, 28:38-40. *Hampiholi's* vehicle is capable of driving automatically. *Hampiholi*, [0057] (describing “**automatically** controlling the vehicle speed or braking” and “**automatically** bringing the vehicle to a complete stop”), [0073], [0076] (“**automatic** adjustment of engine operation”), Fig. 4. A POSITA would have understood that a vehicle capable of driving automatically in at least some scenarios is a self-driving vehicle (SDV) per the '004 Patent. For example, as I discussed above, *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. *See*, ¶ 46.

64. *Attard* teaches such an autonomous self-driving vehicle in which autonomous driving module 106 of computer 105 controls steering, braking, and speed, among other functions including navigation. *Attard*, 1:15-65, 9:60-10:12, 10:36-41. Specifically, *Attard* teaches controlling a driving mode, transitioning from autonomous mode to either semi-autonomous mode or manual mode responsive to

detecting a fault. *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"), 9:60-10:12 ("all vehicle 101 operations, e.g., steering, braking, speed, etc., could be controlled by the module 106 in the computer 105."), 10:36-41.

65. A POSITA would have appreciated that the resulting SDV would have thus furthered *Hampiholi's* stated goal of increasing driver, passenger, and bystander safety by controlling a driving mode of an SDV to respond to faults such as decreased driver competence (per *Hampiholi*) as well as hardware failures or

weather conditions per *Attard* – components that were already present in the *Hampiholi* vehicle, such as outward-facing cameras and external weather sources. *Hampiholi*, [0002], [0017]; *Attard*, 1:41-2:9. This modification would have been combining prior art elements according to known methods to yield the predictable result of an SDV specifically augmenting the automated systems and sensors disclosed in *Hampiholi* according to *Attard* to provide SDV functionality. Further, the modification would have been use of a known technique of implementing hardware and/or software features in a vehicle, resulting in an SDV, which were known in the prior art. Further, the modification would have been use of a known technique of implementing hardware and/or software features in a vehicle, resulting in an SDV.

66. A POSITA would have had a reasonable expectation of success (REOS) for combining the vehicles of *Attard* and *Hampiholi* because each describe vehicles configured to automatically take measures to increase the safety of the vehicle in response to detected danger. *Attard*, 5:44-53, 8:1-61; *Hampiholi*, [0002], [0057], [0065]-[0069]. Whether the source of the danger was hardware failure, weather conditions, or human incompetence, a POSITA would have appreciated that core functions of each of *Attard* and *Hampiholi* were to identify and mitigate that danger to improve the safety of the driver and potentially nearby vehicles/drivers. Further, a POSITA would not have had to personally fabricate an SDV to modify

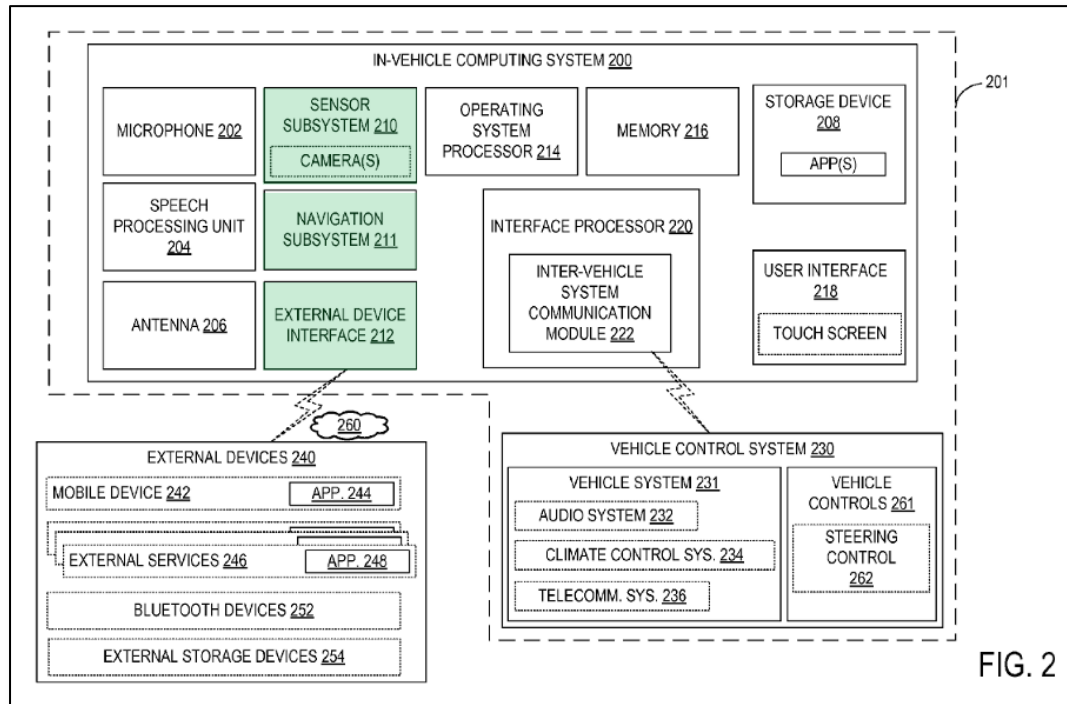
Hampiholi per *Attard*'s teachings as discussed herein. *See*, 10(c)³ for additional motivation to modify *Hampiholi* per *Attard* to include features for self-driving functionality (*vehicle controls*, *see* 10(c)).

2. Claim 10(a): “a sensor system having a plurality of sensors, comprising:”

a) *Hampiholi*'s System of Sensors

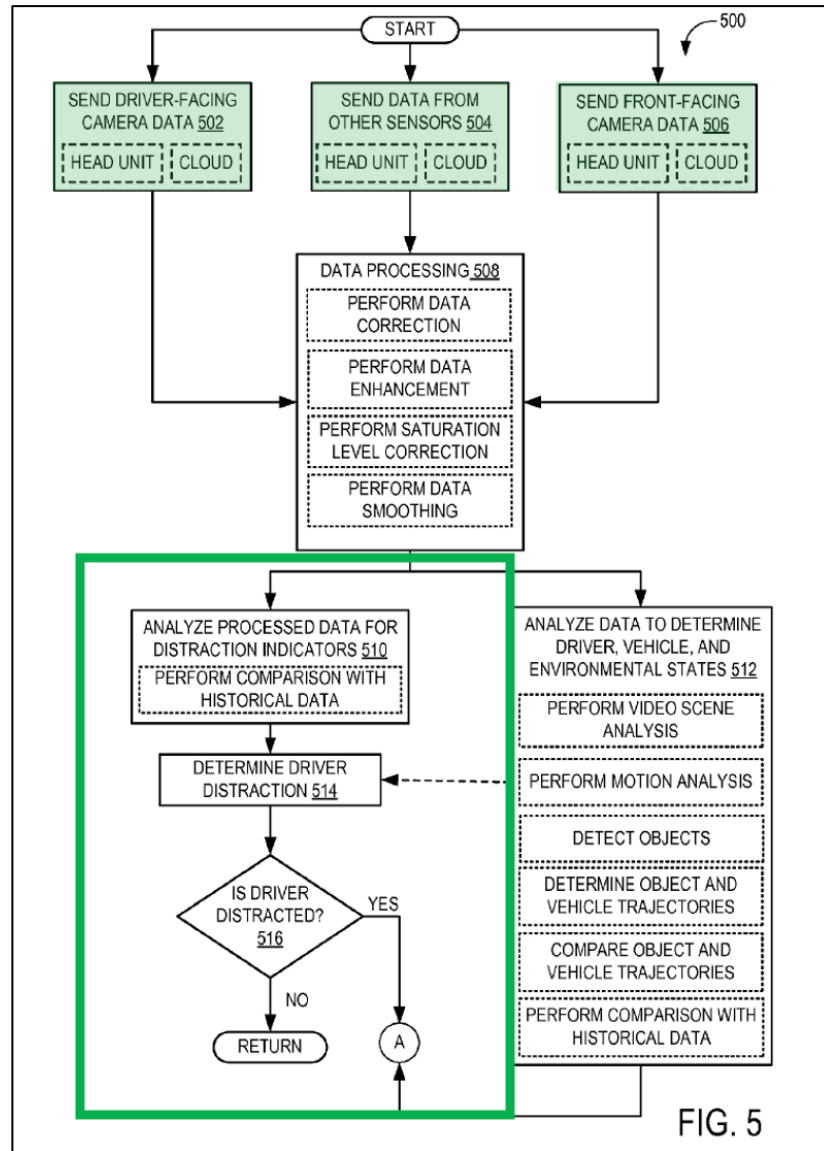
67. *Hampiholi* teaches receiving inputs from a plurality of sensors in sensor subsystem 210, external device interface 212, and navigation subsystem 211 (collectively, *a sensor system having a plurality of sensors*) including signals regarding gas pedal and brake inputs, temperatures, vehicle and engine speed, cameras, and the vehicle's location.

³ Any citation to a claim limitation is to the limitation's mapping in this Declaration, and such mapping is otherwise incorporated by reference in the section citing the limitation.



Hampiholi, Fig. 2, [0031], [0034], [0046]. A POSITA would have understood a plurality of readings from these sensors would have been collected from across the vehicle for processing and analysis at the vehicles computing processor in order to provide the vehicle with a constantly-updating analysis of the vehicle's operating condition. Each of these sensors were well known prior to the '004 Patent for inclusion in SDVs, enabling the vehicle to operate safely and effectively. These sensors are collectively mapped as the *sensor system*.

68. As illustrated in Fig. 5, *Hampiholi* teaches sending sensor readings from this *sensor system* to determine the driver's distraction level – quantified as severity rank R, the mapped *competence level of the human driver* (HDCL) – which I discuss further with respect to 10(g)(v).

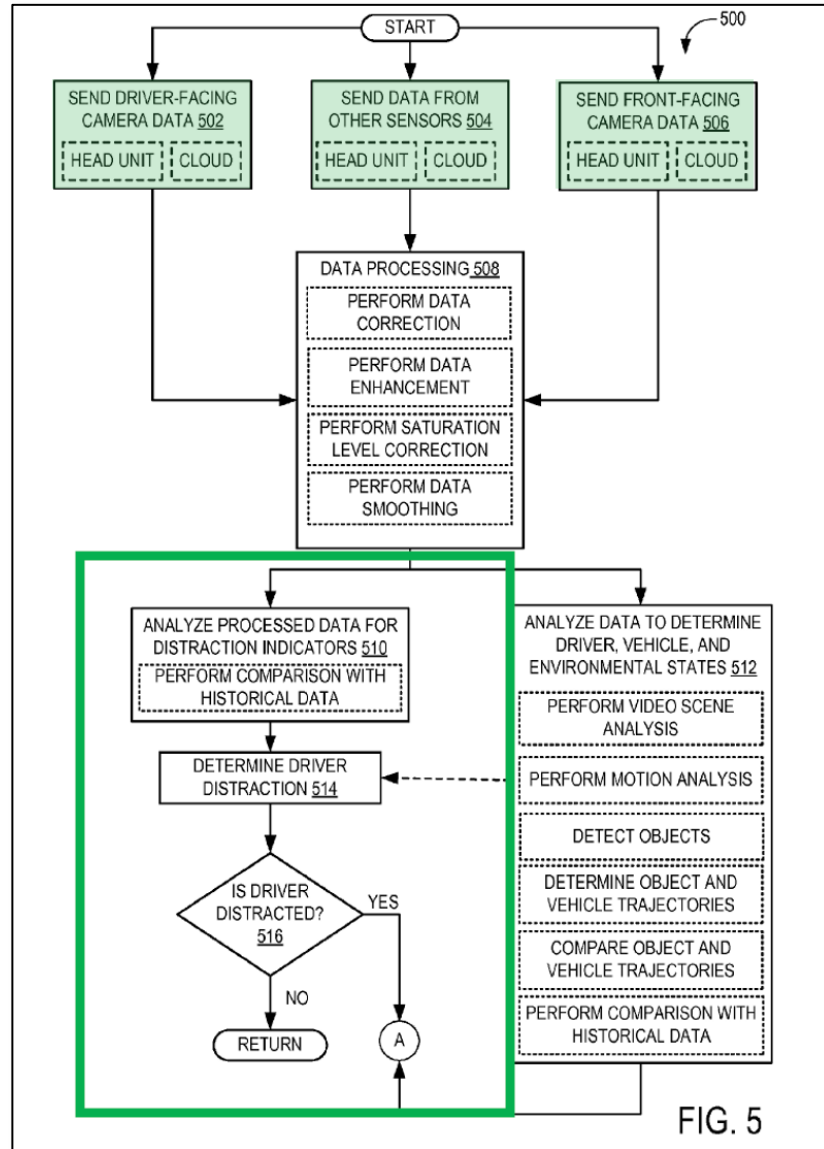


Hampiholi, FIG. 5. Sensor readings used to determine *Hampiholi*'s severity rank R include driver's eyelid position as determined by the video from a driver-facing camera ([0062]) and speed and/or location of the vehicle ([0057]).

a) Claim 10(a)(i): "a first camera"

69. *Hampiholi* teaches a driver-facing camera (*a first camera*). For example, mobile/wearable device 302 includes a driver-facing camera and

Declaration of Christopher Wilson
U.S. Patent No. 12,037,004 (Claims 10-24, 27)
communicates with the in-vehicle computing system. *Hampiholi*, [0004], [0005],
[0035]-[0036], [0046], [0055], [0058]-[0059], [0061]-[0062], [0065].



Hampiholi, FIG. 5. See, 10(g)(v).

3. **Claim 10(a)(ii): “a second camera”**

a) **Attard’s Second Camera**

70. *Attard* teaches “[d]ata collectors 110 could also include sensors or the like for detecting conditions outside the vehicle” including “image capture devices”, i.e., a *second camera*. *Attard*, 4:8-17, 14:63-67.

b) Motivation to Combine *Hampiholi-Attard*

71. A POSITA would have been motivated and found it obvious to include a second camera, per *Attard*, in the *Hampiholi-Attard* SDV to increase the total amount of data collected (and to be collected from potentially different angles from that of the first camera), resulting in a safer vehicle. That is, the use of a second, exterior camera, per *Attard*, enables exterior data from the vehicle to be obtained, e.g., for self-driving. A POSITA would have had a REOS because *Hampiholi* already includes a camera and vehicles utilizing multiple cameras were well-known. *See, e.g., Cullinane* (Ex. 1019), 7:39-49, 5:60-6:3; *Scofield* (Ex. 1022), 5:13-15, 6:39-40. This modification would have been combining prior art elements according to known methods to yield the predictable result of an SDV having multiple cameras, e.g., at least one for monitoring the driver, per *Hampiholi*, and another for imaging the external environment, per *Attard*. Further, this would have been use of a known technique of an SDV with a camera monitoring the exterior of the vehicle to improve the *Hampiholi-Attard* SDV in the same way as *Attard*’s. As I previously discussed, SDVs included these exterior facing cameras, such that the modification would have been obvious, within the skillset of a POSITA, and had a REOS. *See* Section V.E.1.

Additional motivation to combine *Hampiholi-Attard* is provided above. See, 10(Pre).

4. Claim 10(a)(iii): “a sensor configured to detect input from a steering wheel”

72. First, I note that steering wheel grip sensors were well known in the prior art before the '004 Patent and that there were vehicles in production that used steering wheel sensors to monitor the driver's attention level. For example, it was known that the Mercedes 2013 S-class included sensors that “can detect whether the driver's hands are actually on the steering wheel. If they are not, a visual warning is issued first.” *GCC* (Ex. 1053), 3; *Mercedes2013* (Ex. 1055), 2.

73. *Attard* teaches that the commanded steering input is measured. *Attard*, 7:8-11 (“[A] measured change in lateral acceleration for a given commanded steering input (steering gain) could be compared to an internal model.”) A POSITA would have understood that when the steering is manual and the command is from the steering wheel, this requires *a sensor configured to detect input from a steering wheel*. Otherwise, there would be no way to detect the steering input command.

74. To the extent it is argued this is not taught by *Attard*, *McNew* teaches a “steering wheel grip sensor [that] can detect whether the driver's hands are in contact with the steering wheel,” i.e., *a sensor configured to detect input from a steering wheel*. *McNew*, 4:15-18, 4:6-29 (“steering wheel grip sensor”), 3:26-52, 5:4-15.

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

75. A POSITA would have been motivated and found it obvious to modify the *Hampiholi-Attard* SDV further per *McNew* to yield the predictable result of *the Hampiholi-Attard* SDV operable to detect whether the driver's hands are on the steering wheel. Having the current position of the driver's hands as data would have improved SDV decision-making, such as whether to transition from autonomous mode to manual mode. If a driver's hands are not on the wheel at the current moment, it would likely not be safe to make such a transition, whereas if a driver's hands are on the wheel, that is a data point that may help indicate it is safe to transition to manual mode. This would have predictably improved *Hampiholi's* driver distraction system by providing another avenue by which to detect whether the driver is paying attention. Thus, a more accurate and/or a more flexible severity rank R would be computed. I discuss *Hampiholi's* severity rank R further with respect to Claim 10(g)(v).

76. *Hampiholi* provides an express teaching, suggestion, and motivation by teaching the use of a camera for detecting whether "the driver may have taken his/her hands from the driving wheel." *Hampiholi*, [0065]. A POSITA would have recognized that adding a steering wheel grip sensor, per *McNew*, would have improved *Hampiholi's* detecting of the driver's hands being on the wheel. For example, perhaps the driver's hands are near the steering wheel but outside the range

of the camera, which is more focused on the driver's face and eyes. The additional information would have predictably improved *Hampiholi's* severity rank R to more accurately assess when the human's driving competence was diminished, increasing vehicle/driver safety, furthering *Hampiholi's* express safety goal. *Hampiholi*, [0002]. In particular, *McNew's* teachings would have improved the *Hampiholi-Attard* SDV by monitoring whether a driver has his/her hands on the steering wheel, the location of the hands (e.g., is only one hand in a non-ideal location such as on the bottom of the steering wheel or are both hands on the wheel at 9 o'clock and 3 o'clock), and how hard or lightly the driver is gripping the steering wheel (which may indicate stress or lack of attention). Thus, this use of a known technique of using a steering wheel sensor to determine if a driver's hands are on the steering wheel would have improved the *Hampiholi-Attard* SDV in the same way as *McNew's* SDV.

77. This modification would have been combining prior art elements according to known methods to yield the predictable result of a steering wheel sensor in an SDV, i.e., combining a steering wheel grip sensor with *Hampiholi's* driver distraction system's sensors to yield the predictable result of *Hampiholi's* severity rank R further being based on the driver's interaction with the steering wheel. As discussed above, *Hampiholi-Attard* SDV already includes numerous sensors, and sensors were well known for use in SDVs in the prior art. Modifying *Hampiholi-*

Attard to include an additional sensor would have simply been combining a known prior art element in an SDV. Further, the modification is use of a known technique of employing a steering wheel grip sensor that would have improved *Hampiholi-Attard* in the same way as *McNew*. Indeed, using a steering wheel sensor such as *McNew* teaches would have allowed the *Hampiholi-Attard* SDV to make more informed decisions regarding the state of the driver (e.g., attentive, not paying attention, hands not on the wheel) and corrective actions, such as transitioning to manual mode.

78. A POSITA would have had REOS because monitoring driver states using steering wheel sensors was well-known in the art before the '004 Patent and further because such would have required only straightforward hardware and/or programming changes to the *Hampiholi-Attard* SDV, e.g., to detect driver input via a steering wheel sensor. A POSITA would have understood that adding a sensor would have been a straightforward process, and that adding or changing programming instructions to account for the sensor would likewise have been straightforward, including because using sensors, such as steering wheel sensors, was well known in the prior art as I discussed above.

5. Claim 10(a)(iv): “a GPS sensor”

79. The *Hampiholi-Attard* SDV includes a *GPS sensor*. *Hampiholi*, [0031] (“[L]ocation sensors such as Global Positioning System [GPS] sensors); *Attard*, 3:4-7.

6. Claim 10(a)(v): “a thermometer; and”

80. See, 10(a). *Hampiholi* teaches or renders obvious a thermometer. Namely, *Hampiholi* teaches an “inter vehicle system communication module 22 that outputs data “provided by individual information sources” including “**thermometers.**” *Hampiholi*, [0031]. *Hampiholi* additionally provides a number of temperatures that are measured.

[T]he inputs received by sensor subsystem 210 may include transmission gear position, transmission clutch position, gas pedal input, brake input, transmission selector position, vehicle speed, engine speed, mass airflow through the engine, **ambient temperature, intake air temperature**, etc., as well as inputs from climate control system sensors (such as **heat transfer fluid temperature, antifreeze temperature**, fan speed, **passenger compartment temperature**, desired passenger compartment temperature, ambient humidity, etc.)

Hampiholi, [0034]. To the extent it is argued *Hampiholi* does not teach a thermometer, *Yamada* teaches such. See, 10(b)(ii).

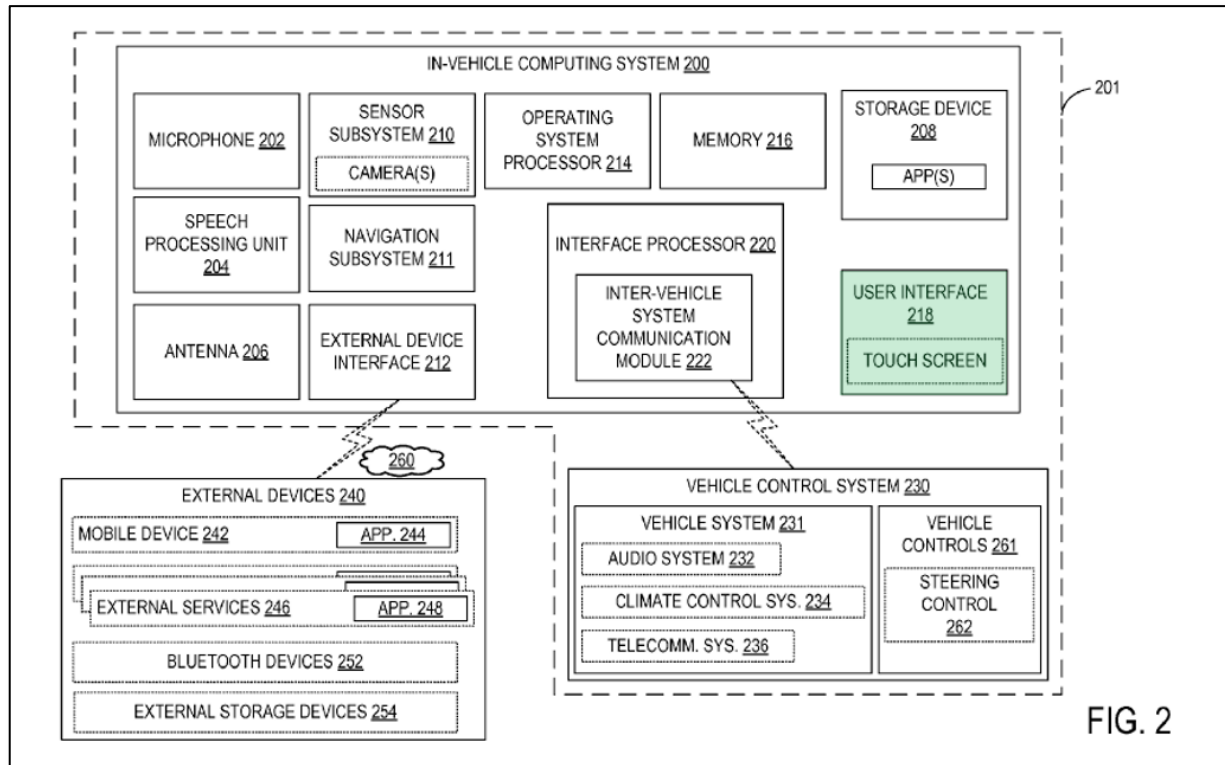
7. Claim 10(a)(vi): “a speedometer”

81. *Hampiholi* teaches “inputs received by sensor subsystem 210 may include...vehicle speed,” which a POSITA would have understood as teaching or rendering obvious *a speedometer*. To the extent it is argued *Hampiholi* does not teach a speedometer, *Yamada* teaches such. *See*, 10(b)(iii). Further, a POSITA would understand that a speedometer is required on road vehicles sold in the USA.

8. Claim 10(b): “a display that is capable of displaying”

82. *Hampiholi* teaches a user interface 218 that “may include a graphical user interface presented on a touch screen,” meeting the claimed *display*. *Hampiholi*, [0044]. A POSITA would have understood that a display such as *Hampiholi*’s would have been capable of displaying sensor readings because the display is a GUI, which is capable of displaying information from vehicle sensors, such as the temperature.

83. To the extent it is argued that *Hampiholi* does not teach UI 218 *is capable of displaying* the GPS, thermometer, and speedometer readings required by 10(b)(i)-(iii); however, *Yamada* teaches such, and a POSITA would have found it obvious and been motivated to modify *Hampiholi* based on *Yamada* as discussed below for 10(b)(i)-10(b)(iii).



Hampiholi, FIG. 2.

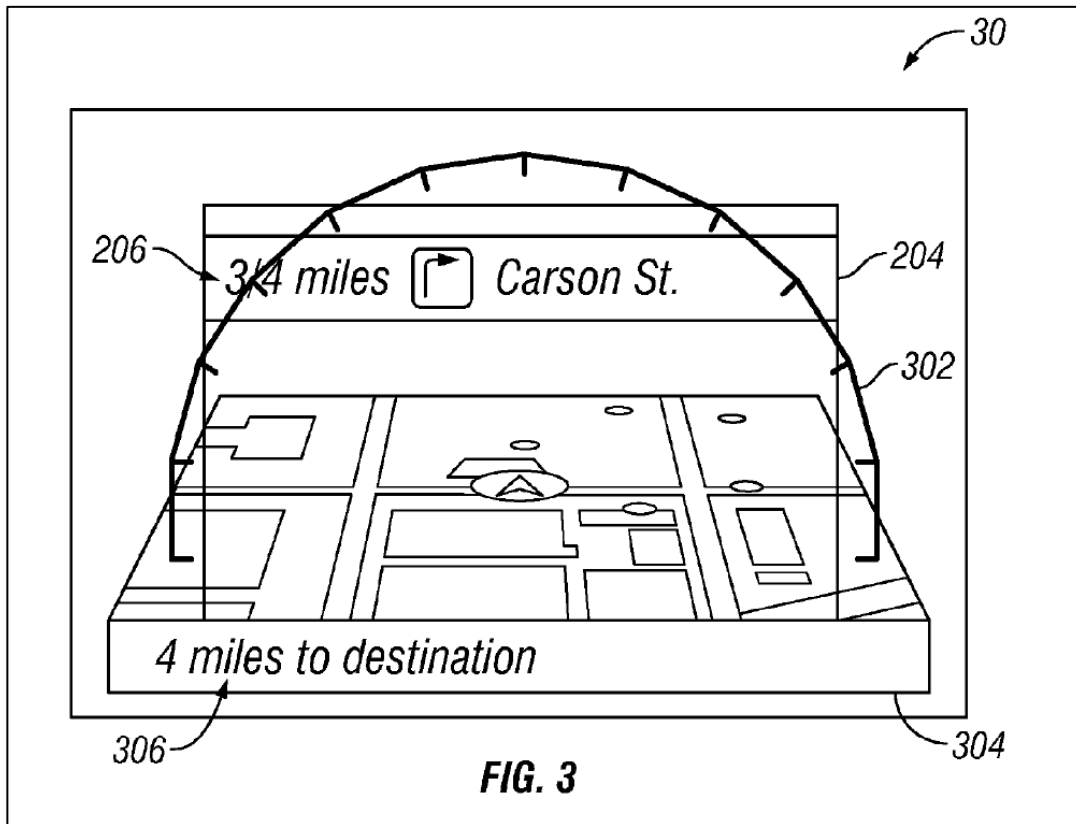
9. Claim 10(b)(i)-(iii): “displaying...” “a reading from the GPS sensor;” “a reading from the thermometer; and” “a reading from the speedometer;”

a) Yamada’s readings from GPS sensor, thermometer, speedometer

84. Yamada teaches a display capable of displaying a reading from a GPS sensor. Yamada, 4:26-32 (GPS), 8:30-53 (speedometer), 8:64-9:22 (thermometer, GPS), 5:4-8, 5:31-41, 1:28-35. Yamada teaches information sensors 72 including interior/exterior/engine temperature sensors (i.e., *thermometers*) may display a reading from a thermometer on a vehicle display. Yamada, 8:64-9:22. Similarly,

Yamada teaches displaying a reading from the speedometer. *Yamada*, 8:30-66, 5:4-

8. A speedometer and GPS navigation map are depicted in Fig. 3 below.



Yamada, Fig. 3. While not depicted for Fig. 3, a POSITA would have understood that *Yamada*'s display was capable of displaying temperature readings. In fact, such is expressly taught by *Yamada*.

A data source may be any suitable device, data store, or combination thereof that generates, detects, collects, records, calculates, aggregates, or otherwise acquires information that **may be communicated to the driver using the combined display**. In a vehicle, suitable data sources may include, without limitation: one or more vehicle information

sensors 72, such as a wheel speed sensor, **interior or exterior temperature sensor, engine temperature sensor...**

Yamada, 8:60-9:1.

b) Motivation to Combine Hampiholi-Attard-McNew-Yamada

85. A POSITA would have been motivated and found it obvious to modify the *Hampiholi-Attard* SDV to display readings from sensors including GPS sensor, thermometer, and speedometer per *Yamada's* teachings to provide the driver additional visual aid during driving. Displaying a reading from a GPS sensor would have aided the driver in navigation, for example, by showing the current location of the driver. Such was well known before the '004 Patent. For example, the 2013 Tesla Model S displayed GPS location. *Model S Manual* (Ex. 1054), 78. Displaying thermometer readings would have informed a driver of interior and exterior vehicle temperature for climate control and would have provided valuable information to a driver regarding the possibility of ice on the road. Informing a driver of engine temperature would have been advantageous for a user to monitor if an engine is overheating or too cold to effectively run the vehicle's heater. This was well known before the '004 Patent – the 2013 Tesla Model S displayed cabin temperature via a display. *Id.*, 42, 62-63. Displaying a reading from a speedometer would have advantageously helped a driver know the vehicle's current speed and comply with traffic laws regarding speeding and has been done for years before the '004 Patent.

For example, the 2013 Tesla Model S displayed vehicle speed via a touch screen. *Id.* 42, 67.

86. Modifying the *Hampiholi-Attard* SDV to utilize a display capable of displaying these sensor readings would have been combining prior art elements according to known methods to yield predictable results the predictable results of displaying the GPS, temperature, and speedometer data already gathered by the *Hampiholi-Attard* SDV. Further, this modification would have been use of *Yamada's* known technique to improve the similar *Hampiholi-Attard* SDV in the same way as *Yamada's* SDV, i.e., “conveying additional important driving information...to allow the driver to read the information.” *Yamada*, 1:31-35.

87. This modification would have had a REOS because displaying, GPS, temperature, and speedometer readings was well-known in the art prior to the '004 Patent as I discussed above. Further, this *modification* would have had a REOS because *Hampiholi-Attard* already has the necessary hardware including sensors and a display, processor, and memory for storing programming instructions. *Hampiholi*, [0032], [0044]; *Attard*, 15:12-46. Only straightforward changes to programming instructions would have been required, e.g., to cause the already-gathered sensor data to be displayed. To the extent it is argued that the *Hampiholi-Attard* SDV's display would have needed to be replaced, such would have been a simple substitution of one known display for another and would have obtained predictable

results at least because such in-vehicle displays were already well known by the time of the '004 Patent. *See* Section V.E.1.b.

10. Claim 10(c): “vehicle controls comprising: an engine throttle, a steering mechanism, and a braking system;”

88. As discussed above, the *Hampiholi-Attard* SDV is configured to automatically modify particular operations of the vehicle, including specifically autonomously controlling the vehicle speed and bringing the vehicle to a complete stop (per *Hampiholi*) and disabling one or more autonomous operations, such as in response to a fault (per *Attard*). *See*, 10(Pre). *Attard* teaches the claimed *vehicle controls*.

89. *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.” *Attard*, 9:63-10:12. 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.” A POSITA would have recognized or at least found obvious that controlling the vehicle’s “steering” teaches controlling its “steering mechanism,” as claimed, because the steering mechanism would have naturally and/or intentionally adjusted to stay in sync with the movements of the

vehicle to enable the driver to retake control of the vehicle when desired and/or necessary. Similarly, a POSITA would have recognized that *Attard's* description of controlling its “speed” teaches controlling its “engine throttle,” as claimed, because the vehicle’s engine throttle would have been adjusted to increase the thrust of the engine to result in an increase in the vehicle’s speed. It is established fact that the vehicle’s speed is controlled via the throttle, which controls the air 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. Additionally, *Attard's* description of controlling its “braking” would have been done via its braking system at least including the vehicle’s brakes, and thus *Attard* teaches controlling its “braking system,” as claimed.

90. 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 system*) and direction (*steering mechanism*). *Attard* expressly envisions that its vehicle “may be operated wholly or partly without human intervention,” relying on its central computer to

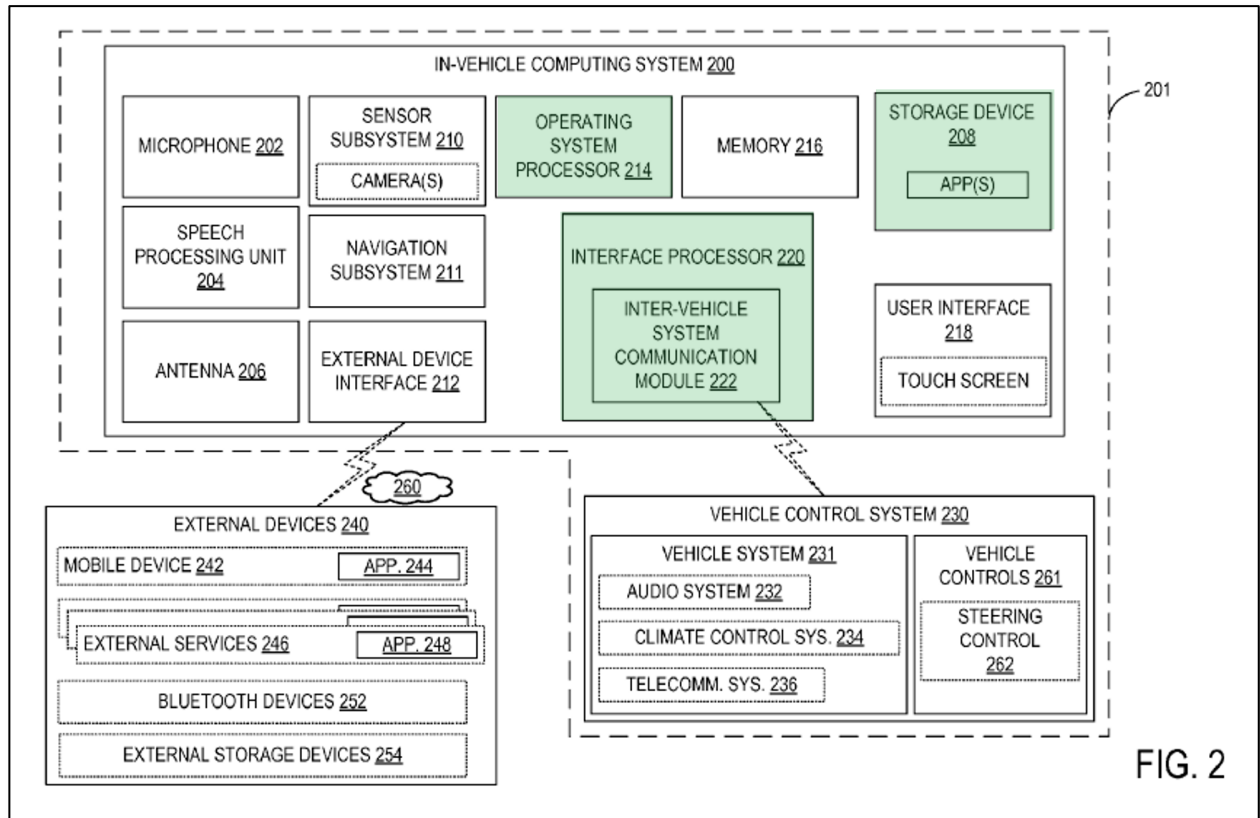
“operate the vehicle, e.g. to make decisions regarding vehicle speed, course etc.”

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 driver controls.

91. 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. A POSITA would have recognized each of these autonomous operations would have required control of the *engine throttle*, *steering mechanism*, and *braking system*. Stopping requires control of the engine throttle, and braking system and pulling over requires control of the steering mechanism. Thus, a POSITA would have recognized each of these autonomous operations would have required control of the engine throttle, steering mechanism, and braking system. 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*.”

11. Claim 10(d): “a non-transitory computer readable storage medium comprising”

92. *Hampiholi*’s Fig. 2 below depicts vehicle 201 including vehicle storage device 208 including “instructions executable by processors 214 and 220 in non-volatile form:”



Hampiholi, Fig. 2, [0029], [0032].

93. *Hampiholi* teaches storage device 208 may store instructions and/or code that, when executed by a processor (e.g., operating system processor 214 and/or interface processor 220), controls the in-vehicle computing system 200 to perform one or more actions.

A non-volatile storage device 208 may be included in in-vehicle computing system 200 to store data such as instructions executable by processors 214 and 220 in non-volatile form.... **Non-transitory storage devices, such as non-volatile storage device 208** and/or volatile memory 216, may store instructions and/or code that, when executed by a processor (e.g., operating system

processor 214 and/or interface processor 220), controls the in-vehicle computing system 200 to perform one or more of the actions described in the disclosure.

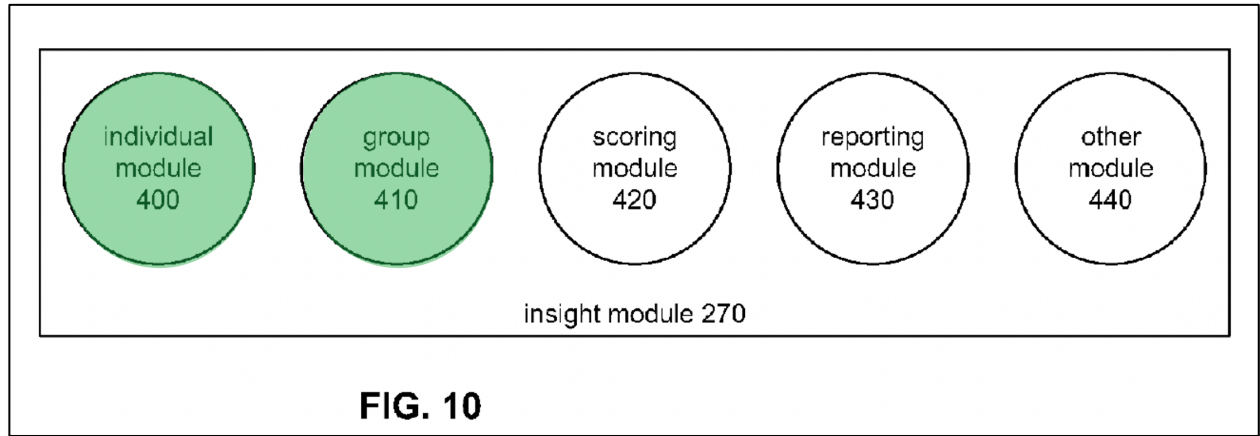
Hampiholi, [0032]. These instructions would have included those taught by both *Hampiholi* and *Attard* in the *Hampiholi-Attard* SDV, including specifically the instructions for “controlling a driving mode” according to *Attard*’s disclosure. *Hampiholi*, [0003], [0032]; *Attard*, 3:22-27, 3:56-67, 9:60-10:12. Thus, a POSITA would have understood or found obvious *Hampiholi*’s storage device 208 is a *non-transitory computer readable storage medium*.

12. Claim 10(d)(i): “a first plurality of weights, and the first plurality of weights comprising first active learning data from a first cohort of other SDVs:”

a) Gunderson’s Teachings

94. *Gunderson* teaches vehicle 10 and event capture device 20 (e.g., camera) determining driver behaviors. *Gunderson*, [0030]. Further, *Gunderson* teaches event detector 30 in combination with event capture devices 20 “identifies an event and stores certain audio and video data along with related information about the event.” *Gunderson*, [0032]. Data regarding event 150 is stored locally until being provided to evaluation server 50. *Gunderson*, [0040]-[0045]. Evaluation server 50 includes insight module 270, which aggregates event data into a database and correlates the data to identify trends in driving behavior that relate to risk factors and generates a driver rating/score for a driver. *Gunderson*, [0056], [0059].

95. Insight module 270 includes individual module 400 and group module 410.



Gunderson, Fig. 10, [0060]. Individual module 400 analyzes event data for an individual, and scoring module 420 applies scoring regarding risk factors (e.g., changing lanes without signaling). *Gunderson*, [0061]. Group module 410 analyzes event data for a group of drivers and “assign[s] relative weights to the risk factors depending on their prevalence to the group as a whole.” *Gunderson*, [0062]. For example, a tendency of not utilizing a turn signal before changing lanes appears in only one driver out of ten, reducing that tendency by 90 percent when applied to the group. *Id.* Additionally, *Gunderson*’s scoring module 420 uses data from the individual and group modules (including the weights) to derive a score for the individual. *Gunderson*, [0063]. Thus, *Gunderson*’s weights applied to risk factors are *a first plurality of weights* because multiple weights form a plurality. Furthermore, A POSITA would have understood or found obvious that weighting

driver behaviors in this way teaches *weights comprising active learning data from a first cohort (Gunderson's group of drivers) of other SDVs*. To state another way, since the weights are applied based on data from other drivers, the weights *comprise* that *active learning data*.

b) Motivation to Combine *Gunderson*

96. A POSITA would have been motivated and found it obvious to modify the *Hampiholi-Attard* SDV per *Gunderson's* weight teachings. This modification would have improved the *Hampiholi-Attard* SDV to advantageously use more accurate/flexible information when computing *Hampiholi's* severity rank R. Weighting variables in equations is a long-standing practice that a POSITA would have understood to improve the computation by assigning more/less severity to variables based on their importance or prevalence to the desired output of the equation. For example, *Gunderson* teaches negative tendencies may be relatively uncommon among drivers, and the weights may be set to learn from such behaviors, such as how many drivers in a group properly use their turn signal. *Gunderson*, [0061]. Thus, driver behaviors trends among a group of drivers can be identified to accurately weight such trends according to their prevalence amongst drivers. Accordingly, modifying the *Hampiholi-Attard* SDV in this way would have enabled, for example, assigning a higher weight to certain distraction indicators that are more prevalent based on data from other drivers and a lower weight to those distraction

indicators that are less prevalent among drivers. *Hampiholi*, [0062]-[0063], FIG. 5.

For example, if a distraction indicator of a driver looking at their phone was found to be prevalent and to result in dangerous driving, per *Gunderson*, *Hampiholi's* R determination would have been weighted to assign such behavior a higher R value to cause a more severe corrective action to be taken. This modification would have been use of a known technique that would have improved *Hampiholi-Attard's* similar vehicle in the same way as *Gunderson's* vehicle by assessing driver behavior in a more nuanced way.

97. Furthermore, a POSITA would have been motivated and found it obvious to store *Gunderson's* weights in *Hampiholi's* storage device 208 (*non-transitory computer readable storage medium*). A POSITA would have thus been motivated and found it obvious to apply *Gunderson's* teachings of weighting driver behaviors to *Hampiholi's* similar system that evaluates driver behaviors to compute severity rank R. A POSITA would have understood that such weights needed to be stored or accessible somewhere and would have found it obvious to store them in *Hampiholi's* storage device so that the weights are accessible when computing R while driving.

98. Modifying the *Hampiholi-Attard* SDV per *Gunderson* would have had a REOS. *Hampiholi-Attard* already includes hardware necessary to perform *Gunderson's* steps, including *Hampiholi's* sensors, processor, memory, and

programming instructions. *Hampiholi*, [0032]; *Gunderson*, [0086]. Because *Hampiholi* already accounts for historical information in determining driver distractedness, a POSITA would have had a reasonable expectation of success in the modification because it would have been a straightforward modification to weight such historical medication, per *Gunderson*. *Hampiholi*, [0062]-[0063]. Thus, modifying the *Hampiholi-Attard* SDV per *Gunderson* would have required only straightforward changes to programming instructions well-within the skillset of POSITA, i.e., by weighting data used to compute R. Further, modifying the *Hampiholi-Attard* SDV, e.g., to store *weights* per *Gunderson* would have been a straightforward modification well within the skillset of a POSITA because weighting was so well known as previously discussed.

13. Claim 10(e): “the non-transitory computer readable storage medium comprises”

99. See, 10(d).

14. Claim 10(e)(i): “a second plurality of weights, and the second plurality of weights comprising second active learning data from the first cohort of other SDVs;”

a) Grimm’s Weights

100. *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 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.

101. 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 the following equation:

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

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.

102. *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 its properties 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.

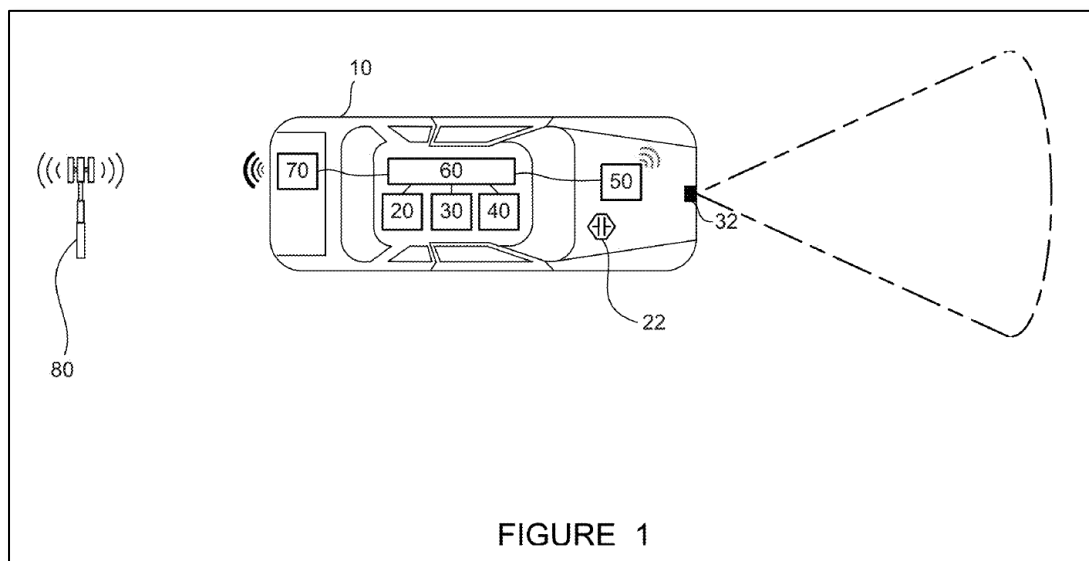
103. The weights w_j in the threat level equation teach *a second plurality of weights*. Further, because these weights are derived from different properties reported from the other vehicles, the weights *compris[e] second active learning data from the first cohort of other SDVs*. A POSITA would have understood or found obvious to modify the *Hampiholi-Attard* SDV such that *Gunderson’s* and *Grimm’s* weights are from the same *(first) cohort of other SDVs*, thereby advantageously leveraging data/weights from the same set of vehicles for the decision-making process. For example, a POSITA would have found it obvious and understood the benefit obtaining the driver-related weights *(first plurality of weights)* and the vehicle-related weights *(second plurality of weights)* from the same cohort of SDVs such that the data is as similar/relevant to the *Hampiholi-Attard* SDV as possible.

b) Motivation to Combine with *Grimm*

104. Per Claim 10(g)(iv) and 10(g)(vi), the *second plurality of weights* are used with *a second plurality of inputs* to obtain *a second weighted voting result*, which is in turn used to *autonomously maintain a buffer of space*.

105. A POSITA would have been motivated and found it obvious to modify the *Hampiholi-Attard* SDV per *Grimm*'s teachings of a *second plurality of weights* and to store those weights in memory, beneficially improving the *Hampiholi-Attard* SDV by enabling a more nuanced/flexible computation for autonomously controlling the SDV as I discuss in further detail with respect to 10(g)(vi). This would have combined prior art elements according to known methods to yield the predictable result of the *Hampiholi-Attard* SDV storing *Grimm*'s weights in memory for computing the *second weighted voting result*. This use of a known technique would have improved the *Hampiholi-Attard* SDV in the same way as *Grimm* as I discussed above. It has been long standing practice to weight different variables in an equation/determination according to their importance such that a POSITA would have recognized the benefits to modifying the *Hampiholi-Attard* SDV based on *Grimm*'s weighting teachings. A motivation to combine *Grimm*'s teachings of a *second weighted voting result* based on the *second plurality of weights* is discussed below with respect to Claim 10(g)(vi).

106. Modifying the *Hampiholi-Attard* SDV per *Grimm* would have had a REOS. *Hampiholi-Attard* already includes hardware necessary to perform *Grimm*'s steps, including *Hampiholi*'s sensors, processor, memory, and programming instructions. *Hampiholi*, [0032] (processor, memory). Likewise, *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 includes 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:

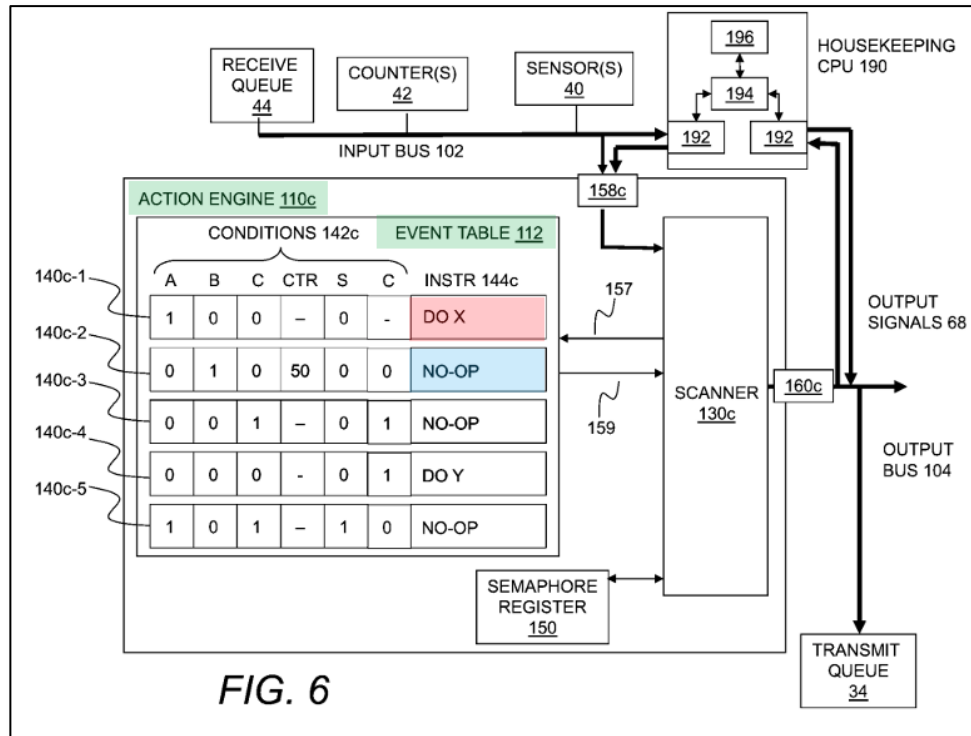


Grimm, FIG. 1. Thus, modifying the *Hampiholi-Attard* SDV per *Grimm* would have required only straightforward changes to programming instructions well-within the skillset of POSITA. Lastly, weighted voting in automobiles was well known. *See, e.g., An* (Ex. 1008), 5:64-6:24; *Chandra* (Ex. 1034), 1:46-2:18.

15. Claim 10(f): “the non-transitory computer readable storage medium comprises a fault remediation table comprising a first quota, a second quota, a first corrective action, and a second corrective action;”

a) Frazer’s Fault Remediation Table

107. *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 (*a corrective action*) to be taken when 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, including *a first corrective action* and *a second corrective action*:



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

108. A POSITA would have recognized *Frazer's* event table 112 mirrors the description of a fault-remediation table in the '004 Patent. *See*, '004 Patent, 8:27-44 (“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 represent fault conditions, a first column 142c refers to a condition manifested by that fault, and a second column 144c refers to the corrective 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 as many rows and/or columns would have been included as necessary to capture all the various scenarios for faults and corresponding corrective actions according to programming instructions. In some cases, the table may be streamlined with fewer scenarios; while in other scenarios, the table may be enlarged to include more conditions and corresponding corrective actions. It would have been well-within the skillset of a POSITA to modify programming instructions to suit such a design choice.

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).

109. 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 via an icon and/or audio alert and/or transitioning from an autonomous mode to manual mode.

110. *Frazer* further teaches event table 112 “can be implemented in any suitable type of memory, including but not limited to computer readable storage media such as a volatile or non-volatile memory...” *Frazer*, 22:43-51.

b) Motivation to Combine with *Frazer*

111. A POSITA would have found it obvious and been motivated to modify *Hampiholi-Attard's* fault handling (including determining a corrective action, such as visual/audio *warnings*) 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 *Hampiholi's* memory comprising *a fault remediation table comprising...a first corrective action, and a second corrective action*. 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).

112. A POSITA would have specifically appreciated the if/then type of fault remediation data already present in *Hampiholi-Attard's* SDV 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., *Hampiholi's* in-vehicle computing system 200, may quickly access the table in storage device 208 and find the action that should be taken given the fault and conditions.

113. The proposed combination thus applies a known technique (*Frazer* using a fault-remediation table) to *Hampiholi-Attard's* known fault handling method

ready for improvement to yield predictable results. Modifying *Hampiholi-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 *Hampiholi-Attard's* similar vehicle (including determining a corrective action in response to a fault) in the same way as *Frazer's* vehicle, by using a fault-remediation table, such as taught by *Frazer*. Based on *Hampiholi's* teachings that faults have associated actions (*see, e.g., Hampiholi*, [0056]-[0057]), 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*.

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 the *Hampiholi-Attard* SDV would have been advantageous for the driver, including by increasing safety.

115. A POSITA would have appreciated that modifying *Hampiholi-Attard* per *Frazer* would have had a REOS. For example, *Attard* and *Frazer* both teach SDVs, with *Frazer* expressly teaching 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. *Hampiholi*, *Attard*, and *Frazer* teach implementing programs and functions using programming instructions executed by a processor. *Hampiholi*, [0032], *Attard*, 15:12-46 (teaching computer-executable instructions, processor, memory); *Frazer*, 21:20-50 (“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.”). Modifying *Hampiholi-Attard* would have merely required straightforward changes to programming instructions. Thus, a POSITA would have

understood or found obvious that the *Hampiholi-Attard* SDV already has the necessary computer hardware for implementing an event table, such as *Frazer's*.

116. Further, a POSITA would have recognized the ease of modifying *Hampiholi-Attard's* computer and memory to include an event table. *Hampiholi, Attard*, and *Frazer* are similar as each describe detecting faults/events based on sensor data. Compare *Hampiholi*, [0031], [0034], [0046] with *Attard* 1:50-52, 12:53-62 with *Frazer*, 21:52-56, 22:31-47. 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. Thus, there would have been a REOS in modifying *Hampiholi-Attard* to utilize an event table per *Frazer*.

117. To the extent it is argued that *Hampiholi-Attard's* hardware is insufficient for this modification, a POSITA would have understood that it would have been straightforward to modify the vehicle 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.

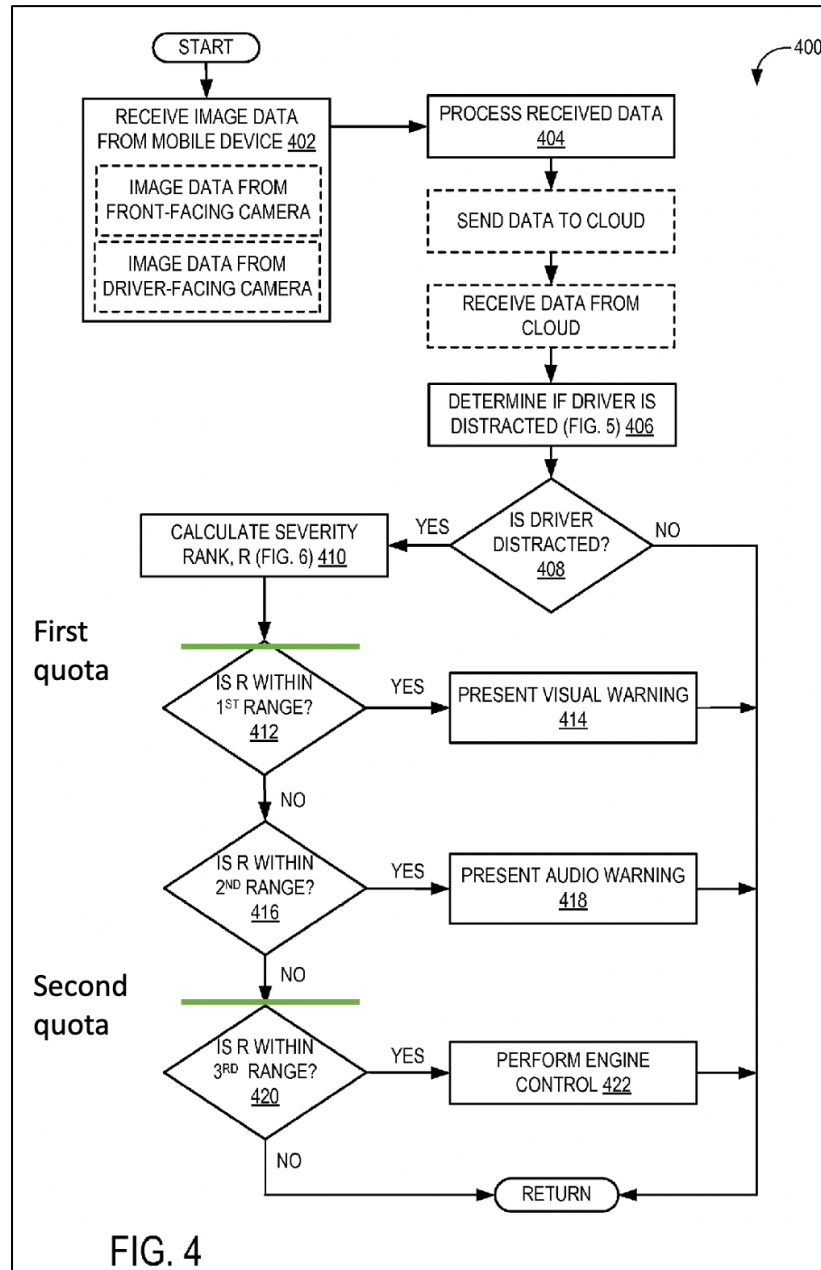
c) *Hampiholi's* First and Second Quotas

118. The '004 Patent defines "quota" as "quota (q) is the minimum number of votes required to "pass a motion." '004 Patent, 9:1-2. A POSITA would consider the "quota" to be equivalent to a threshold – the value at which something "passes."

119. *Frazer's* event table 112 does not expressly teach *first and second quotas*; however, a POSITA would have found it obvious to store *Hampiholi's* thresholds (*quotas*) in *Frazer's* event table 112. *Hampiholi* teaches determining whether a severity ranking R falls within a severity rank range to determine a corrective action to take. *Hampiholi*, [0056]-[0057]. The upper and lower bounds of each severity rank range are thresholds/*quotas*. For example, *Hampiholi* teaches exemplary R values of 1 = low severity; 4 = medium severity; and 8 = high severity. *Hampiholi*, [0066]. Thus, a POSITA would have envisioned, e.g., a 1st range to be from 1-3, and 2nd range to be from 4-6, and a third range to be from 7-9 for example. In this case, R values 1 and 3 form *quotas* for the 1st range, R values 4 and 6 form *quotas* for the 2nd range, and R values 7 and 9 form *quotas* for 3rd range. Per *Hampiholi*, any severity rank outside of the three ranges [in FIG. 4] may correspond to a low enough severity to forego any warnings." *Hampiholi*, [0057]. Thus, in my

above example, a severity rank of $R = 0$ would not cause any corrective action to be taken.

120. Two exemplary *quotas* are shown below, where when R is above the first *quota* (i.e., *better than*, or the value of R is less than the 1st range), nothing happens and when R is below the first *quota*, a corrective action is taken, e.g., based on whether R is below the second quota.



Hampiholi, FIG. 4.

121. *Hampiholi's* quotas are conditions that, when met, cause an action (e.g., visual and/or audio warning, or engine control) to be carried out. Thus, *Hampiholi's* quotas are analogous to the conditions 142c taught by *Frazer*. Compare *Hampiholi*, [0057] (describing FIG. 4 and use of ranges/thresholds for determining actions to

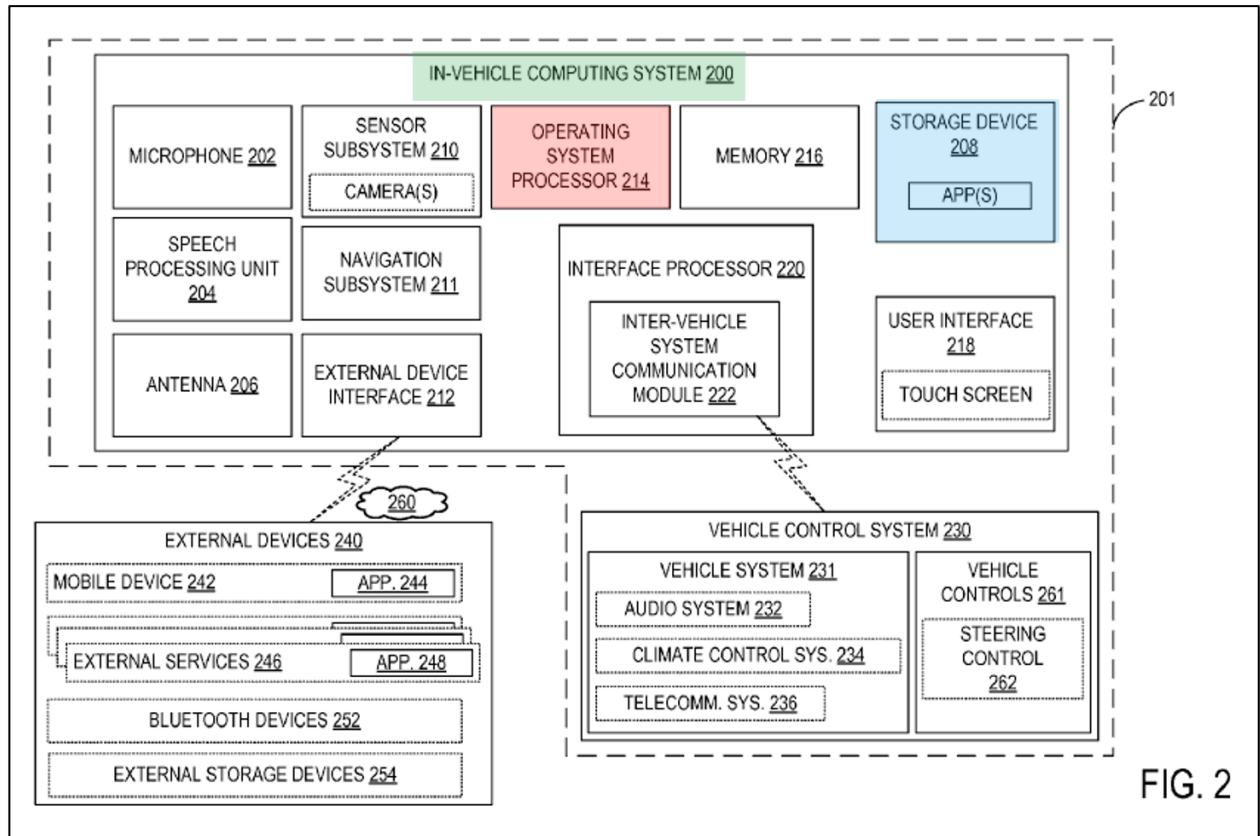
take) *with Frazer*, 21:33-64 (use of thresholds to trigger actions 144c). As such, a POSITA would have found it obvious and been motivated to modify the *Hampiholi-Attard* SDV to store *Hampiholi's* quotas in the event table 112 such that, when the quotas are met, actions 144c are executed. For example, a POSITA would have implemented *Hampiholi's* FIG. 4 processing by, for example, storing the requisite R values as conditions 142c in event table 112 and tying them to the corresponding actions 414, 418, 422, which would be stored as actions 144c in event table 112.

122. Modifying the *Hampiholi-Attard* SDV in such a way is merely the combination of known prior art elements according to known methods to yield predictable results. *Hampiholi* teaches severity ranges having thresholds (*quotas*) that, when met, cause a corrective action to be taken. *Hampiholi*, [0057]. *Frazer* teaches an event table 112 usable in vehicles that stores the relationship between conditions and actions to take when the conditions are met. *Frazer*, 22:20-51. A POSITA would have had a REOS in making this modification for the reasons stated above in the previous section. See, ¶¶ 111-117.

16. Claim 10(g): “a computer system comprising a processor coupled to the non-transitory computer readable storage medium and program code, the program code readable and executable by the processor, wherein the computer system is capable of performing operations comprising:”

123. *Hampiholi's* vehicle includes an in-vehicle computing system 200 (a computer system) that comprises an operating system processor 214 (a processor)

that is coupled to **storage device 208** (*non-transitory computer readable storage medium*). The **storage device 208** stores *program code* that is *readable and executable* by the processor 214. *Hampiholi*, [0032] (“Non-transitory storage devices, such as non-volatile storage device 208 and/or volatile memory 216, may store instructions and/or code that, when executed by a processor (e.g., operating system processor 214 and/or interface processor 220), controls the in-vehicle computing system 200 to perform one or more of the actions described in the disclosure.”) A POSITA would have understood or found obvious the storage device and the processor 214 to be coupled in order for the processor to execute the executable instructions stored in storage device 208. Otherwise, the processor 214 would be unable to perform *Hampiholi’s* functions, rendering the SDV inoperable. The in-vehicle computing system 200 (*computer system*) is capable of performing the operations recited in the subsequent Claim 10(g) limitations or is modified to be capable of performing the claimed operations.



Hampiholi, FIG. 2, [0032], [0072], [0089].

17. Claim 10(g)(i): “receiving a first plurality of inputs comprising readings from the first camera and the sensor configured to detect input from the steering wheel;”

124. See, 10(a), 10(a)(i), 10(a)(iii). The Hampiholi-Attard SDV receiv[es] a first plurality of inputs when the first camera and the sensor configured to detect input from the steering wheel collect data (driver data).

18. Claim 10(g)(ii): “receiving a second plurality of inputs comprising readings from the second camera and the speedometer;”

125. *See*, 10(a), 10(a)(ii), 10(a)(vi). The *Hampiholi-Attard* SDV receiv[es] a second plurality of inputs when the second camera and the speedometer collect data (vehicle data).

19. Claim 10(g)(iii): “determining a first weighted voting result comprising multiplying a first input from among the first plurality of inputs by a weight from among the first plurality of weights;”

126. Per 10(g)(v), the *first weighted voting result* is used to determin[e] a competence level of a human driver (HDCL). *Hampiholi* teaches computing a severity rank R, which is mapped to the HDCL. *Hampiholi* modified by *Gunderson* teaches 10(g)(iii). In the combination, *Hampiholi*’s severity rank R computation is modified, per *Gunderson*, such that *Hampiholi*’s first input (e.g., a camera reading) is multipl[ied]...by a weight from among the first plurality of weights (per *Gunderson*). A motivation to combine the *Hampiholi-Attard* SDV with *Gunderson* is above. *See*, 10(d)(i). Further, a POSITA would have been motivated and found it obvious to modify *Hampiholi* such that inputs for computing R are weight[ed], thereby providing greater accuracy/flexibility in determining the driver’s distraction level. At least *Attard* provides an express motivation for weighting inputs when computing a competence level. *Attard*, 6:28-35.

20. Claim 10(g)(iv): “determining a second weighted voting result comprising multiplying a second input from among the second plurality of inputs by a weight from among the second plurality of weights;”

127. Per 10(g)(vi), *the second weighted voting result is used to autonomously maintain[] a buffer of space from other vehicles (see 10(g)(vi)). Grimm teaches a threat level equation where properties are multiplied by weights.*

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

Grimm, 5:59-65. The result of the threat level equation is a second weighted voting result where a second input p_j^i is multiplied by a weight w_j . That is, the threat presented by a neighboring vehicle, determined by the threat level equation, is a second weighted voting result. As I discuss below, a POSITA would have been motivated and found it obvious to use such threat information to maintain[] a buffer of space from other vehicles, e.g., from a vehicle exhibiting threatening driving behavior. See, 10(g)(vi). Motivations to combine and reasons for reasonable expectation of success in the combination are set forth above and below. See, 10(e)(i), 10(g)(vi).

21. Claim 10(g)(v): “determining a competence level of a human driver using the first weighted voting result;”

a) Hampiholi’s HDCL

128. *Hampiholi teaches determining a competence level of a human driver via severity rank R. Driver distractions include not looking at the road and being sleepy/tired. Hampiholi, [0001]-[0004], [0050].*

129. A low-level R includes short-lived driver distraction while the vehicle is not in immediate danger; a medium-level R includes 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 R includes any driver distraction while collision risk is high. *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. Fig. 7 depicts exemplary severity ranks R corresponding to detected human behaviors and road/vehicle conditions.

700

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

Less Distracted/
Higher
Competence

More Distracted/
Lower
Competence

FIG. 7

Hampiholi, FIG. 7. 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.

130. 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 (thus higher values would be better, indicating higher competence). 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 an inverted scale, 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 $H=8$ 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 10.

131. *Hampiholi's* severity rank R teaches a competence level of the human driver. For example, a driver paying more attention is more competent at taking control of the vehicle if a transition to manual mode is required. 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, who would not see the deer as quickly. 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.

132. Additionally, driver paying more attention allows for more possible corrective actions (e.g., transition to manual, disabling autonomous driving feature(s), automatically slowing to a stop) by allowing sufficient lead time to safely transition to manual mode or disable autonomous driving feature(s). For example, it was known that SDV drivers required sufficient lead time to accept the transition to manual mode. *J3016*, 4; *McNew*, 19:46-20:39, FIG. 7A (teaching transitioning to manual when it is safe to do so). In the case where the driver is severely distracted, the sufficient lead time may be insufficient such that the transition to manual mode is not sufficiently timely to avoid an unsafe condition, forcing the vehicle to transition to a minimal risk condition. If a driver is fatigued, asleep, or otherwise inattentive (lower competence level), transitioning to manual mode would be more dangerous, and corrective actions may be limited to automatically slowing/stopping the vehicle.

b) Using the first weighted voting result

133. As discussed in 10(g)(iii), *Hampiholi* is modified per *Gunderson* such that severity rank R is determined by weighting *Hampiholi's* inputs. See, 10(g)(iii). Thus, the *Hampiholi-Attard* SDV modified by *Gunderson* teaches determining a HDCL (*Hampiholi's* severity rank R) using the first weighted voting result.

22. Claim 10(g)(vi): “autonomously maintaining a buffer of space from other vehicles around the SDV using the vehicle controls and the second weighted voting result;”

a) Attard’s Teachings

134. *Attard* teaches its vehicle autonomously “maintain[s] a distance from other vehicles,” i.e., *a buffer of space from other vehicles around the SDV using the vehicle controls*. *Attard*, 1:65-2:6; see, 10(c) (*vehicle controls*). A motivation to combine *Hampiholi-Attard* is above. See, 10(Pre).

b) Motivation to Combine Grimm’s second weighted voting result

135. A POSITA would have been motivated and found it obvious to modify the *Hampiholi-Attard* SDV to *autonomously maintain[] a buffer of space* using *Grimm’s second weighted voting result*, advantageously improving the autonomous driving of the SDV by accounting for the erratic driving behavior of other vehicles, per *Grimm*. *Grimm*, 5:47-6:20. Specifically, such would have enabled the *Hampiholi-Attard* SDV to “maintain a distance from other vehicles” based on the data from those vehicles, which is incorporated into *Grimm’s* threat level equation (*second weighted voting result*). That is, the higher the threat level of *Grimm*, the greater the buffer space the *Hampiholi-Attard* SDV vehicle would maintain. *Attard*, 1:65-2:6 (disclosing maintaining a distance from other vehicles). For example, *Grimm* teaches that if the threat level is above a second, higher threshold, vehicles are warned, which a POSITA would have found obvious to use to adjust the buffer

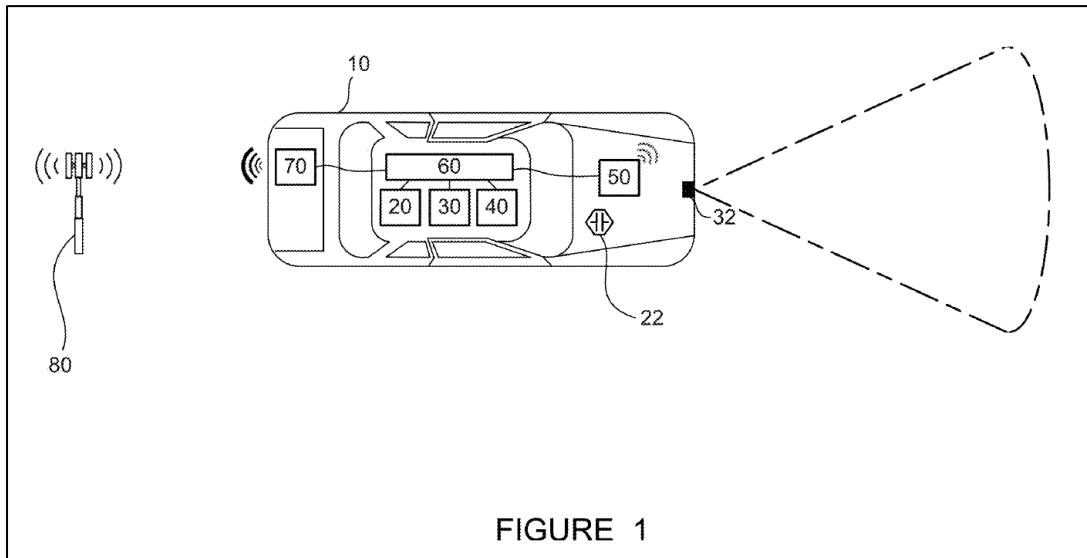
of space maintained by *Hampiholi-Attard* SDV from that vehicle. *Grimm*, 6:5-17. Similarly, *Grimm* teaches the threat level can indicate vehicles braking on a freeway, which again, would have been advantageously used by a POSITA to autonomously maintain a greater buffer of space from other vehicles due to an anticipated future braking event to allow a safe stopping distance. *Grimm*, 6:20-24. Thus, a POSITA would have found it obvious to implement this weighted voting technique to enable the *Hampiholi-Attard* SDV to, for example, attribute relatively more importance to very critical data from other SDVs, such as their braking, than the amount of importance attributed to other available SDV data that is less relevant to safe operation of the vehicle.

136. As I mentioned, *Grimm* teaches the *result* of the threat level equation can result in a “warning report [] indicative of a vehicle exhibiting severely dangerous driving behavior” to be communicated to vehicles. *Grimm*, 6:11-17. This report can result in the vehicle taking action such as braking and evasive steering. *Grimm*, 4:60-5:4. Further, *Grimm* explicitly teaches several advantages including improved vehicle safety. *Grimm*, 10:52-56. Thus, *Grimm* provides an express teaching, suggestion, and motivation for modifying with *Hampiholi-Attard* by improving vehicle safety and taking automatic actions based on the second weighted voting result to *maintain a buffer of space*, i.e., to avoid a collision.

137. Modifying *Hampiholi-Attard* per *Grimm* to have use *weighted voting* in autonomous driving would have been use of *Grimm*'s known technique and would have improved the *Hampiholi-Attard* SDV in the same way as *Grimm*'s system and vehicle, by improving vehicle safety and the available data for making an autonomous driving decision. Indeed, modifying, e.g., *Hampiholi-Attard*'s Φ computation per *Grimm*'s teachings would have obtained predictable results of safer autonomous driving by incorporating data from other vehicles that is weighted.

138. A POSITA would have had a REOS when making this modification. Indeed, *Hampiholi-Attard* teaches natively obtaining data of nearby vehicles. *Hampiholi*, [0058], [0064]; *Attard*, 4:46-5:20. Thus, the modification would have merely required straightforward changes to programming instructions of the vehicle and potentially adding additional sensors for traffic-related data. I note, however, that *Attard* teaches such sensors such that the combination would have been made using solely *Attard*'s sensors. *Attard*, 6:57-60, 1:65-2:6. Combining prior art sensors with a vehicle according to known methods would have yielded predictable results.

139. Further underscoring the REOS, *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:

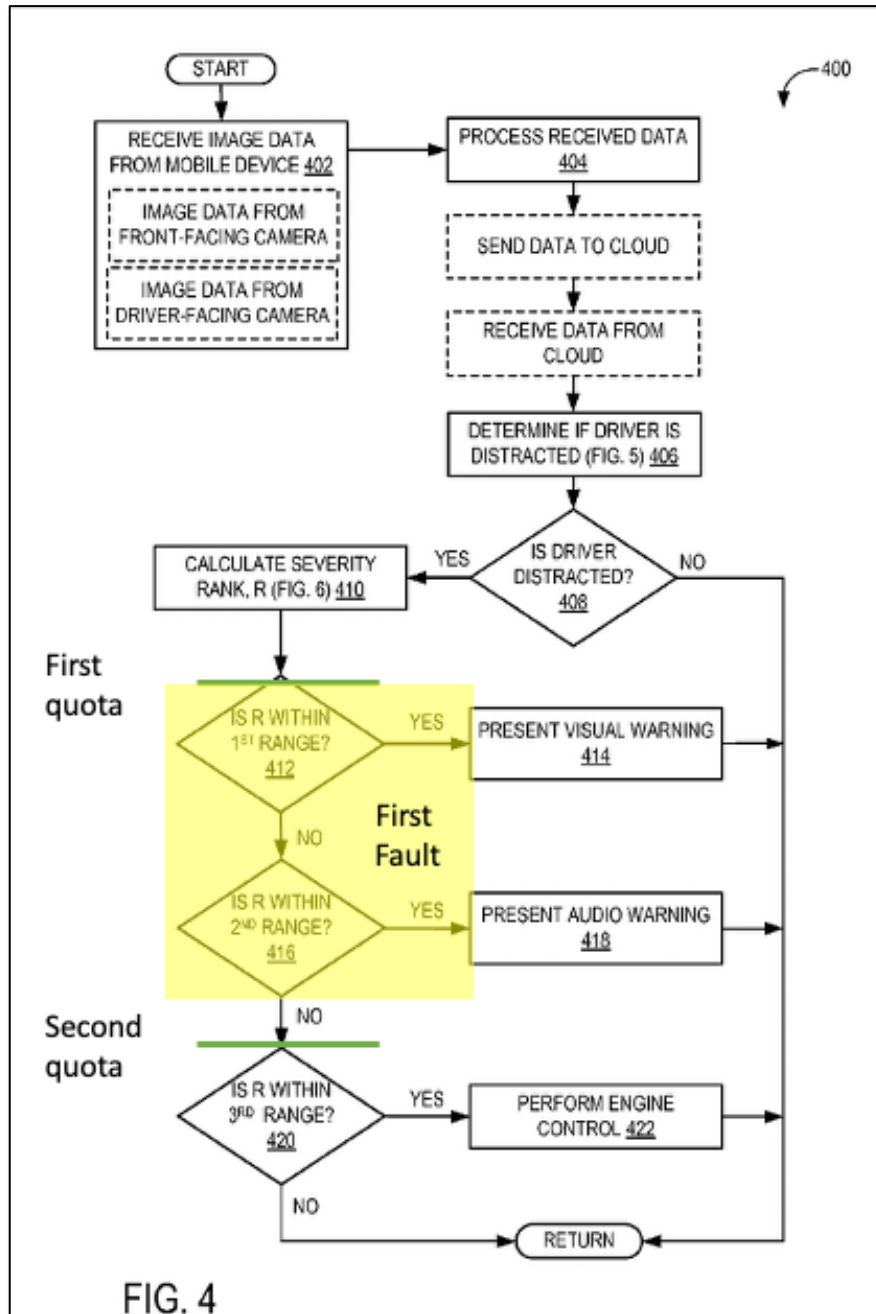


Grimm, Fig. 1, 3:63-4:12.

140. As discussed above, *Hampiholi-Attard* also teaches similar vehicle-based computing system with processor and program instructions stored in memory. *See*, 10(Pre), 10(d), 10(g). Thus, modifying *Hampiholi-Attard*'s functionality per *Grimm* would have required only straightforward changes to programming instructions that would have been well-within the skillset of a POSITA as I discussed with respect to Claim 10(e)(i) and 10(g)(iv).

23. Claim 10(g)(vii): “determining that a first fault has occurred when the competence level of the human driver is below the first quota; and”

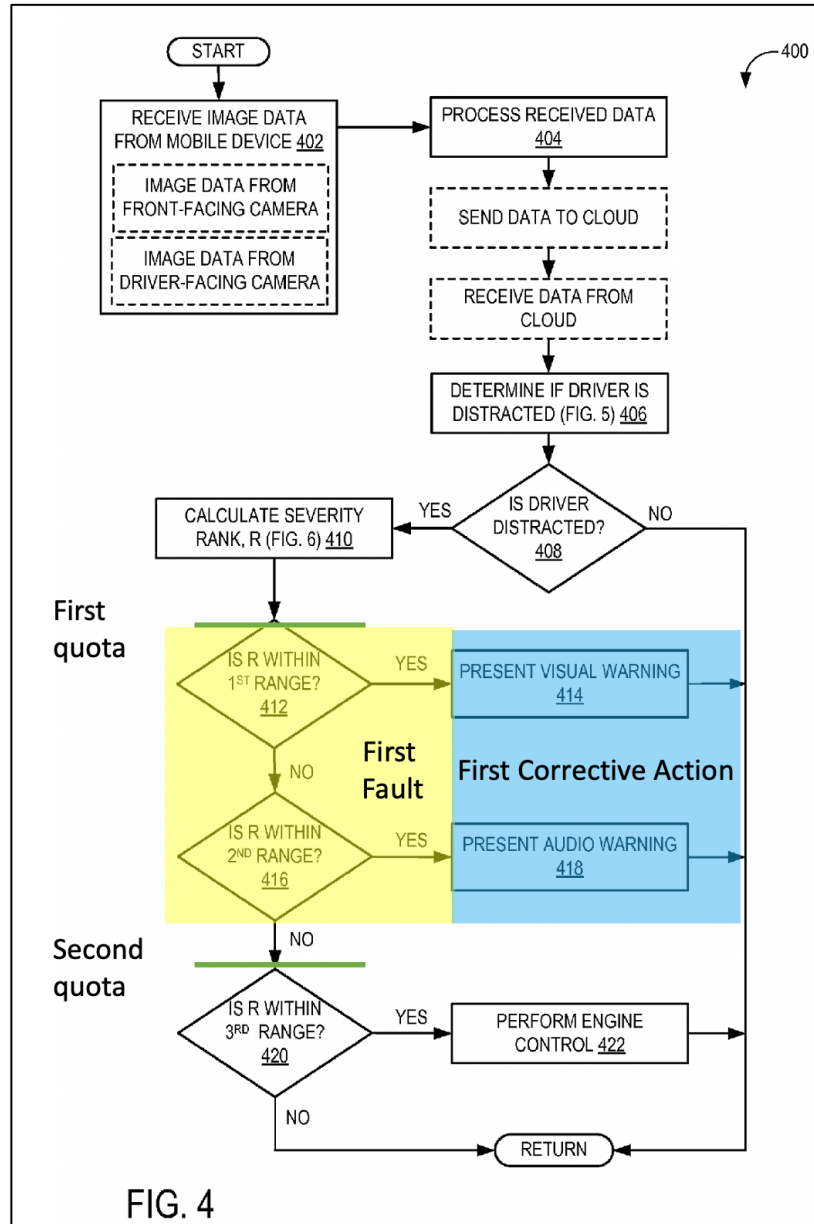
141. When R is below the *first quota* (i.e., exceeds the first quota), then it is determined that *a first fault has occurred* because a corrective action is taken. The yellow range below indicates R values below the *first quota*.



Hampiholi, FIG. 4, [0056]-[0057].

24. Claim 10(g)(viii): “taking the first corrective action when the first fault has occurred.”

142. *Hampiholi* teaches the first corrective action (present visual warning and present audio warning) is *taken when the first fault occur[s]*.



Hampiholi, FIG. 4.

143. While *Hampiholi* depicts the visual and audio warnings as occurring when R is in different ranges, a POSITA would have been motivated and found it

obvious to combine both warnings as a single corrective action to be taken when R is below the first quota and that the 1st and 2nd ranges in FIG. 4 would have easily been combined by changing the range boundaries accordingly. It would have been a matter of mere design choice on which warning type(s) to send the driver. Additionally, *Hampiholi* expressly teaches a combined visual and audio alert. *Hampiholi*, [0070] (“combination of an audio and a visual alert”). Regarding this modification, whether (1) *Hampiholi* initially presents a visual warning when R is within a 1st range and then subsequently presents both a visual and audio warning when R is within a 2nd range, or (2) both the 1st and 2nd ranges are combined into a single range such that a visual warning and audio warning are presented when R is within said particular range, either would have satisfied the claim. For example, it would have been obvious for a POSITA to modify *Hampiholi*’s system such that each corrective action subsumes the previous action, e.g., the audio alert would have been added in addition to the visual alert.

144. This modification would have advantageously improved the *Hampiholi-Attard* SDV by providing warnings of different modalities, improving the chances of obtaining the driver’s attention so that the driver can correct their distractedness. Furthermore, *Hampiholi* expressly teaches that “[a]ny suitable action may be mapped to any suitable severity ranking,” thereby motivating the modification. *Hampiholi*, [0066]. Further still, *Hampiholi* expressly contemplates

presenting a “combination of an audio and a visual alert” as a corrective action. *Hampiholi*, [0070]. Therefore, *Hampiholi* has an express teaching, suggestion, or motivation to perform both an audio and visual warning as a corrective action. Thus, a POSITA would have had a reasonable expectation of success in modifying the *Hampiholi-Attard* SDV (to the extent such a modification is required) because of *Hampiholi*’s express teaching, suggestion, and motivation of presenting a combined audio and visual alert. Again, such modification would have predictably improved the safety of the *Hampiholi-Attard* SDV by attempting various warning modalities to obtain the driver’s attention.

B. Claim 11

1. Claim 11(a): “The SDV of claim 10, further comprising: the computer system is further capable of performing operations comprising:”

145. The *Hampiholi-Attard* SDV includes a computer system capable of performing operations including those claimed at 11(b)-11(d).

2. Claim 11(b): “recording a number of times the first fault has occurred;”

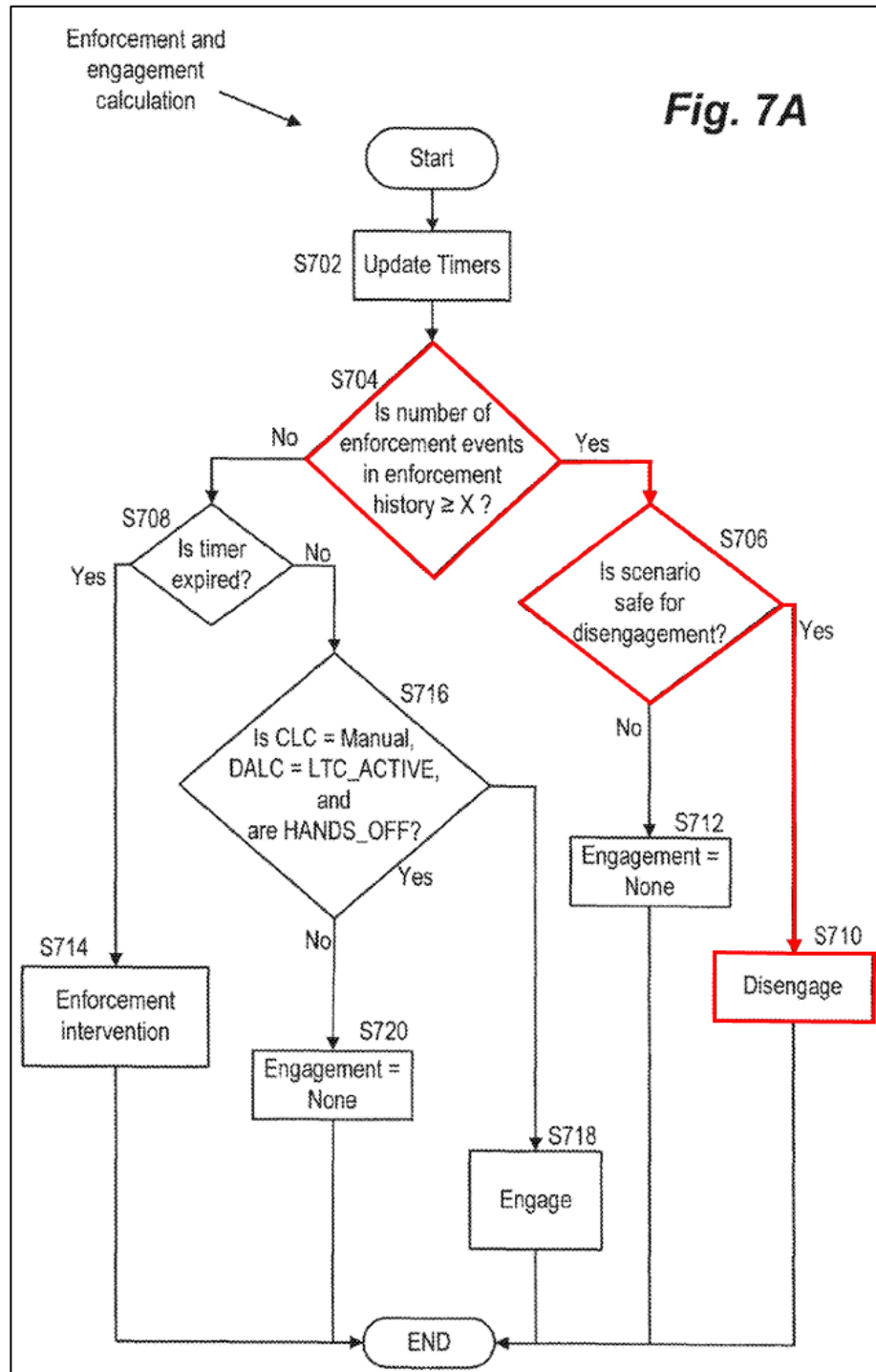
a) McNew’s Teachings

146. *Hampiholi* teaches a first fault of the HDCL being below a first quota. See, 10(g)(vii). *Hampiholi* does not teach recording a number of times the first fault has occurred. *McNew*, like *Hampiholi*, teaches faults related to driver distraction. As discussed further below, *McNew*’s faults relate to a driver not responding to a

warning, and *McNew* further teaches logging the number of times the driver does not respond. Thus, a POSITA would have found it obvious and been motivated to combine *McNew*'s teachings of tracking the number of times a fault has occurred with *Hampiholi*'s *first fault* teachings of severity rank R being below a quota. A POSITA would have understood that this would have provided several advantages, which I discuss further below.

147. More specifically, *McNew* teaches “generat[ing] warnings and/or requests to prompt the driver to interact with the steering wheel and/or pay attention to the road, and enforc[ing] driver attention or *steering* interaction when the driver is not responding to the warnings.” *McNew*, 3:15-21. Each warning is an “enforcement event” and, when “the number of enforcement events is greater than or equal to” a threshold/quota, a corrective action of shutting down semi-autonomous driving occurs. *McNew*, 19:57-20:25, 6:9-28. The *first fault* in *Hampiholi* occurs when R exceeds some predefined quota. At that time, the vehicle begins to alert the driver and attempts to get the driver to engage via the steering wheel; the steering wheel inputs would cause R to go back down (in the absence of other factors). However, with no feedback from the driver, the value of R will continue to increase with each successive computation (as the observed disengagement of the driver is becoming longer and thus more severe). After a particular number of computation iterations (in this example, e.g. each successive

iteration would increase the value of R by some value e.g., 0.5), the value of R then exceeds the second quota, and the vehicle begins to shut down the automated driving functionality.



McNew, FIG. 7A.

148. The enforcement event is a *first fault* because it is an event where the driver does not respond to a warning. A POSITA would have understood that a driver not responding to a warning would have been dangerous, especially in cases where the driver needs to be paying attention to take control of the vehicle, for example, in case of a sensor malfunction. Therefore, because *McNew* logs the number of enforcement events, *McNew* teaches *recording a number of times the first fault has occurred*. By recording the number of enforcement events, the vehicle can thus keep track of whether the driver is paying attention to warnings, and the vehicle can provide escalating corrective actions (e.g., start with visual alert, increase to audio alert, etc.) based on the number of times the enforcement event has occurred.

b) Motivation to Combine with *McNew*

149. A POSITA would have found it obvious and been motivated to modify the *Hampiholi-Attard* SDV further with *McNew*'s teachings of *recording a number of times the first fault has occurred*. Such a modification is merely the combination of known elements according to known methods to yield predictable results. Indeed, this modification would have been simply utilizing well-known elements like enforcement events, processor, memory, and programming instructions for enforcement events to record a number of times *the first fault has occurred*. This modification would have been use of a known technique that would have improved

the *Hampiholi-Attard* SDV in the same way as *McNew*. Indeed, *McNew* uses this technique to escalate corrective actions, and the *Hampiholi-Attard* SDV when modified would have used the same technique to achieve the same advantages as *McNew*. A POSITA would have recognized the safety benefits of further modifying the *Hampiholi-Attard* SDV to address situations where “the driver may be purposely ignoring the semi-automatic driving system.” *McNew*, 6:15-20. It was well known that level 3 and below SDVs required driver supervision. *See* Sections V.C-D. Further motivations are provided with respect to 10(a)(iii).

150. There would have been a REOS because the modification merely would have required a straightforward software/programming change to record the number of sequential times the HDCL is below the first quota. *Hampiholi-Attard* already teaches the necessary hardware such as a processor and memory. *Hampiholi-Attard* also already teaches determining when faults occur. Here, the modification would have required simply recording information to memory, which is a basic function of computers. For example, *McNew* teaches such a straightforward modification, i.e., a “log of enforcement events...that can be stored in memory.” *McNew*, 19:62-65. It would have straightforward and well-within the skillset of a POSITA to modify *Hampiholi-Attard* to log the enforcement events in, e.g., *Hampiholi*’s storage device 208. This modification would have required only straightforward changes to

programming instructions, which would have been well-within the skillset of a POSITA.

3. Claim 11(c): “determining that a second fault has occurred when the number of times the first fault has occurred exceeds the second quota; and”

a) McNew’s Teachings

151. McNew teaches “determin[ing] that the driver is abusing the system by purposely ignoring warnings and requests from the SAMM [semi-autonomous mode manager].” McNew, 20:7-9, FIG. 7A. Determining the driver is ignoring warning is analogous to *determining* an HDCL because it relates to the driver’s inattention. Specifically, if a driver is ignoring warnings, the driver is likely inattentive. On the other hand, if the driver is purposefully ignoring warnings, that is also unsafe and speaks to the driver’s competence level. A POSITA would have understood such because if a driver is not paying attention, the driver’s ability to take control of the vehicle is diminished compared to if the driver is paying attention to the road and holding the steering wheel, for example. If a driver continues to ignore the warnings and requests from the SDV beyond a threshold, the SDV can take escalating corrective actions. Thus, the *Hampiholi-Attard* SDV modified by McNew teaches or renders obvious 11(c) because determining the driver is ignoring warnings includes logging the number of enforcement events and comparing the number to a threshold (*determining that a second fault has occurred when the number of times the first*

fault has occurred exceeds the second quota). When the number of times exceeds a second threshold, it is determined a second fault has occurred. A POSITA would have understood that some number of ignored warnings would have been determined as a threshold, and that if the number of times exceeds the threshold, then it would have been determined that a *second fault* had occurred, and it would have been appropriate and beneficial to take further corrective action(s).

b) Motivation To Combine with *McNew*

152. A POSITA would have found it obvious and been motivated to modify *Hampiholi-Attard's* warning system with *McNew's* teachings of using the number of times a driver *has* not responded to an alert to determine *Hampiholi's* severity rank R, i.e., the HDCL. A POSITA would have understood that this number would have indicated a driver continuing to ignore the system warnings and not paying attention (or perhaps even being asleep), which indicates a low driver competence.

153. A POSITA would have been motivated to modify *Hampiholi-Attard* in this manner at least because of the safety benefit such a modification would provide. A POSITA would have understood that monitoring the number of times a driver ignores the system warnings would have been useful information for determining corrective actions to take, such as escalating corrective actions (e.g., start with visual warning, next provide visual and audio warning, then pulse the brakes or slow the vehicle, etc.). As discussed in the Claim 10 mapping, *Hampiholi's* severity rank R

is used to determine an appropriate action to take, including sending an alert and escalating to performing automatic control of the vehicle. *See*, Claim 10; *Hampiholi*, [0057]. While *Hampiholi* considers driver's historical information in computing R, *Hampiholi* does not track how the driver has responded to prior warnings. *McNew*, however, recognizes that historical information is beneficial for ensuring the vehicle is safely driven. Thus, such a combination is merely the application of a known technique to a known method ready for improvement to yield predictable results. *McNew*'s technique would have provided valuable information recorded over time, which the SDV would have been able to utilize to determine patterns and determine when escalating corrective actions makes sense and/or would have been advantageous to improve driver safety. This use of a known technique would have improved the *Hampiholi-Attard* SDV in the same way as *McNew*. A POSITA would have had a REOS for the modification as discussed in 11(b).

4. Claim 11(d): “taking the second corrective action when the second fault has occurred.”

154. *See*, 10(f)-(g), 11(c). When a second fault occurs, a corrective action is taken. Examples of *corrective* actions are mapped for Claim 12. *See*, 12.

C. Claim 12

1. Claim 12(a): “The SDV of claim 11, further comprising: the computer system is further capable of performing operations comprising:”

155. *See*, 11, 12(b)-12(c).

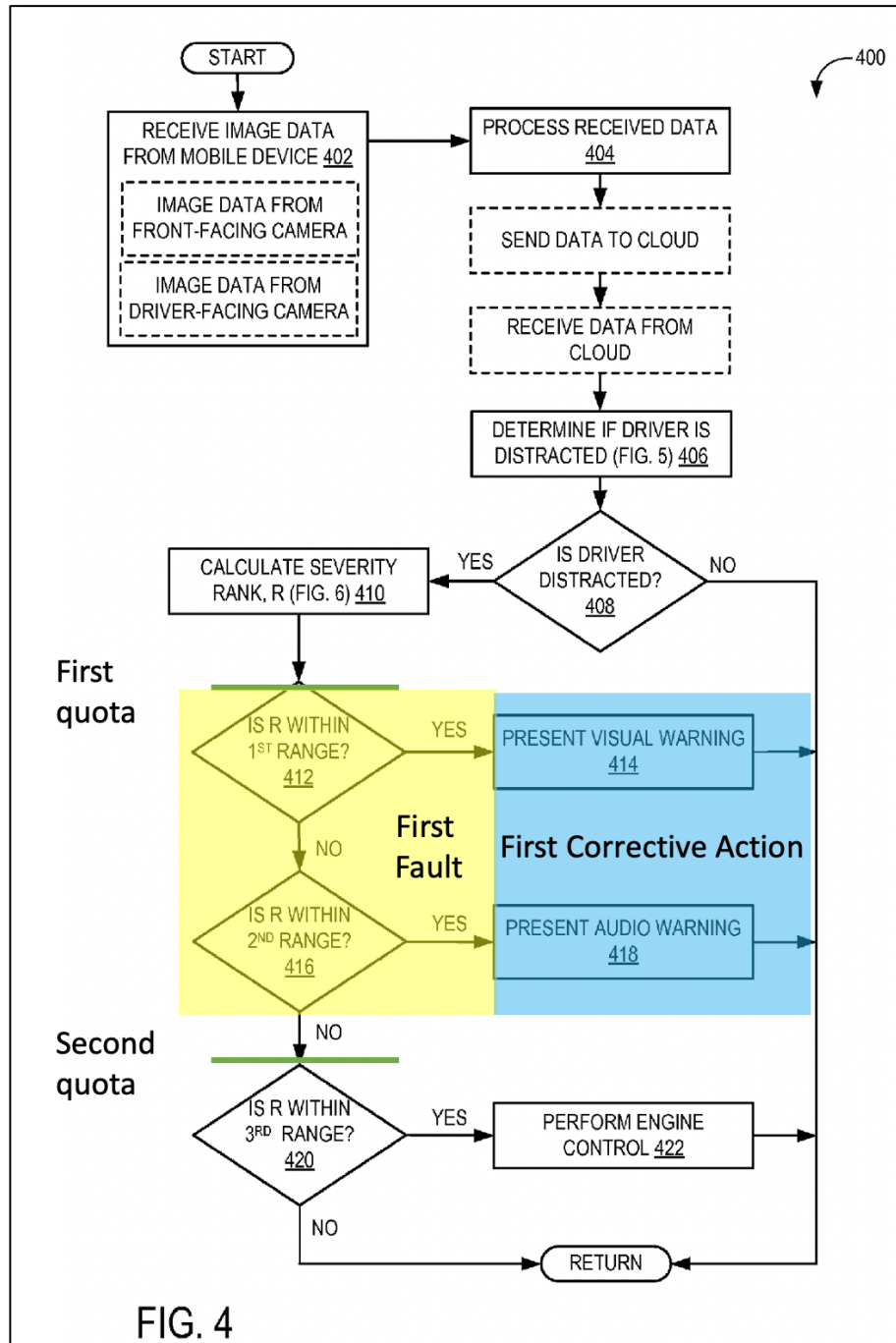
2. Claim 12(b): “taking the first corrective action comprising sounding a warning sound and displaying an icon on a display screen; and”

a) *Hampiholi-Attard’s* Corrective Actions

156. *Hampiholi-Attard* teaches faults based on R’s value in relation to various thresholds/quotas. *See*, 10(f)-(g). Further, *Hampiholi* teaches taking corrective actions based on faults. *See*, 10(f)-(g) *citing Hampiholi*, Fig. 4, [0056]-[0057]. For example, in one embodiment, *Hampiholi* envisions implementing a visual warning message in response to determining a low R distraction level, an audio warning response to determining a medium R distraction level and controlling engine speed or braking response to determining a high R distraction level. *Hampiholi*, [0057]. However, a POSITA would have understood that *Hampiholi* is not so limited, and that various ranges may be combined, or various corrective actions may be taken depending on how the vehicle is programmed. *Hampiholi* expressly teaches that “any number of ranges and associated types of actions may be analyzed in the performance of method 400.” *Hampiholi*, [0057].

157. For example, a POSITA would have understood that combining the first and second ranges into a single range (or reducing a range to 0, or alarming cumulatively, as was well known in the art) where two corrective actions are taken is well-within the scope of *Hampiholi’s* teachings. A POSITA would have been motivated to do so to have a more simplified system as compared to one with a

higher number of ranges and separate corrective actions corresponding to each range. Here, two of *Hampiholi's* ranges would have been combined, thus resulting in a lower total number of ranges. Thus, in this mapping, *Hampiholi's* corrective actions associated with the first fault are sounding a warning sound 418 and presenting a visual warning 414.



Hampiholi, Fig. 4, [0056]-[0057].

158. Hampiholi teaches a display screen for displaying visual warning 414.

Hampiholi, [0020]-[0021], [0044], FIG. 1. Further, Attard teaches that displayed

alerts may be “icons.” *Attard*, 7:33-38. Thus, in the *Hampiholi-Attard* SDV, a first fault triggers a *first corrective action comprising sounding a warning sound and displaying an icon on a display screen*.

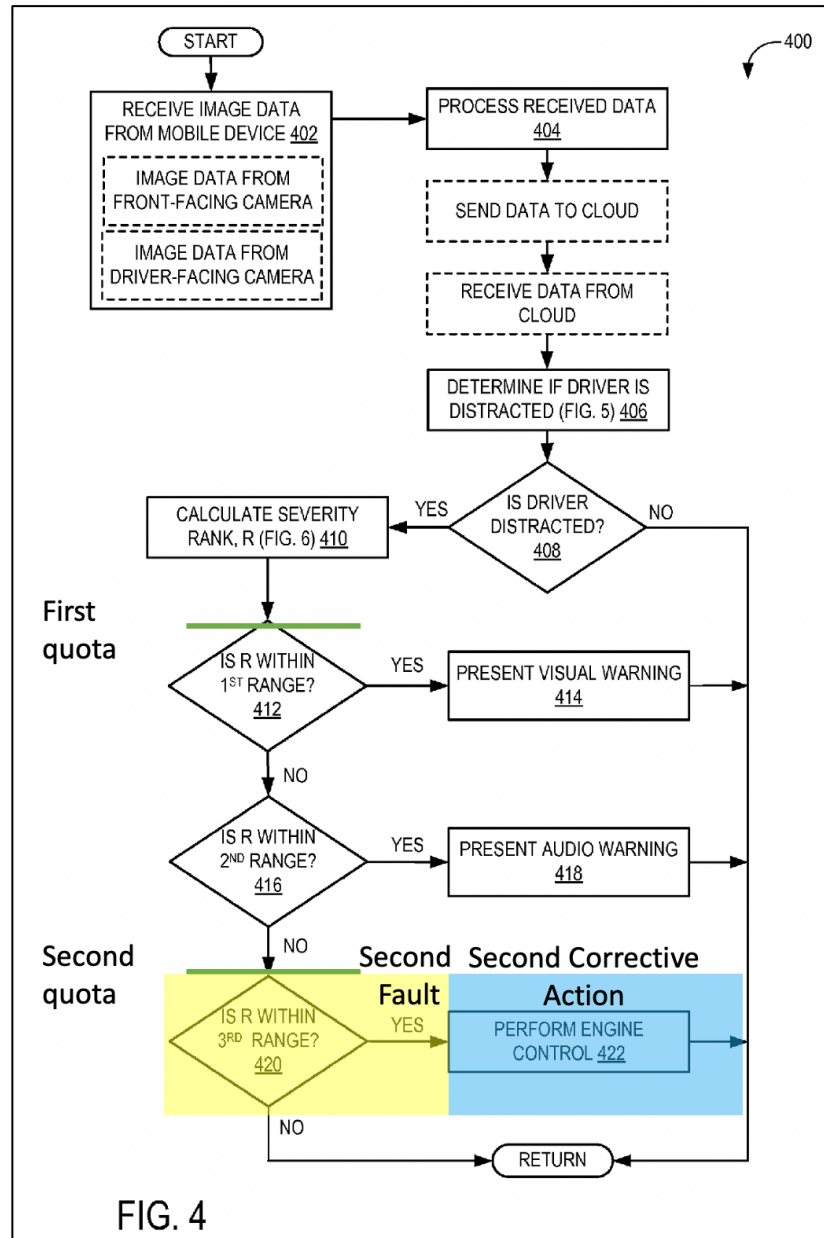
b) Motivation to Combine *Hampiholi-Attard*

159. A POSITA would have been motivated and found it obvious to modify *Hampiholi*’s visual warning to include *Attard*’s display icon and further to both display the icon and sound a warning, advantageously increasing the likelihood of obtaining the driver’s attention. A POSITA would have understood that there was a general level of progression for urgency extending from visual icons, to audio earcons, to haptic feedback, and that any (including in combination with each other) or all would be used as appropriate to the situation. For example, a driver may not notice only an icon, but if an alert sound is played and an icon is displayed, the combination of alerts would have been more effective at drawing the driver’s attention to the icon. Further, once the driver views the display to see the warning icon, a driver would have quickly understood the meaning of the warning icon. Additionally, icons conserve space on the display screen relative to purely-textual warnings, motivating the combination to a POSITA. Indeed, icons are utilized frequently in vehicles as a language independent way to quickly convey a concept or warning. This use of a known technique would have improved *Hampiholi*’s similar vehicle in the same way as *Attard*’s.

160. The combination would have had a REOS because *Hampiholi* already teaches a display screen presenting visual warnings, as well as computer hardware and programming instructions. Thus, *Hampiholi* is ready for this improvement, and the modification would have yielded predictable results with a reasonable expectation of success. Similarly, *Attard* teaches an autonomous vehicle and computer hardware and programming instructions, such that modifying *Hampiholi* would have required only modifying programming instructions and/or a display to display an icon per *Attard*. This straightforward modification to programming instructions would have been well-within the skillset of a POSITA, further leading to a REOS.

3. Claim 12(c): “taking the second corrective action comprising decreasing a speed of the SDV and transferring driver controls to manual control.”

161. *Hampiholi*’s corrective action associated with the *second fault* is performing engine control.



Hampiholi, Fig. 4, [0056]-[0057]. As seen in Fig. 4, when severity rank R is below the first and second quotas (e.g., block 420 – “Is R within 3rd range? – YES”) it is determined that a *second fault has occurred*, and a second corrective action is taken (perform engine control 422). A POSITA would have understood that taking a second corrective action such as performing engine control would have been

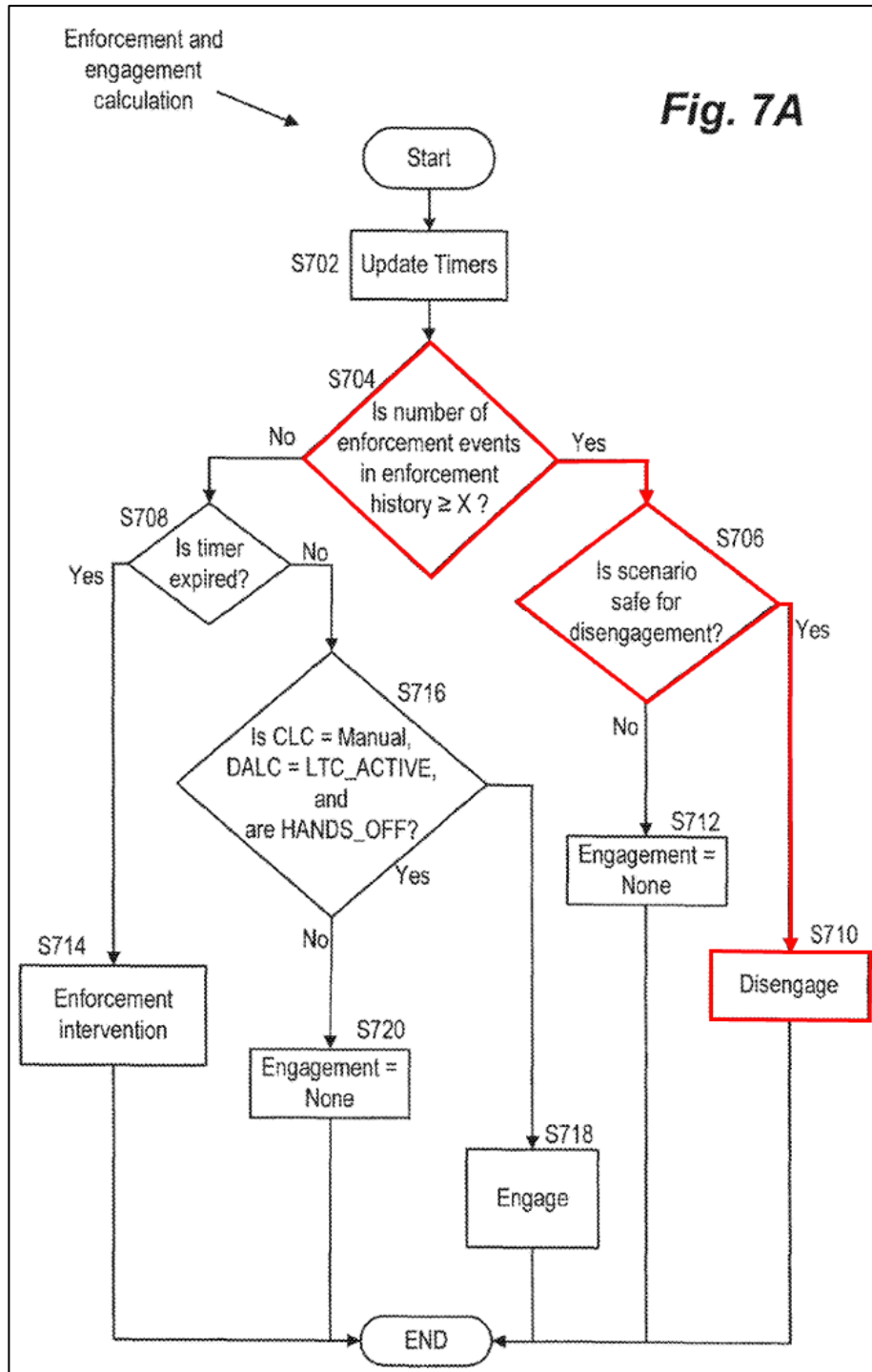
escalating corrective actions beyond the previous icon and audio alerts and would have been used to further increase the likelihood that a driver would respond to the SDV. *Hampiholi* specifically describes engine control operations “include automatically controlling the vehicle speed or braking...” teaching *decreasing a speed of the SDV. Hampiholi*, [0057].

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

162. *McNew* teaches managing vehicle control states of a semi-autonomous vehicle *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 (LTC system is on and sensing, but the driver is in control) and OFF (LTC system is off). *McNew*, 3:59-4:5. *McNew* teaches monitoring driver states (e.g., attention) and taking actions if the driver is not paying attention, enhancing vehicle/driver safety. *McNew*, 1:17-30, 1:59-65, 6:15-28.

163. If a driver continues ignoring warnings, *McNew* teaches disengaging the semi-autonomous⁴ driving system if 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 system...[where] the LTC system transitions through the CO-STEER and **MANUAL** settings before being turned off[.]” (Step S710). Fig. 7A below depicts Steps S704, S706, and S710, resulting in disengaging the vehicle’s semi-autonomous system and transferring the driver controls to manual control:

⁴ *McNew* refers to its system as both “semi-autonomous” and “semi-automatic.” *McNew*, 1:7-17, 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.



McNew, Fig. 7A. 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. I again note that this disengagement of autonomous mode occurs when it is

safe to do so, as disengaging autonomous mode and transitioning to manual mode when a driver is not ready to take over control of the vehicle would potentially lead to crashes, collisions, or other undesirable outcomes.

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

164. A POSITA would have been motivated and found it obvious to include decreasing a speed and transferring driver controls to manual control as a corrective action in the *Hampiholi-Attard* SDV's event table responsive to the second fault per *McNew*. 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 decrease vehicle speed, disengage autonomous mode, and allow the driver to take over. Thus, the *Hampiholi-Attard* SDV would have been modified such that a corrective action is taken to decrease speed and transfer driver controls to manual, 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 speed is reduced and transitions from autonomous mode to manual mode as a corrective action.

165. A POSITA would have been motivated because *Attard* includes a specific suggestion to do so, repeatedly disclosing recommending transferring driver controls to manual. *Attard*, 2:55–3:4. Modifying the *Hampiholi-Attard* SDV in this

way would have been use of a known technique of taking particular corrective action(s) (e.g., transition to manual control) responsive to fault(s) and would have improved the *Hampiholi-Attard* similar SDV in the same way as *McNew's*. I note that *Attard*, *Frazer*, and *McNew* all teach SDVs, such that modifying the similar *Hampiholi-Attard* SDV would have been straightforward, such as by making straightforward modifications to programming instructions. Thus, the *Hampiholi-Attard* SDV would have benefited from *McNew's* advantages in the same way as *McNew's* SDV.

166. Further, modifying the *Hampiholi-Attard* SDV per *McNew* would have allowed the SDV to advantageously alert a driver of a need to transition to manual mode and perform the transition to manual mode. Further, *Hampiholi* teaches performing “engine control” (e.g., slowing the vehicle) such that adding an additional corrective action of transitioning to manual mode would have simply been use of a known technique to extend *Hampiholi's* native engine control teachings to further include transitioning to manual control in the *Hampiholi-Attard* SDV. 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 warn the driver, decrease vehicle speed, and actually perform the transition to manual mode. Indeed, in such a scenario, 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. Further, slowing/stopping the vehicle alone may not be sufficient in some scenarios, such that transitioning to manual mode would have been advantageous in at least some scenarios, further motivating the combination.

167. A POSITA would have been motivated and found it obvious to include transferring driver controls to manual control as a corrective action for the situation where the driver's distraction level precludes a quick and safe intervention if required. Transitioning to manual mode would have made it clear to the driver that the driver was in control and had to take responsibility for being attentive and would have allowed a driver to continue driving to their destination manually or stop driving if the driver chose to stop. Indeed, this modification would have enhanced driver safety and increased driver confidence in using an SDV by knowing that the driver can take over if necessary and would have enhanced 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 (e.g., sensor failures), the vehicle may still be operable in a manual mode, allowing a driver to continue driving in manual mode if the driver feels they are capable. I note this was a common scenario for automated systems even in the 2015 time frame. If the driver could not demonstrate that they were sufficiently attentive to take over on short notice (generally through handling the steering wheel or providing other feedback to the system) the automated systems

would cut out for some period of time. For example, the 2013 Mercedes S class advertised that “sensors can detect whether the driver’s hands are actually on the steering wheel. If they are not, a visual warning is issued first. Should the driver fail to react, a warning signal sounds and lateral lane guidance is deactivated.” *Mercedes2013*, 2.

168. A POSITA would have understood that modifying the *Hampiholi-Attard* SDV to include transferring driver controls to manual control would have had a REOS. *Hampiholi-Attard* and *McNew* teach similar SDVs, and *Hampiholi-Attard* and *McNew* teach SDV hardware (processor, memory) and programming instructions. This modification would have required only straightforward changes to programming instructions. Indeed, *McNew* teaches implementing its system in computer program instructions, and *Hampiholi-Attard*’s SDV includes a native manual (non-autonomous) control mode, thus making the modification straightforward. For example, the straightforward changes would have included modifying *Hampiholi-Attard-Frazer*’s event table to include decreasing vehicle speed and transferring driver controls to manual control as a corrective action. Modifying programming instructions would have been well-within the skillset of a POSITA. 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 *Hampiholi-Attard* 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. Finally, *McNew* teaches it is advantageous to pump the brakes (decrease vehicle speed) to gain the driver's attention. *McNew*, 8:10-14. (“[T]he 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.”)

D. Claim 13

1. Claim 13(a): “The SDV of claim 10, further comprising: the computer system is further capable of performing operations comprising:”

169. The *Hampiholi-Attard* SDV includes a computer system capable of performing operations including those claimed at 13.

2. Claim 13(b): “recording a duration of time during which the first fault has occurred;”

a) McNew's Teachings

170. *McNew* teaches “determin[ing] whether the timers that monitor how long it takes for the driver to respond to steering or attention requests have expired.” *McNew*, 20:42-44. As discussed, *McNew* teaches a *fault* that is an attention/steering warning. *See*, 11(b). Therefore, the *Hampiholi-Attard* SDV modified by *McNew* teaches or renders obvious *recording a duration of time during which the first fault*

has occurred, where the *first fault* is *Hampiholi*'s severity rank R falling below the *first quota* (see 10(g)(vii)). A POSITA would have been motivated and found it obvious to modify the *Hampiholi-Attard* SDV as I discuss below.

b) Motivation to Combine with *McNew*

171. See, 11(b). Here, a POSITA would have been motivated to record a duration of time during which a first fault has occurred for the same reasons discussed above as why a POSITA would have been motivated to track a number of times the first fault has occurred, and this modification would have had a REOS for the same reasons as above. See, 11(b). For example, recording the duration of time in addition to the number of times would have provided additional information useful for determining faults and corrective actions. Utilizing timers such as *McNew* teaches advantageously allows the SDV to know how quickly the driver is responding to alerts in addition to simply whether the driver responds to the alerts.

3. Claim 13(c): “determining that a second fault has occurred when the duration of time during which the first fault has occurred exceeds the second quota; and”

a) *McNew*'s Teachings

172. *McNew* teaches “implement[ing] an enforcement intervention” when “one or more timers has expired due to the driver not complying with a warning.” *McNew*, 20:55-59, FIG. 7A. Determining the driver is ignoring warnings is analogous to determining an HDCL. For example, if a driver takes thirty seconds to

respond, that may indicate that the driver is not paying much attention, and thus the driver competence would be lower than for a driver who responds within three seconds, for example. I note that this is similar to my opinions at 11(b). *See*, 11(b). Here, however, the duration of time is utilized for the determination rather than (or in addition to) a number of times. Thus, the *Hampiholi-Attard* SDV modified by *McNew* teaches or renders obvious 13(c) because determining the driver is ignoring warnings includes tracking the length of time the driver has ignored the warning (*duration of time during which the first fault has occurred exceeds the second quota*).

b) Motivation To Combine with *McNew*

173. *See*, 11(c).

4. Claim 13(d): “taking the second corrective action when the second fault has occurred.”

174. *See*, 12(c).

E. Claim 14

1. Claim 14(a): “The SDV of claim 13, further comprising: the computer system is further capable of performing operations comprising”

175. *See*, 12(a).

2. Claim 14(b): “taking the first corrective action comprising sounding a warning sound and displaying an icon on a display screen; and”

176. *See*, 12(b).

3. Claim 14(c): “taking the second corrective action comprising decreasing a speed of the SDV and transferring driver controls to manual control.”

177. See, 12(c).

IX. GROUND 2: CLAIM 15 IS OBVIOUS OVER HAMPIHOLI, ATTARD, MCNEW, GUNDERSON, GRIMM, FRAZER, DUNCAN, AND ENGELMAN

A. Claim 15

1. Claim 15(Pre): “A self-driving vehicle (SDV) comprising:”

178. See, 10(Pre).

2. Claim 15(a): “a sensor system having a plurality of sensors, comprising:”

179. See, 10(a).

3. Claim 15(a)(i): “a first camera;”

180. See, 10(a)(i).

4. Claim 15(a)(ii): “a second camera;”

181. See, 10(a)(ii).

5. Claim 15(a)(iii): “a sensor configured to detect input from a steering wheel;”

182. See, 10(a)(iii).

6. Claim 15(a)(iv): “a GPS sensor; and”

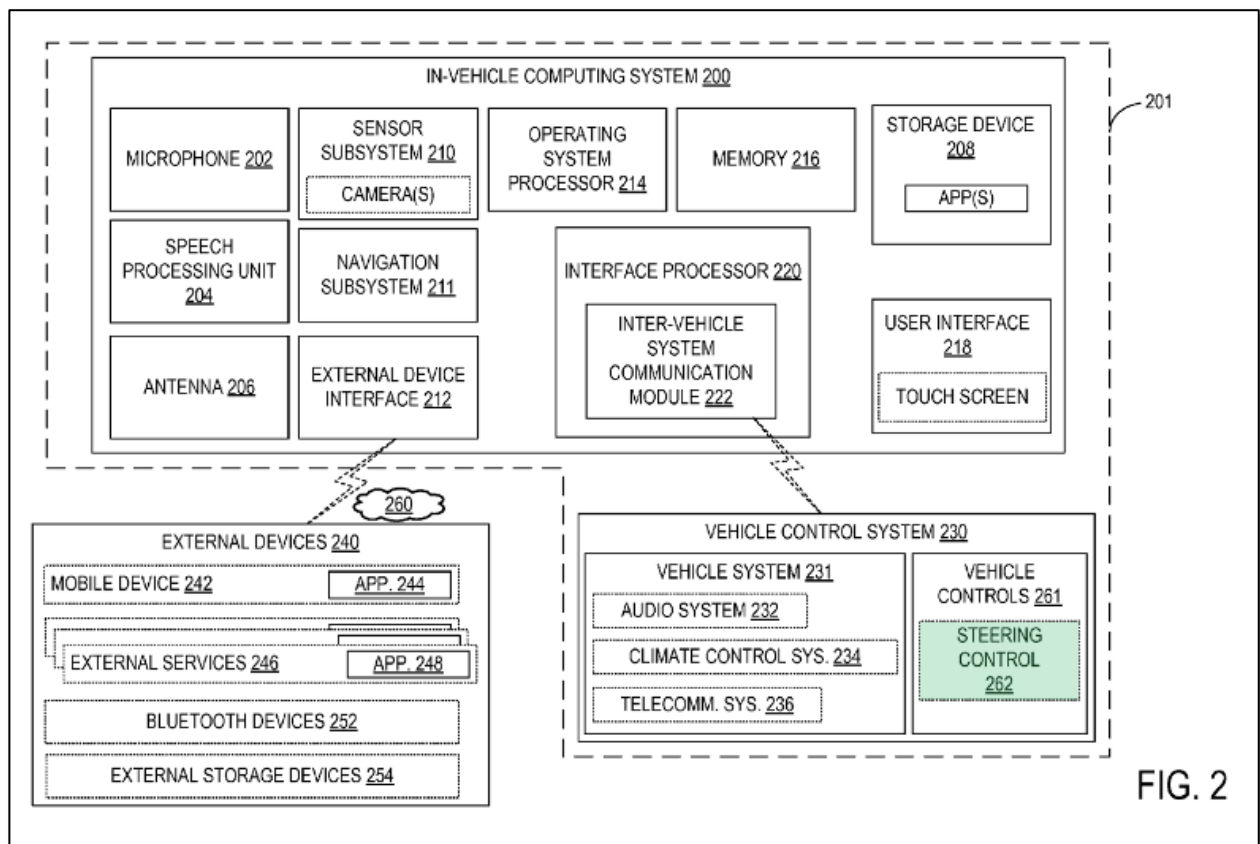
183. See, 10(a)(iv).

7. ***Claim 15(a)(v): “a speedometer;”***

184. See, 10(a)(vi).

8. ***Claim 15(b): “vehicle controls comprising: an engine throttle, a steering mechanism, a turn signal, and a braking system;”***

185. The *Hampiholi-Attard* SDV teaches *vehicle controls comprising: an engine throttle, a steering mechanism and a braking system*. See, 10(c). *Hampiholi* further teaches *a turn signal*, disclosing that “steering wheel controls 262” of vehicle 201 include “turn signal controls.” *Hampiholi*, [0041].



Hampiholi, FIG.2.

9. Claim 15(c): “a non-transitory computer readable storage medium comprising:”

186. See, 10(d).

10. Claim 15(c)(i): “a first plurality of weights;”

187. See, 10(d)(i).

11. Claim 15(c)(ii): “a second plurality of weights; and”

188. See, 10(d)(ii).

12. Claim 15(c)(iii): “a fault remediation table comprising:”

189. See, 10(f).

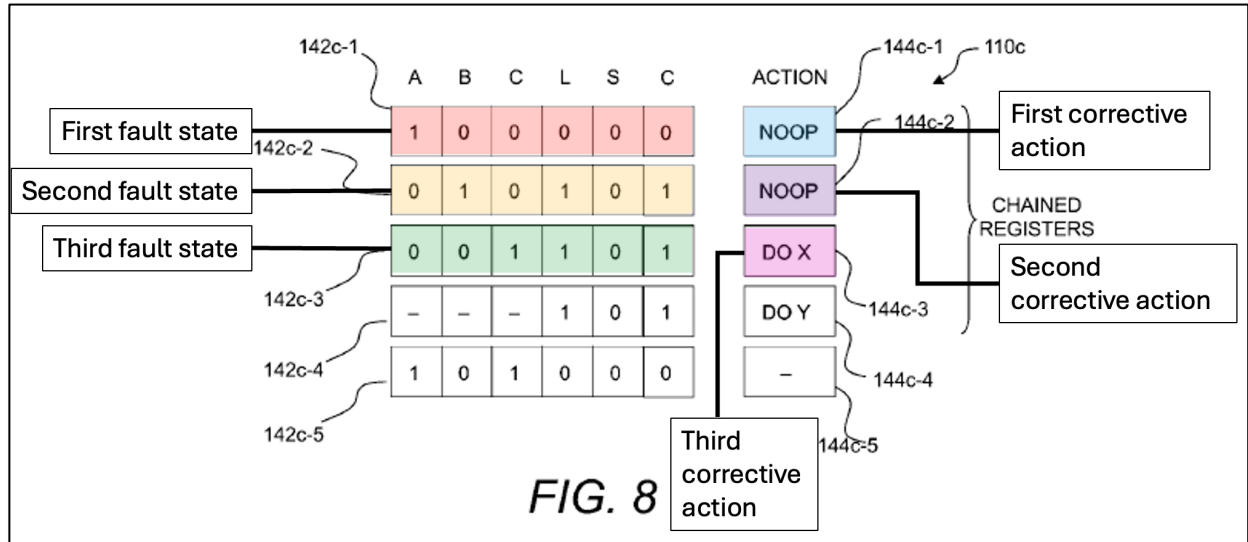
13. Claim 15(c)(iii)(1)-(6): “a first fault state; a first corrective action associated with the first fault state; a second fault state; a second corrective action associated with the second fault state; a third fault state; and a third corrective action associated with the third fault state;”

190. Frazer’s event table 112 (fault remediation table) includes *a first fault state*, *a second fault state*, and *a third fault state* i.e., conditions 142c-1, 142c-2, and 142c-3, which cause corresponding (associated) *first*, *second*, and *third* corrective actions 144c to be carried out.

In addition to representations of conditions 142 c, each event table register 140 c also includes representations of one or more actions 144 c to be carried out if the state input matches the condition(s) 144 c. Accordingly, if a scanner 130 c of the action engine 110 c determines that the input signals 66 match a

given condition 142 *c* stored in an event table register 140 *c*, the scanner 130 *c* accesses the corresponding action(s) 144 *c* stored in the event table register 140 *c*, and executes the action(s) 144 *c* so as to control one or more aspects of the dynamic environment.

Frazer, 22:6-15, *see also*, 21:33-43.



Frazer, FIG. 8. As shown in the annotated FIG. 8, *Frazer's* event table (*fault remediation table*) has condition 142c-1 (*first fault state*) is associated with action 144c-1 (*first corrective action*); condition 142c-2 (*second fault state*) is associated with action 144c-2 (*second corrective action*); and condition 144c-3 (*third fault state*) is associated with action 144c-3 (*third corrective action*).

14. Claim 15(d): “a computer system comprising a processor coupled to the non-transitory computer readable storage medium and program code, the program code readable and executable by the processor, wherein the computer system is capable of:”

191. *See*, 10(g).

15. Claim 15(d)(i): “receiving a sensor reading from the system of sensors;”

192. *Hampiholi* teaches receiving a sensor reading from the system of sensors. See, 15(a); *Hampiholi*, FIG. 2, [0031], [0034], [0046].

16. Claim 15(d)(ii): “operating the vehicle controls;”

193. As discussed above, the *Hampiholi-Attard* SDV is configured to automatically modify particular operations of the vehicle, including specifically autonomously controlling the vehicle speed and bringing the vehicle to a complete stop (per *Hampiholi*) and disabling one or more autonomous operations, such as in response to a fault (per *Attard*). See, 10(Pre).

194. *Attard* teaches its vehicle is operated partially or completely autonomously by autonomous driving module 106 in its computer 105. *Attard*, 9:63-10:12, 14:13-48.

195. 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 *operating the vehicle controls*, 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. Additionally, a POSITA would have found it obvious for *Attard* to control *the turn signal* at least because *Attard* teaches “module 106 could control when a vehicle 101 changes lanes,” which a POSITA would have found obvious to involve controlling the *turn signal* as required by law to signal the vehicle’s intention to other drivers/SDVs on the roadway.⁵

a) Motivation to Combine

196. *See*, 10(Pre). A POSITA would have incorporated *Attard*’s teachings regarding autonomous control of the driver controls listed in 15(b) in the *Hampiholi*-

⁵ *See*, California Vehicle Code 22108 (Ex. 1051 – “22108”), 1 (“Any signal of intention to turn right or left shall be given continuously during the last 100 feet traveled by the vehicle before turning.”); *Gorelick* (Ex. 1052), 1 (“Violation of 22108 VC is an infraction punishable by a fine of up to \$238.”).

Attard vehicle to provide an SDV operable to provide additional convenience and safety afforded by *Attard's* autonomous features in *Hampiholi's* vehicle that is already intended to increase the safety of the driver, and this modification would have had a REOS. A POSITA would have recognized that a vehicle which is capable of taking over control and self-driving through dangerous situations, or when a driver is not sufficiently capable, would have been safer than a vehicle unable to do so and would have resulted in a more-desirable vehicle to consumers. *See*, 10(Pre).

197. Such a modification is merely the combination of known prior art elements (*Attard's* sensors and controlling functions) according to known methods to yield predictable results of a car operable to autonomously perform corrective actions such as “slow to a stop,” “pull over and stop,” and/or “limp home” operations. 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 *Hampiholi-Attard* SDV and would have improved *Hampiholi* and *Attard's* similar vehicles in the same way— by allowing the vehicle to autonomously drive when no fault has occurred, and to detect when such conditions occur. While this modification may add additional complexity to *Hampiholi's* vehicle, a POSITA would have been motivated to make such a tradeoff to achieve *Attard's* benefits. A POSITA would have appreciated that self-driving vehicles increase driver, passenger, and bystander safety, furthering *Hampiholi's*

intended purpose. *Hampiholi*, [0002]. *Attard* expressly extols the benefits of incorporating its system utilizing a CPCL (Φ), explaining that “mechanisms are needed for evaluating a computer’s ability to autonomously operate the vehicle, and for determining an action or actions to take when one or more faults are detected” such as “determin[ing] a safe stopping location,” leading a POSITA to a motivation to combine *Attard*’s methods and supporting systems into *Hampiholi*’s vehicle, to result in a self-driving vehicle. *Attard*, 1:21-24, 14:27-48. A POSITA would have been aware that SDVs provide desirable features to users, benefitting sales of the vehicles while improving safety. Autonomous driving functionalities allow users to be more relaxed while driving and reduce the likelihood of accidents borne of human error.

198. A POSITA would have had a REOS for the combination at least because *Hampiholi* already includes an engine throttle, steering, and braking, and the processor and memory necessary for performing automatic functions; *Attard* is merely used to teach autonomous control of these driver controls. *Hampiholi* calls out its GPS sensor, navigation system, brake input, gas pedal input, engine speed, and steering wheel controls. *Hampiholi*, [0031], [0041]. Methods of autonomously controlling the *driver controls* were known, and the predictable result would have been an SDV better suited to respond to unsafe driving situations, including driver distraction, as taught by *Hampiholi*.

17. Claim 15(d)(iii): “receiving a first plurality of inputs, comprising readings from the first camera and the sensor configured to detect input from the steering wheel;”

199. See, 10(g)(i).

18. Claim 15(d)(iv): “receiving a second plurality of inputs, comprising readings from the second camera;”

200. See, 10(g)(ii).

19. Claim 15(d)(v): “generating a human driver profile;”

201. *Attard* teaches generating and storing a human driver profile including parameters relating to the driver, including biometric data and the driver’s “age, level of driving experience.” *Attard*, 5:30-42. To the extent *Attard* does not teach *generating a human driver profile*, *Duncan* teaches such.

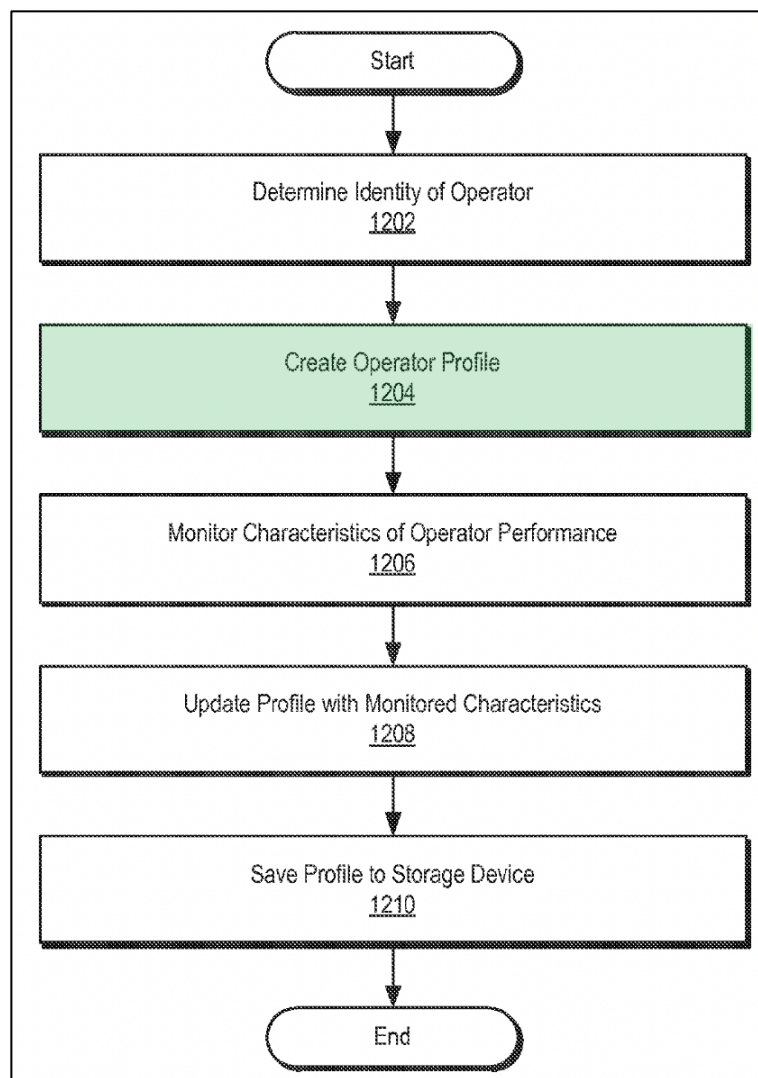
a) Duncan’s Teachings

202. *Duncan* teaches an autonomous vehicle with “a monitoring unit configured to determine a characteristic of performance of an operator” including “historical characteristic[s] of operator performance,” such as attentiveness:

A vehicle may include a monitoring unit configured to determine a characteristic of performance of an operator of the vehicle. The characteristic of operator performance may include a historical characteristic of operator performance (e.g., driving habits, aggressiveness, attentiveness, etc.), a real-time characteristic of operator performance (e.g., a current impairment of the operator),

characteristics of operator performance during specific external conditions, and/or the like.

Duncan, [0007], *see also*, [0049], [0052]. Additionally, *Duncan* teaches creating an “operator profile [that] may include one or more historical characteristics of operator performance.” *Duncan*, [0100]-[0101]. *Duncan*’s creation of an operator profile teaches *generating a human driver profile*.



Duncan, FIG. 12.

b) Motivation To Combine with *Duncan*

203. A POSITA would have found it obvious and been motivated to modify *Hampiholi-Attard* per *Duncan* to generat[e] a human driver profile. Such a modification is merely the combination of known prior art elements (*Hampiholi*'s driver distraction system with *Duncan*'s operator profile) according to known methods to yield the predictable result of the *Hampiholi-Attard* SDV generating a driver profile to store *Hampiholi*'s historical data used for computing severity rank R. A POSITA would have appreciated the benefits of storing a history of severity ranks R for a driver to improve future decision making. For example, a POSITA would have understood that such would have enabled future corrective actions to be based on the driver's past driving behavior.

204. *Hampiholi* already teaches using historical driver data, such as eyelid position, head movement, and pulse data, to determine severity rank R. *Hampiholi*, [0062], ("If the eyelids remain closed when compared with historical data, such eyelids' position compared to earlier times, for example, then it may be determined at 514 that the driver is distracted."), [0063] ("By comparing the pulse rate with historical data at 510, and analyzed at 512 to determine the state of the driver, and may further be used to determine if the driver is distracted at 514"). *Duncan*, meanwhile, teaches the operator profile can be based on attentiveness. *Duncan*, [0101] ("[A] characteristic of operator performance, such as speed, attentiveness,

and/or the like, may be continuously monitored and/or periodically sampled. The operator profile may be updated 1208 based on the monitored performance.”) Thus, it would have been obvious to modify *Hampiholi* per *Duncan*’s teachings to generate a human driver profile based on, e.g., the driver’s eyelid position, head movement, and pulse data per *Duncan*’s attention-based operator profile teachings. Such a modification would have predictably improved the *Hampiholi-Attard* SDV by providing it with easily retrievable data from which *Hampiholi* would access the historical data used to compute severity rank R. That is, such a modification is effectively an implementation detail for storing *Hampiholi*’s data in a profile, per *Duncan*. Additionally, each of *Hampiholi*, *Attard*, and *Duncan* teach executing their methods in software, and it would have only required a minor software change to the *Hampiholi-Attard* SDV to generate a profile, per *Duncan*. *Hampiholi*, [0032] (processor, memory); *Attard*, 15:12-46 (processor, memory); *Duncan*, [0054]-[0056], [0062] (computer executable instructions stored in memory).

205. A POSITA would have been motivated to modify the *Hampiholi-Attard* SDV per *Duncan* to generat[e] a human driver profile. Such a modification would have improved the *Hampiholi-Attard* SDV by tracking driver competence levels temporally and allowing for said driver profile data to be stored and retrieved. As I discussed above, this would be useful for tracking the driver’s history of distraction events, e.g., a number of times the driver was assigned a certain severity rank R,

which is expressly taught, suggested, and motivated by *Duncan*. *Duncan*, [0101] (“The operator profile may include one or more entries containing an indication of a number of occurrences of a particular action, a statistical characteristic of operator performance, and/or the like...”.) This modification would have been use of a known technique that would have improved the *Hampiholi-Attard* SDV in the same way as *Duncan* by monitoring historical characteristics. *Duncan*, [0100].

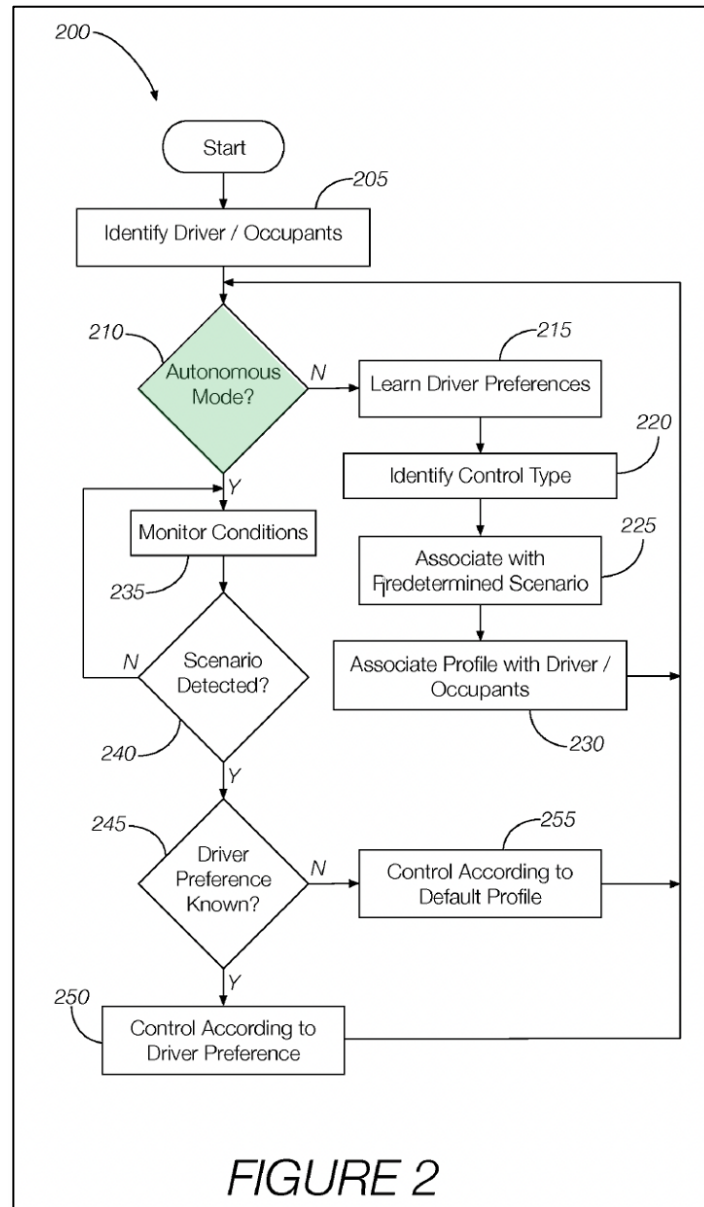
20. Claim 15(d)(vi): “generating a control processor profile;”

206. Per 16(c), *generating a control processor profile comprises determining whether the computer system is currently operating in a first autonomous mode, a second autonomous mode, or a manual mode. Attard* teaches that the vehicle can be “operated partially or completely autonomously” or under manual control. A POSITA would have understood that the “profile” (e.g. what is computer-controlled) must be known to the computer so that the driver and computer can effectively coexist. That is, the computer must know that it is operating in autonomous mode in order to operate autonomously. To the extent not taught by *Attard*, *Engelman* teaches such.

a) Engelman’s Teachings

207. *Engelman* teaches a “vehicle includes at least one autonomous driving sensor configured to monitor at least one condition while the vehicle is operating in an autonomous mode.” *Engleman*, [0004]. An exemplary process 200 includes

“determin[ing] whether the vehicle 120 is operating in the autonomous mode” or “in the non-autonomous mode.” *Engleman*, [0022]. A POSITA would have understood the non-autonomous mode to be a manual mode.



Engelman, FIG. 2. *Engelman* additionally teaches a processing device 115 of the vehicle learns preferences and associates these preferences to profile controls.

In some possible implementations, **the processing device 115 may be configured to associate each learned driver preference to one or more profile controls, such as a longitudinal profile control, a lateral profile control, and a route profile control.** The longitudinal profile control may define how the vehicle 120 operates in the autonomous mode when travelling longitudinally (e.g., in forward or reverse directions). The longitudinal profile control may include a speed profile control, a deceleration profile control, and an acceleration profile control. The speed profile control may define the speed of the vehicle 120, when operating in the autonomous mode, relative to a posted speed limit. The deceleration profile control may define how quickly the vehicle 120 decelerates when the vehicle 120 is operating in the autonomous mode, and the acceleration profile control may define how quickly the vehicle 120 accelerates when operating in the autonomous mode.

Engelman, [0012], *see also*, [0013] (lateral profile control), [0014] (route profile control).

208. Thus, because *Engelman* teaches determining whether the vehicle is in autonomous or manual mode, which per 16(c), satisfies *generating a control processor profile*, *Engelman* likewise teaches 15(d)(vi).

b) Motivation to Combine with *Engelman*

209. A POSITA would have found it obvious and been motivated to combine *Engelman's* teachings with the *Hampiholi-Attard* SDV, yielding the predictable

result of *generating a control process profile* that indicates which driving mode the *Hampiholi-Attard* SDV is in. As I discussed above, a POSITA would have understood *Attard's* vehicle to know which mode it is in, motivating the combination for at least this reason. See ¶ 206. Modifying the *Hampiholi-Attard* SDV in this way is merely the combination of known prior art elements according to known methods to yield predictable results of the *Hampiholi-Attard* SDV determining which autonomous mode it is currently operating in, i.e., *generating a control processor profile*. The *Hampiholi-Attard* SDV teaches three driving/control modes: full autonomous, semi-autonomous, and manual mode. *Attard*, 1:44-49, 2:55-58. It would have been obvious to modify the *Hampiholi-Attard* SDV to determine which mode it is in at least to ensure *Attard's* module 106 is aware of which autonomous driving features it does (or does not) have permission to use. This use of a known technique would have improved the *Hampiholi-Attard* SDV in the same way as *Engelman* by enabling the *Hampiholi-Attard* SDV to operate the correct features based on which autonomous mode the driver or the SDV has placed the SDV in. There would have been a REOS in modifying the *Hampiholi-Attard* SDV in this way at least because such would have required only straightforward software/programming changes to monitor and/or store the current driving mode of the SDV in memory, e.g., in *Hampiholi's* storage 208. Like *Hampiholi* and *Attard*,

Engelman teaches implementing its teachings as computer executable instructions in memory. *Hampiholi*, [0032]; *Attard*, 15:12-46; *Engleman*, [0016].

21. Claim 15(d)(vii): “taking the first corrective action when the first fault state has occurred;”

210. See, 10(g)(viii).

22. Claim 15(d)(vii): “taking the second corrective action when the second fault state has occurred; and”

211. See, 10(g)(viii), 15(c)(iii)(3)-(4). In the *Hampiholi-Attard* SDV, the *second corrective action* is taken when the *second fault state* has occurred, i.e., when conditions 142c-2 are met because the modified *Hampiholi-Attard* SDV associates fault states with actions per *Frazer*’s teachings of event table 112.

23. Claim 15(d)(ix): “taking the third corrective action when the third fault state has occurred.”

212. See, 10(g)(viii), 15(c)(iii)(5)-(6). In the *Hampiholi-Attard* SDV, the *third corrective action* is taken when the *third fault state* has occurred, i.e., when conditions 142c-3 are met because the modified *Hampiholi-Attard* SDV associates fault states with actions per *Frazer*’s teachings of event table 112.

X. GROUND 3: CLAIMS 16-17 ARE OBVIOUS OVER HAMPIHOLI, ATTARD, MCNEW, GUNDERSON, GRIMM, FRAZER, DUNCAN, ENGELMAN, AND STRAUSS

A. Claim 16

1. Claim 16(a): “The SDV of claim 15, further comprising: the computer system is further capable of:”

213. *See*, 15(d). The *computer system* of the *Hampiholi-Attard* SDV is *further capable* of performing limitations 16(b)-(c).

2. Claim 16(b): “generating the human driver profile comprising using a human driver competence level;”

214. *Duncan’s* operator profile (*human driver profile*) is generat[ed] using *a human driver competence level* because the profile is based on “a monitored [driver] performance” such as “speed, attentiveness, and/or the like,” which indicate *a human driver competence level*. *Duncan*, [0101]. *See*, 15(d)(v).

3. Claim 16(c): “generating the control processor profile comprising determining whether the computer system is currently operating in a first autonomous mode, a second autonomous mode, or a manual mode;”

215. *See*, 15(d)(vi).

4. Claim 16(d): “while operating in the first autonomous mode, autonomously maintaining a buffer of space from other vehicles around the SDV using the vehicle controls, without requiring the human driver to control the vehicle controls;”

216. *See*, 10(g)(vi). *Attard’s* full autonomous mode is *the first autonomous mode* that autonomously maintain[s] a buffer of space from other vehicles. *Attard*, 1:44-50, 1:65-2:6.

5. Claim 16(e): “while operating in the second autonomous mode, autonomously controlling the engine throttle and the breaking⁶ system while the human driver controls the turn signal; and”

217. *Attard* teaches a second autonomous mode, i.e., the semi-autonomous mode. *Attard*, 1:44-48. *Attard* does not detail which autonomous features are controlled in the semi-autonomous mode. A POSITA would understand that “Adaptive Cruise Control” (ACC) uses a radar to control the longitudinal distance to other vehicles and has been available in the United States on production cars since at least 2000, and by 2010 was “commercially available in a wide range of passenger vehicles.” *Xiao* (Ex. 1056), 1168.

a) Strauss’s Teachings

218. *Strauss* teaches an autonomous system for lateral and longitudinal control of a vehicle in which autonomous control of the “accelerator pedal” (*engine throttle*) and “brake pedal” (*braking system*) are provided. *Strauss*, 1:27-36, 6:37-53, 8:31-39. Per *Strauss*, a “lane change can be recommended to the vehicle operator...whereupon the vehicle operator can agree to an autonomous lane change...by **activating the vehicle turn signal.**” *Strauss*, 5:67-6:4.

⁶ I have been instructed by Petitioner to treat “*breaking*” as a typographical error of “*braking*.” ’004 Patent, 6:4-5 (“failure of an antilock breaking system in the SDV.”), 12:59-60.

b) Motivation to Combine with *Strauss*

219. A POSITA would have found it obvious and been motivated to modify the *Hampiholi-Attard* SDV with *Strauss*'s teachings of an autonomous driving system in which a driver uses the turn signal to control lane changes. Such a modification is merely the combination of known prior art elements according to known methods to yield the predictable results of the *Hampiholi-Attard* SDV driving semi-autonomously but changing lanes upon confirmation from the driver, which would have improved the user experience for the driver by ensuring they are comfortable with a lane change before it is implemented. A POSITA would have understood that the turn signal needed to be activated to signal a lane change as required by law, thus it would have been a matter of mere design choice to allow the driver to control the turn signal or the vehicle. *See*, California Vehicle Code 22108 (Ex. 1051 – “22108”), 1 (“Any signal of intention to turn right or left shall be given continuously during the last 100 feet traveled by the vehicle before turning.”); *Gorelick* (Ex. 1052), 1 (“Violation of 22108 VC is an infraction punishable by a fine of up to \$238.”). This modification constitutes use of a known technique: an autonomous driving system which autonomously controls engine throttle and braking system while a human driver controls a turn signal that would have improved the similar *Hampiholi-Attard* SDV in the same way as *Strauss* by enabling the driver to approve lane changes.

220. A POSITA would have had a REOS in modifying the *Hampiholi-Attard* SDV further based on *Strauss*'s teachings at least because street-legal cars include turn signals, and the modification would have required only straightforward changes to programming instructions for the *Hampiholi-Attard* SDV to thus require turn signal input prior to changing lanes. A POSITA would have appreciated the benefits of such a modification that would have provided the driver with more comfort in using the autonomous driving features. For example, this would allow drivers to disapprove a lane change the SDV wishes to make if the driver is not comfortable making it. Additionally, this provides the driver with more control over the autonomous maneuvers of the vehicle. For example, if the vehicle wants to merge into the left lane, but the driver is aware of an upcoming right-hand exit off a highway they need to take, the driver may not want to move into the left-hand lane and, therefore, can choose not to supply the turn signal input to prevent the lane change.

6. Claim 16(f): “while operating in the manual mode, allowing the human driver to control the vehicle controls.”

221. *Attard* teaches the driver can “take complete control of the vehicle,” teaching 16(f). A motivation to combine *Hampiholi-Attard* is above. *See*, 10(Pre).

B. Claim 17

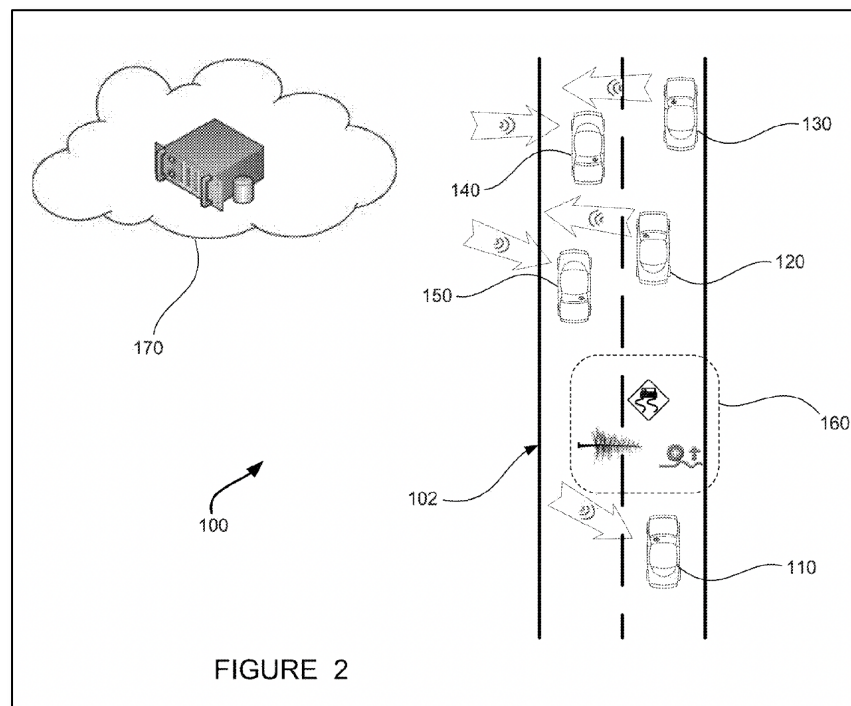
1. Claim 17(a)-(b): “The SDV of claim 16, further comprising: the first plurality of weights comprises first active learning data from

a first cohort of other SDVs; the second plurality of weights comprises second active learning data from a second cohort of other SDVs;

222. See, 15(c)(i), 10(d)(i) for *Gunderson*'s teachings of *the first plurality of weights* and *Grimm*'s teachings of *the second plurality of weights*.

a) *Grimm*'s First and Second Cohorts

223. *Grimm* teaches a vehicle 110 receives weather and other data from a server 170, which in turn receives data from vehicles 120, 130 (e.g., *active learning data*), thereby forming *a first cohort of other SDVs* as shown below:



Grimm, FIG. 2, 4:33-49 (“The vehicles 120 and 130 communicate data regarding the event location 160 to a central server 170.”), 4:57-60 (“[B]ased on the report of an obstacle on the road by the vehicles 120 and 130, the server 170 issues advisories to the vehicle...”), 13:27-36.

224. *Grimm* further teaches vehicle 110 receives weather and other data (e.g., *active learning data*) via V2V communications, such that the vehicles sending V2V data to vehicle 110 form *a second cohort of other SDVs*. *Grimm*, 3:44-52 (“The vehicle 10 also includes a vehicle-to-vehicle (V2V) communications module 50, which communicates with other, similarly-equipped vehicle within communications range...”). Thus, the *Hampiholi-Attard* SDV further modified by *Gunderson* (*first plurality of weights*) and *Grimm* (*second plurality of weights, first/second cohorts*) renders obvious 17(a)-(b).

b) Motivation to Combine with *Grimm*

225. A POSITA would have been motivated and found it obvious to modify the *Hampiholi-Attard* SDV further with *Grimm*’s teachings of receiving *active learning data* from *first* and *second cohorts* of vehicles. A POSITA would have appreciated the benefits of receiving active learning data from multiple groups of other vehicles and via various communication means (e.g., V2V and from a central server) to increase the data available to determine how to safely operate the *Hampiholi-Attard* SDV. Such a modification is merely the application of *Grimm*’s known technique of a vehicle polling data from multiple vehicle groups for decision making purposes according to known methods to yield the predictable results of the *Hampiholi-Attard* SDV obtaining *Gunderson*’s *weights* and *Grimm*’s *weights* from *first* and *second cohorts*. For example, a POSITA would have found it obvious and

been motivated to modify the *Hampiholi-Attard* SDV per *Grimm* such that *Gunderson's weights* are received from a central server because these are driver related weights such that the location of the sending vehicles to the central server does not matter. In contrast, a POSITA would have been motivated and found it obvious to modify the *Hampiholi-Attard* SDV per *Grimm* such that *Grimm's weights* are received via V2V communications from nearby vehicles because these weights are used to make autonomous driving decisions, which is impacted by data from surrounding vehicles. *Attard*, 6:57-60; *Grimm*, 5:54-6:30. This use of a known technique would have improved the similar *Hampiholi-Attard* SDV in the same way as *Grimm's* vehicle. Further motivations to combine *Hampiholi-Attard* with *Grimm* are above. *See* 10(e)(i), 10(g)(iv), 10(g)(vi), 18(g).

226. A POSITA would have had a REOS in the modification for the reasons set forth above. *See*, 10(e)(i), 10(g)(vi). Further underscoring the REOS, the *Hampiholi-Attard* SDV is already configured for V2V and server communications, thus leading to a straightforward modification. *Hampiholi*, [0026], [0032]; *Attard*, 4:57-6:20. Further still, the standard message set for sending weather data between vehicles was standardized before the '004 Patent, leading to an REOS. *Harding* (Ex. 1037), 79, 77 (discussing ambient air temperature, wiper status, and rain sensors).

2. Claim 17(c): "the computer system is further capable of:"

227. *See*, 15(d), 10(g).

3. Claim 17(d): “generating a first weighted voting result comprising multiplying an input from among the first plurality of inputs by a weight from among the first plurality of weights; and”

228. See, 10(g)(iii).

4. Claim 17(e): “generating a second weighted voting result comprising multiplying an input from among the second plurality of inputs by a weight from among the second plurality of weights.”

229. See, 10(g)(iv).

XI. GROUND 4: CLAIMS 18-20 ARE OBVIOUS OVER HAMPIHOLI, ATTARD, MCNEW, GUNDERSON, GRIMM, FRAZER, DUNCAN, ENGELMAN, STRAUSS, AND SAKO

A. Claim 18

1. Claim 18(a): “The SDV of claim 17, further comprising: the computer system is further capable of:”

230. See, 15(d), 10(g).

2. Claim 18(b): “determining a length of time during which the sensor configured to detect input from the steering wheel has not detected an input from the human driver;”

231. See, 13(b). *McNew* further teaches a “steering timer monitors how long it takes a driver to put hands on the steering wheel.” *McNew*, 19:46-51. A motivation to combine is above. See, 13(b).

3. Claim 18(c): “determining that the first fault state has occurred when the length of time exceeds a first threshold;”

232. See, 13(c).

4. Claim 18(d): “taking the first corrective action comprising sounding a warning sound and displaying an image on a display screen;”

233. See, 12(b).

5. Claim 18(e): “determining that the second fault state has occurred when the length of time exceeds a second threshold;”

234. *McNew*’s teachings of monitoring the time it takes a driver to put hands on wheel renders obvious 18(e). See, 18(b). Namely, a POSITA would have been motivated and found it obvious to include any multiple thresholds tracking the length of time the driver has their hands off the wheel. For example, it would have been obvious to use escalating alert types to obtain the driver’s attention. See, e.g., *Green* (Ex. 1036), [0034], [0092]-[0108] (describing a staged alerting system to obtain the driver’s attention). Further, *McNew* expressly envisions multiple timers. *McNew*, 20:46-59 (“...one **or more** timers ha[ve] expired...”). A POSITA would have appreciated the benefits of adding multiple timers to the *Hampiholi-Attard* SDV, enabling escalating levels of alerts/warnings to be communicated to the driver by increasing the likelihood the driver’s attention is obtained.

235. Including a *second threshold* in the *Hampiholi-Attard* SDV would have had a REOS because it would have required a straightforward software modification to program a second time threshold, e.g., to add another timer. For example, *McNew* already teaches a 20 second timer, and it would have been within the skillset of a POSITA to further modify the *Hampiholi-Attard* SDV to add, e.g., a 10 second

timer. A second timer would additionally have had a REOS and been obvious because it merely required a second application of the first timer technique expressly described, using hardware and memory already present in the *Hampiholi-Attard* SDV as modified by *McNew*. *Hampiholi*, [0032]; *Attard*, 15:12-46; *McNew*, 23:5-17.

6. Claim 18(f): “taking the second corrective action comprising switching to the manual mode;”

236. See, 12(c).

7. Claim 18(g): “determining, using the second weighted voting result, whether the SDV is currently traveling on a first roadway type or a second roadway type;”

237. As discussed, the *Hampiholi-Attard* SDV determines *Attard*’s Φ , taking corrective actions when necessary, including controlling whether or not to drive autonomously. See, 17(e), 10(g)(iv), 10(g)(vi). Claims 18(f) and 19 require taking the action of transferring control to manual when computer is in the second autonomous mode and the vehicle is on a public street.

a) *Sako*’s Teachings

238. As mapped, *Sako* teaches when an SDV moves “from the highway to a general road, it is possible to switch the driving mode to the manual driving mode.” *Sako*, 34:63-35:21 (teaching detecting a public “highway” *first roadway type* vs “a general road” *second roadway type*). *Sako* teaches determining what roadway type

an SDV is on using GPS readings. Further, *Sako* teaches when an SDV moves “from the highway to a general road, it is possible to switch the driving mode to the manual driving mode.” *Sako*, 34:63-35:21. Thus, *Sako* teaches determining whether the SDV is currently traveling on a first or second roadway type. Regarding modifying the *Hampiholi-Attard* SDV, I note the *Hampiholi-Attard* SDV already includes GPS, processor, and memory. *See*, Claim 15.

b) Motivation to Combine with *Sako*

239. A POSITA would have been motivated and found it obvious to modify the *Hampiholi-Attard* SDV to transfer from semi-autonomous (*second autonomous mode*) to manual when the vehicle exits a public highway onto a general (public) street, per *Sako*. A POSITA would have recognized the SDV would have most safely operated autonomously on a public highway, where infrastructure is better and where roads and driver behavior are the most predictable, and thus would have been motivated to cause the SDV to take *Sako*’s corrective action of discontinuing autonomous driving (switching to manual) when moving to a public street from a highway. SDVs that disabled autonomous mode upon exiting a highway were well known. For example, *Desnoyer* taught such an autonomous vehicle in which a “navigation unit identifies the end of [a] delegated driving zone, which corresponds to an entry into another zone in which traffic becomes more fluid or else in which the infrastructure alters: toll, **highway exit**...” *Desnoyer* (Ex. 1049), [0040]. This

modification combines prior art elements (*Attard's* semi-autonomous mode and *Sako's* functionality) according to known methods to yield predictable results of an SDV transferring to manual mode when exiting a public highway.

240. This use of a known technique would have improved *Hampiholi-Attard* in the same way as *Sako* by enabling the *Hampiholi-Attard* SDV to disable autonomous driving based on roadway type. Further, because the hardware/software necessary (including GPS and a map) was already present in *Hampiholi-Attard*, these modifications would have required only straightforward modifications to programming instructions of the *Hampiholi-Attard* SDV, which would have been well-within the skillset of a POSITA and would have had a REOS. *Attard*, 13:50-63 (virtual map).

c) Using the second weighted voting result

241. *See*, 10(g)(vi).

8. Claim 18(h): “determining that the third fault state has occurred when the computer system is operating in the second autonomous mode and the SDV is currently traveling on the second roadway type; and”

242. *See*, 18(g) describing a “general road” *second roadway type*. A POSITA would have been motivated and found it obvious to combine *Sako's* teachings of determining to switch from autonomous mode to manual when on a general road (*determining that the third fault state has occurred*) at least because

Attard expressly teaches that road conditions can cause a switch to manual by causing Φ to fall below $\Phi_{\min}$. *Attard*, 10:47-52. A POSITA would have recognized the SDV's ability to operate autonomously (Φ) would have differed based on the roadway type, with "general roads" (e.g. a road with tighter curves, shorter sightlines, smaller lanes and shoulders and generally less well maintained pavement and striping) being more difficult for the SDV to traverse autonomously than "public highways." For example, the Mercedes 2013 S-Class Active Lane Keeping Assist may not function if "the road is narrow and winding," or "the lane markings are worn away, dark or covered up, e.g. by dirt or snow," among several other warnings more associated with minor roads. *Mercedes S-Class Manual* (Ex. 1057), 370. In another example, unpaved roads or busy, narrow city streets would likely have been more difficult to traverse in automatic/autonomous mode than a smooth, well-maintained, and/or low-traffic highway.

243. The *Hampiholi-Attard* SDV determines corrective actions and fault states using *Frazer's* fault remediation table. *See*, 15c(iii)(1)-(6). A POSITA would have been motivated and found it obvious to add *Sako's* corrective action response (transferring to manual control upon exiting a highway) when necessary (*Attard's* Φ is below $\Phi_{\min}$), improving the SDV by merely adding a row and perhaps columns to the table. For example, in the *Frazer* event table 112 this would look like having action 144c-3 that transfers controls to manual controls and the conditions 142c-3 in

would be the CPCL being below a threshold and the detection of exiting the highway. As discussed, *Frazer* contemplates event table including “tens, hundreds, or even thousands of entries” such that such a modification would have been met with a reasonable expectation of success. *Frazer*, 21:64-22:1 Further motivation to combine the *Hampiholi-Attard* SDV with *Sako* is provided above.

9. Claim 18(i): “taking the third corrective action comprising switching to the manual mode.”

244. See, 12(c).

B. Claim 19

1. Claim 19(a): “The SDV of claim 18, further comprising: the first roadway type comprises a public highway; and”

245. See, 18(g).

2. Claim 19(b): “the second roadway type comprises a public street.”

246. See, 18(g). A POSITA would have understood a “general road” teaches or renders obvious *a public street*. For example, a POSITA would have understood that highways exit onto public roads such that *Sako*’s teachings of transferring from autonomous to manual upon exiting a highway to a general road teaches or renders obvious exiting a highway onto a public street.

C. Claim 20

1. Claim 20(a): “The SDV of claim 15, further comprising: the first plurality of weights comprises first active learning data from a first cohort of other SDVs;”

247. *See*, 17(a).

2. *Claim 20(b): “the second plurality of weights comprises second active learning data from a second cohort of other SDVs;”*

248. *See*, 17(b).

3. *Claim 20(c): “the computer system is further capable of:”*

249. *See*, 15(d), 10(g).

4. *Claim 20(d): “generating a first weighted voting result comprising multiplying an input from among the first plurality of inputs by a weight from among the first plurality of weights; and”*

250. *See*, 17(d)

5. *Claim 20(e): “generating a second weighted voting result comprising multiplying an input from among the second plurality of inputs by a weight from among the second plurality of weights.”*

251. *See*, 17(e).

XII. GROUND 5: CLAIMS 21-24 AND 27 ARE OBVIOUS OVER HAMPIHOLI, ATTARD, MCNEW, GUNDERSON, GRIMM, FRAZER, DUNCAN, ENGELMAN, STRAUSS, SAKO, AND HADA

A. Claim 21

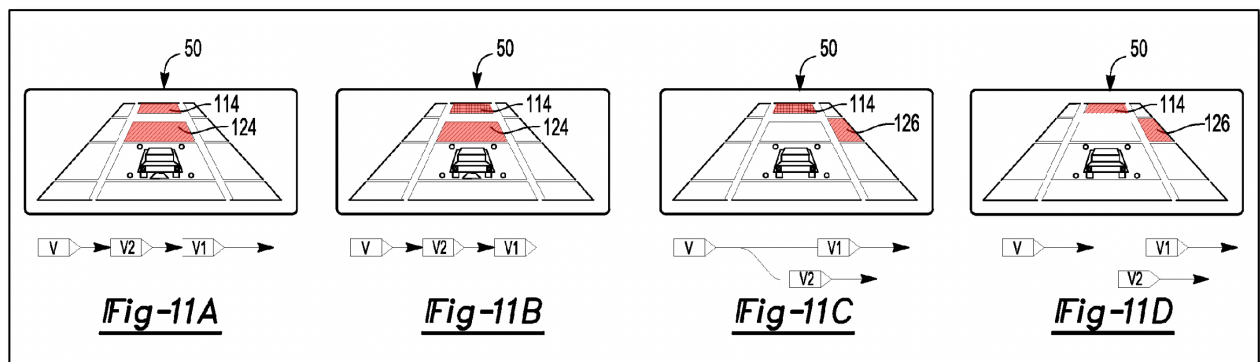
1. *Claim 21(a): “The SDV of claim 20, further comprising: a display that is capable of displaying a position of another vehicle relative to the SDV;”*

252. *Hampiholi teaches a display – user interface 218. See*, 10(b).

a) Hada’s Teachings

253. *Hada* teaches displaying proximity sensor information and/or collision warning information on a single display screen of a vehicle. *Hada*, 1:5-9. *Hada* teaches a display showing a grid for lane markings and illuminating at least one grid section as a function of the location of external objects. *Hada*, 1:41-2:34.

254. For example, *Hada* depicts the location of the user's vehicle (V) and the positions of other nearby vehicles (V1, V2). The **hatched lines** in the grid indicate the position of the other vehicles.



Hada, Figs. 11A-11D, 5:4-10, 6:28-35, 7:8-26. Thus, the *Hampiholi-Attard* SDV modified by *Hada* comprises a display that is capable of displaying a position of another vehicle relative to the SDV.

b) Motivation to Combine with *Hada*

255. A POSITA would have been motivated and found it obvious to modify the *Hampiholi-Attard* SDV to display the position of nearby vehicles per *Hada*. In particular, *Hada* provides an express teaching, suggestion, or motivation for implementing its technique, thus motivating a POSITA to make this modification.

Specifically, *Hada* teaches displaying sensor readings, such as those indicating nearby vehicles, advantageously improves vehicle safety, thereby motivating the combination. *Hada*, 1:5-36, 3:17-21, 3:55-61, 5:23-36. Utilizing *a display that is capable of displaying a position of another vehicle relative to the SDV* would have been use of *Hada*'s known technique to improve the similar *Hampiholi-Attard* SDV in the same way as *Hada*. Further, to the extent it is argued that the *Hampiholi-Attard*'s SDV's display was not capable of displaying in this manner, a POSITA would have been motivated to modify the *Hampiholi-Attard* SDV to combine prior art elements (e.g., display capable of displaying the position of another vehicle relative to the SDV) according to known methods to yield predictable results. This use of a known technique would have improved the similar *Hampiholi-Attard* SDV in the same way as *Hada*'s vehicle.

256. This modification would have had a REOS because it would have required only straightforward modifications to programming instructions, which would have been well-within the skillset of a POSITA. Specifically, the *Hampiholi-Attard* SDV already includes hardware including sensors, a display, a processor, and memory for performing *Hada*'s technique. To the extent it is argued that the *Hampiholi-Attard* SDV's display is insufficient, a POSITA would have known that commercially available, off-the-shelf displays capable of performing this displaying

were available, and a POSITA would have had a REOS in modifying the *Hampiholi-Attard* SDV to include such a display.

2. Claim 21(b): “the computer system is further capable of:”

257. See, 15(d), 10(g).

3. Claim 21(c): “determining the position of another vehicle relative to the SDV using the second weighted voting result; and”

258. *Grimm* teaches *second weighted voting* via its threat level equation. See, 10(g)(iv). *Grimm*’s threat level equation incorporates properties of *another vehicle*, that are obtained from a V2V module 50, which “collect[s] significant amounts of data from nearby vehicles, particularly including position, velocity and acceleration data—as is needed for “smart highway” or autonomous vehicle systems.” *Grimm*, 5:59-6:4, 3:44-52. The position of the vehicle relative to the SDV is computed by differencing to the SDVs position (see *Grimm*, 3:3-5), as was well known in the art. A motivation to combine the *Hampiholi-Attard* SDV with *Grimm* is above. See, 10(g)(iv).

4. Claim 21(d): “autonomously maintaining a buffer of space from other vehicles around the SDV using the vehicle controls and the second weighted voting result.”

259. See, 10(g)(vi).

B. Claim 22

1. Claim 22(a): “The SDV of claim 21, further comprising: the computer system is further capable of:”

260. *See*, 15(d), 10(g).

2. *Claim 22(b): “determining a length of time during which the sensor configured to detect input from a steering wheel has not detected input from the human driver;”*

261. *See*, 18(b).

3. *Claim 22(c): “determining that the first fault state has occurred when the length of time exceeds a first threshold;”*

262. *See*, 18(c).

4. *Claim 22(d): “taking the first corrective action comprising sounding a warning sound and displaying an alert on a display screen; and”*

263. *See*, 18(d).

5. *Claim 22(e): “determining that the second fault state has occurred when a number of times the first fault state has occurred exceeds a second threshold.”*

264. *See*, 18(e).

C. Claim 23

1. *Claim 23(a): “The SDV of claim 22, further comprising: the computer system is further capable of:”*

265. *See*, 15(d), 10(g).

2. *Claim 23(b): “determining, using the control processor profile, whether the computer system is currently operating in a first autonomous mode, a second autonomous mode, or a manual mode;”*

266. *See*, 16(c).

3. *Claim 23(c): “while operating in the first autonomous mode, autonomously maintaining a buffer of space from other vehicles around the SDV using the vehicle controls and the second weighted voting result, without requiring the human driver to control the vehicle controls;”*

267. *See, 16(c), 10(g)(vi).*

4. *Claim 23(d): “while operating in the second autonomous mode, autonomously controlling the engine throttle and the breaking system while the human driver controls the turn signal;”*

268. *See, 16(d).*

5. *Claim 23(e): “while operating in the manual mode, allowing the human driver to control the vehicle controls; and”*

269. *See, 16(e).*

6. *Claim 23(f): “taking the second corrective action comprising the computer system switching from the first autonomous mode to the manual mode.”*

270. *See, 12(c).*

D. Claim 24

1. *Claim 24(a): “The SDV of claim 23, further comprising: the computer system is further capable of:”*

271. *See, 15(d), 10(g).*

2. *Claim 24(b): “generating the human driver profile comprises using active learning data from a current human driver of the SDV;”*

272. *Duncan* teaches *generating a human driver profile using active learning data from a current driver of the SDV. See, 15(d)(v).* A motivation to combine is above. *See 15(d)(v).*

3. Claim 24(c): “determining that the third fault state has occurred using the human driver profile; and”

273. The *Hampiholi-Attard* SDV would have been modified per *Frazer* to include *a third fault state* (e.g., a severity rank R in *Hampiholi’s* 3rd range). *Hampiholi*, FIG. 4, [0057]; *See, 15(c)(iii)(1-6).* *Duncan* teaches generating a human driver profile including driver behaviors. *See, 24(b).* Thus, in the modified *Hampiholi-Attard* SDV, *determining that the third fault state has occurred* would have been done *using the human driver profile.*

274. A POSITA would have been motivated to modify *Hampiholi-Attard* SDV per *Frazer* and *Duncan* such that the fault-remediation table would have included a third fault state based on the human driver profile, where the human driver profile is used to determine *Hampiholi’s* severity rank R. *Duncan* teaches or renders obvious retrieving a human driver profile from a database. *Duncan*, [0101] (“The updated operator profile may be saved 1210 to a persistent storage device.”), [0103] (“The condition of the operator may be evaluated periodically, and a memory and/or storage device may be accessed to retrieve the most recent values”). A POSITA would have understood that organizing the data in a manner to be searched,

modified, and retrieved would have been basic functions for a computer and for databases. Thus, using a driver profile and fault-remediation table stored in memory would have merely been using these same basic computer data management techniques. *See*, 15(c)(iii)(1)-(6).

275. A POSITA would have been motivated to modify the *Hampiholi-Attard* SDV per *Duncan* to store/retrieve a driver profile in persistent storage and to utilize a driver profile in conjunction with a fault-remediation table to determine when a particular fault state has occurred. Storing driver profiles allows for profile data to be collected over a longer period of time and allows for trends to be analyzed over that longer time frame, which a POSITA would have found advantageous. If a memory were not used, for example, then each trip would be like starting with a fresh driver profile, which would not allow for this longer-term analysis. Such a modification would have improved the *Hampiholi-Attard* SDV by tracking driver competence levels temporally and allowing for said driver profile data to be stored and retrieved from a database as well as to utilize a fault-remediation table to determine when fault conditions have occurred. I note that using a database to store and retrieve information was a common function of computers in general, with SDV computers operating similarly. Storing and retrieving human driver profiles would thus have simply been utilizing known techniques for computers, and this

modification would have improved the *Hampiholi-Attard* SDV in the same way as *Duncan*.

276. A POSITA would have had a REOS because the *Hampiholi-Attard* SDV already includes memory, storage, and a processor, and one of the basic functions of a computer is to store and access data in memory. Further, the *Hampiholi-Attard* SDV already collects driver information from sensors. Additionally, the *Hampiholi-Attard* SDV is modified per *Frazer* to include a fault-remediation table. *See*, 10(f), 15(c)(iii)(1)-(6). Thus, a POSITA would have understood that the necessary hardware was already present in the *Hampiholi-Attard* SDV, and that only straightforward programming instructions would have needed to be modified.

4. Claim 24(d): “taking the third corrective action comprising disabling the first autonomous mode.”

277. The *Hampiholi-Attard* SDV disables the first autonomous mode as a corrective action. *See*, 12(c). Likewise, instead of being a *second corrective action* for 12(c), here the corrective action would have been a *third corrective action* in response to a third fault state. *See*, 24(c).

E. Claim 27

1. Claim 27(a): “The SDV of claim 23, further comprising: the computer system is further capable of:”

278. *See*, 15(d), 10(g).

2. Claim 27(b): “determining the third fault state has occurred comprising determining a current weather condition of a roadway on which the SDV is currently traveling; and”

279. See, 15(c)(iii), 15(d)(ix) mapping “third fault state.” Further, *Attard* specifically teaches the fault being a current weather of the roadway on which the SDV is currently travelling, *e.g.* wet or icy roads. *Attard*, 7:14-17.

3. Claim 27(c): “taking the third corrective action comprising switching from the first autonomous mode to the manual mode.”

280. See, 12(c).

XIII. CONCLUSION

281. 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 28, 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 EXPERTICE (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.