

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. IPR2025-01034
U.S. Patent No. 12,037,004

**PETITION FOR *INTER PARTES* REVIEW
OF U.S. PATENT NO. 12,037,004
(Claims 1-9, 29-39)**

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I. INTRODUCTION

Petitioner Tesla, Inc. (“Petitioner”) requests *Inter Partes* Review of Claims 1-9, 29-39 (collectively, the “Challenged Claims”) of USPN 12,037,004 (“the ’004 Patent”) assigned to Granite Vehicle Ventures LLC. ’004 Patent (Ex. 1001).

The Challenged Claims encompass a hotchpotch of features from prior-art self-driving vehicles (SDVs) including determining competence levels of the driver and the SDV—well-known techniques prior to the ’004 Patent. Because the Challenged Claims recite numerous known features, Petitioner’s proposed Grounds rely on combinations of multiple references. “The criterion [for obviousness], however, is not the number of references, but what they would have meant to a person of ordinary skill[.]” *In re Gorman*, 933 F.2d 982, 986 (Fed. Cir. 1991). The Challenged Claims are plainly obvious and should be canceled.

II. SUMMARY OF THE ’004 PATENT

A. Priority Date of the Challenged Claims

The ’004 Patent claims priority to USPN 9,566,986 filed on September 25, 2015. ’004 Patent, (63). For purposes of this Petition only, Petitioner applies September 25, 2015, as the priority date for the Challenged Claims.

B. Level of Skill of a Person Having Ordinary Skill in the Art

A POSITA at the time of the ’004 Patent 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.

III. REQUIREMENTS UNDER 37 C.F.R. § 42.104

A. Grounds for Standing Under 37 C.F.R. § 42.104(a)

Petitioner certifies the '004 Patent is eligible for IPR.

B. Identification of Challenge Under 37 C.F.R. § 42.104(b)

Petitioner requests the Challenged Claims be found unpatentable on the following grounds.¹

Proposed Grounds of Unpatentability	Exhibits
<u>Ground 1:</u> Claim 1 is obvious under 103(a) over <i>Hampiholi, Attard, McNew, and Frazer</i> .	1007, 1004, 1006, 1005
<u>Ground 2:</u> Claims 2-5 are obvious under §103(a) over <i>Hampiholi, Attard, McNew, Frazer, DeRuyck, Gunderson, An, Kang, and Schunder</i> .	1007, 1004, 1006, 1005, 1011, 1012, 1008, 1009, 1010

¹ All References qualify as prior art under §§ 102(a)(1) and/or 102(a)(2).

<u>Ground 3:</u> Claims 6-7 are obvious under §103(a) over <i>Hampiholi, Attard, McNew, Frazer, and Sako</i> .	1007, 1004, 1006, 1005, 1040
<u>Ground 4:</u> Claim 8 is obvious under §103(a) over <i>Hampiholi, Attard, McNew, Frazer, and Coelingh</i> .	1007, 1004, 1006, 1005, 1041
<u>Ground 5:</u> Claim 9 is obvious under §103(a) over <i>Hampiholi, Attard, McNew, Frazer, Coelingh, DeRuyck, Gunderson, An, Kang, and Schunder</i> .	1007, 1004, 1006, 1005, 1041, 1011, 1012, 1008, 1009, 1010
<u>Ground 6:</u> Claim 29 is obvious under §103(a) over <i>Hampiholi, Attard, McNew, Frazer, and Hada</i> .	1007, 1004, 1006, 1005, 1043
<u>Ground 7:</u> Claim 30 is obvious under §103(a) over <i>Hampiholi, Attard, McNew, Frazer, Hada, and Tsimhoni-647</i> .	1007, 1004, 1006, 1005, 1043, 1050
<u>Ground 8:</u> Claims 31-32 are obvious under §103(a) over <i>Hampiholi, Attard, McNew, Frazer, Hada, Tsimhoni-647, DeRuyck, Gunderson, An, Kang, and Schunder</i> .	1007, 1004, 1006, 1005, 1043, 1050,

	1011, 1012, 1008, 1009, 1010
<u>Ground 9:</u> Claims 33-34 are obvious under §103(a) over <i>Hampiholi, Attard, McNew, Frazer, Hada, Tsimhoni-647, DeRuyck, Gunderson, An, Kang, Schunder, and Nagasaka.</i>	1007, 1004, 1006, 1005, 1043, 1050, 1011, 1012, 1008, 1009, 1010, 1042
<u>Ground 10:</u> Claims 35-36 are obvious under §103(a) over <i>Hampiholi, Attard, McNew, Frazer, Hada, Tsimhoni-647, DeRuyck, Gunderson, An, Kang, Schunder, Nagasaka, and Duncan.</i>	1007, 1004, 1006, 1005, 1043, 1050, 1011, 1012, 1008, 1009, 1010, 1042, 1045
<u>Ground 11:</u> Claims 37-39 are obvious under §103(a) over <i>Attard, Hampiholi, McNew, and Frazer.</i>	1004, 1007, 1006, 1005

C. Claim Construction Under 37 C.F.R. § 42.104(b)(3)

In this proceeding, claims are interpreted under the same standard applied by Article III courts (i.e., the *Phillips* standard). 37 C.F.R. § 42.100(b); 83 Fed. Reg. 197 (Oct. 11, 2018); *Phillips v. AWH Corp.*, 415 F.3d 1303, 1312 (Fed. Cir. 2005) (*en banc*). Petitioner applies the plain and ordinary meaning of all claim terms. Petitioner does not waive any argument in any litigation that claim terms in the '004 Patent are indefinite or additional terms need construction.

IV. SHOWING OF ANALOGOUS, PRIOR ART

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*, 1:15-24, 9:63-67; *Frazer*, 1:19-23, 21:20-22:22; *McNew*, 1:17-30, 3:5-52, FIG. 1; *Hampiholi*, [0050]-[0051], [0057]-[0058]; *An*, 1:15-23, 1:52-63, 4:34-45; *Kang*, 2:7-29, 9:32-49, Fig. 7C; *Schunder*, Abstract, 1:63-2:7; *DeRuyck*, 1:16-34; *Gunderson*, [0002]-[0004], [0025]; *Sako*, 1:55-2:3, 9:63-67; *Coelingh*, 1:53-2:15, 4:48-59; *Hada*, 1:5-10; *Nagasaka*, 1:5-39, 3:11-24; *Duncan*, [0023]; *Tsimhoni-647*, 1:12-24. *Dec.*, 59-60.²

² References to *Dec.* are to paragraphs of Ex. 1003, Declaration of Christopher Wilson.

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; *An*, 1:15-23, 1:52-63, 4:34-45, 4:46-6:24, 15:1-60; *McNew*, 20:7-31, 4:3-5, 8:41-44; *Sako*, 34:15-35:21; *Tsimhoni-647*, 6:3-31;

(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;

(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;

(D) adjusting an operation of a vehicle based on driver competence; '004 Patent, 8:50-58; *Hampiholi*, [0001]-[0004], [0057]; *DeRuyck*, 1:16-34, 3:50-63; *Duncan*, [0007]-[0008];

(E) adapting to weather conditions to increase vehicle safety; '004 Patent, 7:42-56, 13:61-14:25, 15:33-50; *Kang*, 2:7-29, 9:32-49, 10:55-11:6, 13:3-18, Fig. 7C; *Schunder*, 1:63-2:7, 9:25-10:11, FIG. 4; and/or

(F) improving vehicle safety. '004 Patent, 9:11-17; *Gunderson*, [0062]; *Kang*, 17:58-18:7; *McNew*, 25:45-61; *Nagasaka*, 19:57-60; *Tsimhoni-647*, 6:3-31; *Hada*,

1:5-36, 3:17-21, 3:55-61, 5:23-36; *Duncan*, [0007]-[0008]; *Coelingh*, 1:22-50. *Dec.*, 59-60.

V. GROUND 1: CLAIM 1 IS OBVIOUS OVER HAMPIHOLI, ATTARD, MCNEW, AND FRAZER

A. The *Hampiholi-Attard* Self-Driving Vehicle

Claim 1 is obvious over a combined *Hampiholi-Attard* self-driving vehicle (SDV)³, operating according to *Hampiholi*'s disclosure and modified to incorporate *Attard*'s self-driving modes, functions, features, and control processor competence level (CPCL⁴), Φ , as well as any hardware and software necessary to provide an operable SDV practicing the techniques taught by *Hampiholi* and *Attard*. The *Hampiholi-Attard* SDV would have desirably been capable of self-driving and implementing corrective actions when appropriate, whether from detected reduced human competence (per *Hampiholi*) or detected reduced processor competence (per *Attard*). *Dec.*, 62-63.

A POSITA would have appreciated the *Hampiholi-Attard* SDV would have furthered *Hampiholi*'s stated goal of increasing driver, passenger, and bystander

³ Herein Petitioner uses the "*Hampiholi-Attard SDV*" as shorthand to refer to the mapped combinations.

⁴ Petitioner uses "CPCL" to refer to the *competence level of the SDV* (Claims 1 and 29) and to the *competence level of a control processor* (Claim 37).

safety by controlling a driving mode of an SDV to respond to faults such as hardware failures, weather conditions, and decreased driver competence. *Hampiholi*, [0002], [0017]; *Dec.*, 63. 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. *Dec.*, 63-64. 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. *Dec.*, 63-64. A POSITA would have had a reasonable expectation of success because producing SDVs was known in the prior art. *Dec.*, 63-64. *See*, 1(c)⁵ for additional motivation to modify *Hampiholi* per *Attard*.

B. Claim 1

1. Claim 1(Pre)⁶

To the extent the preamble is limiting, *Hampiholi-Attard* teaches *a computer program product* that manages fault handling in an SDV including *controlling a driving mode* by automatically responding to detected faults. Further, *Hampiholi-Attard* teaches non-volatile memory and programming code readable and executable

⁵ Any citation to a claim limitation (e.g., 1(c)) is to the limitation's mapping in this Petition, and such mapping is otherwise incorporated by reference in the section citing the limitation.

⁶ *See* Claims Appendix for claim language.

by a processor. A motivation to combine the overall vehicles, systems, and techniques described by *Hampiholi* and *Attard* is above, and particular SDV features are described at 1(c); both discussions are incorporated herein by reference.

a) *Hampiholi-Attard* Teaches Controlling a Driving Mode

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] (“**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; *Dec.*, 67. 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. *Dec.*, 67, 46. *Attard* teaches such an autonomous SDV in which autonomous driving module 106 of computer 105 controls steering, braking, and speed. *Attard*, 1:15-65, 3:22-67, 7:39-46, 9:60-67-10:12, 10:36-41; *Dec.*, 68. Specifically, *Attard* teaches *controlling a driving mode*, transitioning from autonomous mode to either semi-autonomous mode or manual mode responsive to detecting a fault. *Dec.*, 68-70. Thus, the *Hampiholi-Attard* vehicle is an SDV controlling a driving mode. *Id.*

b) *Hampiholi's Computer Program Product*

Hampiholi's vehicle 201 includes storage device 208 comprising “instructions executable by processors 214 and 220 in non-volatile form:”

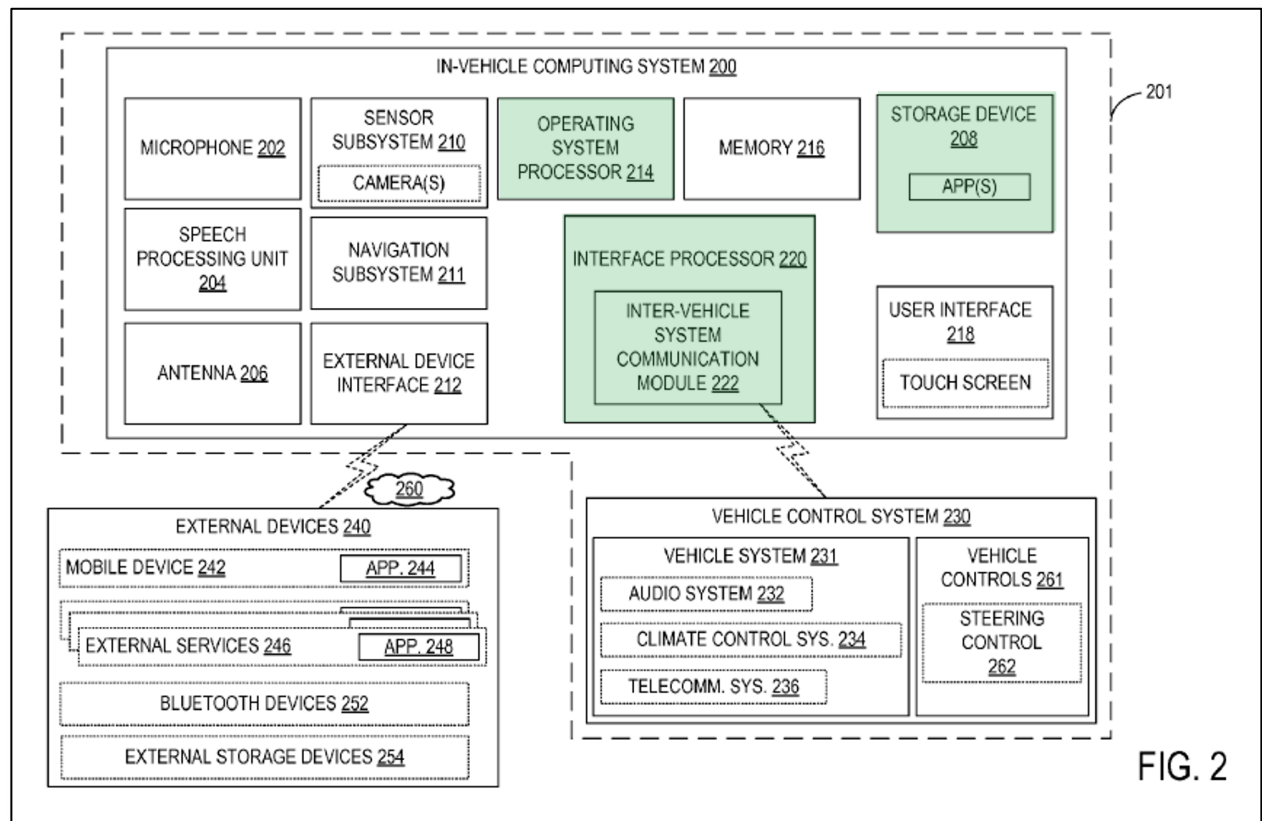


FIG. 2

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

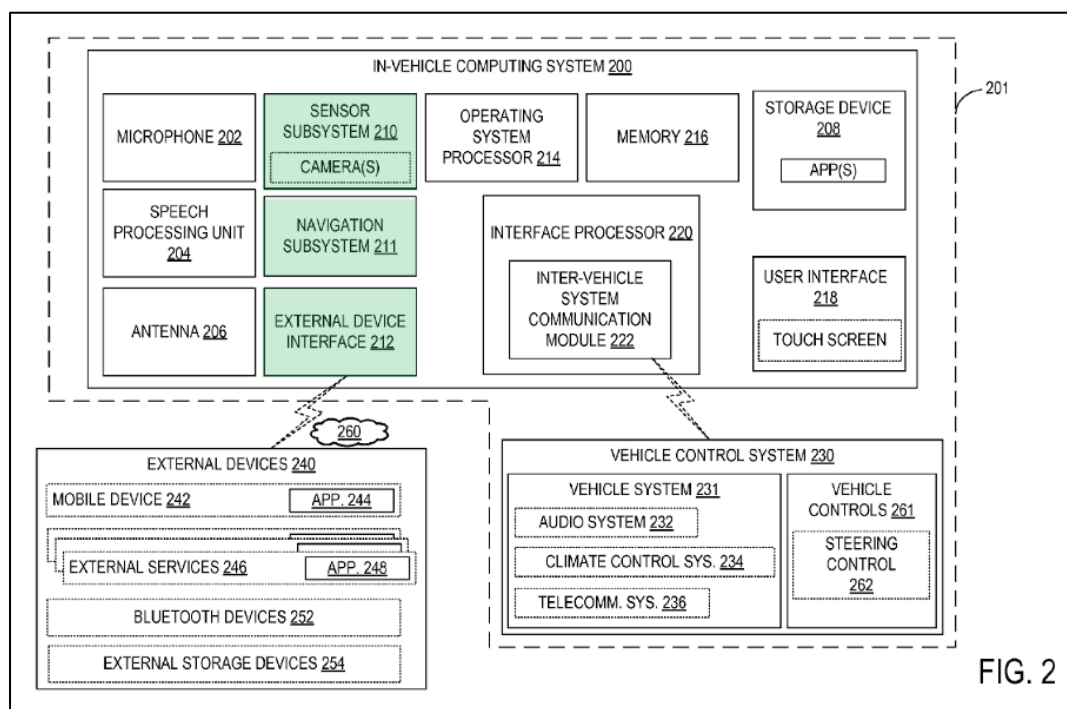
Hampiholi teaches storage device 208 stores instructions and/or code that, when executed by a processor, controls in-vehicle computing system 200 to perform one or more actions. *Hampiholi*, [0032]. These instructions would have included those taught by both *Hampiholi* and *Attard* in the combined vehicle, 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. *Dec.*,

71-73. Thus, a POSITA would have understood or found obvious that *Hampiholi-Attard* teaches a computer program product that controls a driving mode and comprises non-volatile memory and a processor for executing programming instructions. *Id.*

2. Claim 1(a)

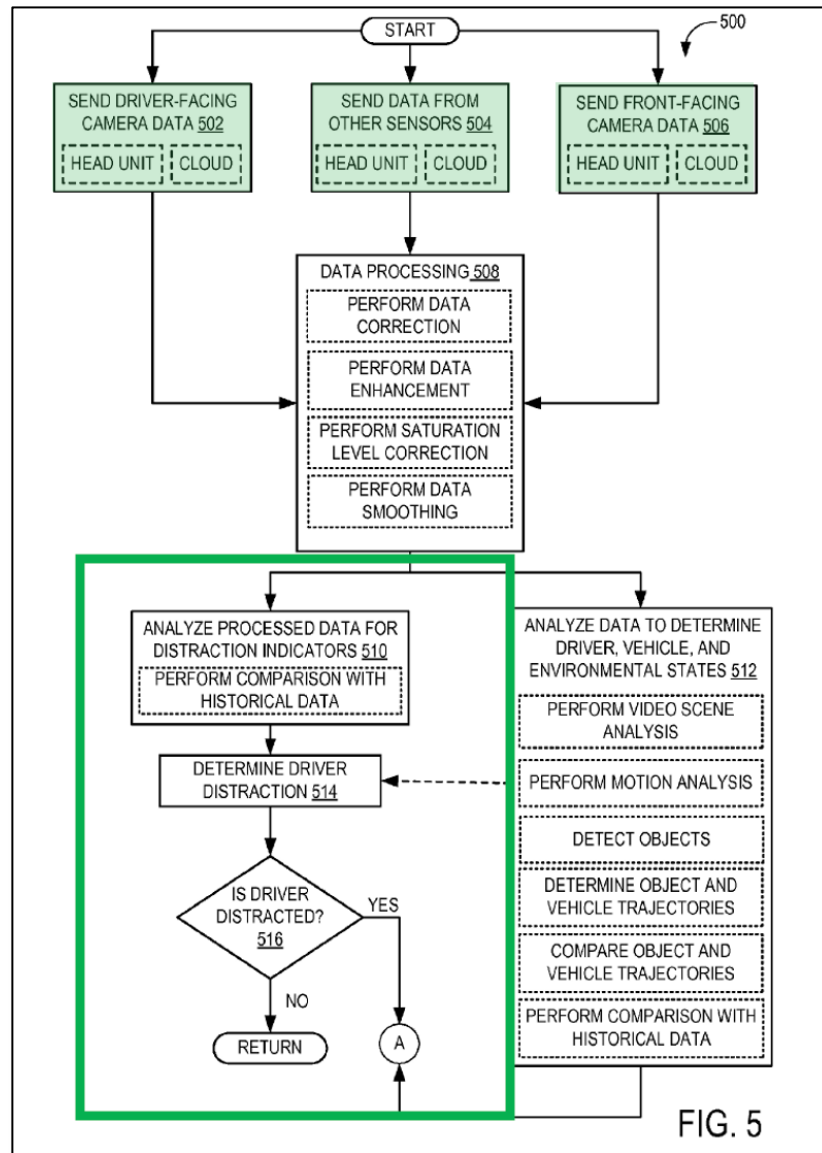
a) *Hampiholi's* System of Sensors

Hampiholi teaches receiving inputs from a plurality of sensors in sensor subsystem 210, external device interface 212, and navigation subsystem 211, including signals regarding gas pedal and brake inputs, temperatures, vehicle speed (*speedometer*), interior and exterior cameras (*camera*), and the vehicle's location (*GPS sensor*).



Hampiholi, Fig. 2⁷, [0031], [0034], [0046]; *Dec.*, 74. These sensors are collectively mapped as the *system of sensors*.

As illustrated in Fig. 5, *Hampiholi* teaches sending sensor readings from this *system of sensors* to determine the driver's distraction level (quantified as severity rank R, the mapped *competence level of the human driver* (HDCL)).



⁷ All annotations and emphases are added by Petitioner unless specified otherwise.

Hampiholi, FIG. 5; *Dec.*, 75. Sensor readings used to determine *Hampiholi*'s severity rank R include driver's eyelid position ([0062]) and speed and/or location of the vehicle ([0057]). *See*, V.A, 1(c).

b) *McNew's Steering Wheel Sensor*

McNew teaches monitoring a driver's behavior and level of attention and monitoring input from a *steering mechanism sensor*. *McNew*, 4:6-29 ("steering wheel grip sensor"), 3:26-52, 5:4-15. A POSITA would have found it obvious and been motivated to modify the *Hampiholi-Attard* SDV with *McNew's* steering wheel grip sensor, improving *Hampiholi-Attard's* fault handling system to make decisions based on additional information, such as the current position of the driver's hands. *Dec.*, 76-77. 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* safety goal. *Hampiholi*, [0002]; *Dec.*, 76-77.

This modification combines prior art elements according to known methods to yield predictable results: combining a steering wheel grip sensor with *Hampiholi's* driver distraction system's sensors predictably yields *Hampiholi's* severity rank R further being based on the driver's interaction with the steering wheel. *Dec.*, 78. This 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*. *Dec.*, 78.

A POSITA would have had a reasonable expectation of success (REOS) because monitoring driver states 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. *Dec.*, 79.

3. *Claim 1(b)*

Hampiholi teaches determining *a competence level of a human driver* via severity rank R, which is based on *the sensor readings*. *See*, 1(a). Driver distractions include not looking at the road and being sleepy/tired. *Hampiholi*, [0001]-[0004], [0050].

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 while the vehicle is in an otherwise safe environment; and a high-level R includes any driver distraction while collision risk is high. *Hampiholi*, [0057]; *Dec.*, 81. Fig. 7 depicts exemplary severity ranks R corresponding to detected human behaviors and road/vehicle conditions.

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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; *Dec.*, 81-82.

Hampiholi's severity rank R teaches a competence level of the human driver. *Dec.*, 82-83. For example, a driver paying more attention is more competent at taking control of the vehicle if a transition to manual mode is required. *Dec.*, 83-84. A driver paying more attention allows for more possible corrective actions. *Dec.*, 83-84. 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. *Dec.*, 83-84.

4. **Claim 1(c)**

a) **'004 Patent's SDV competence level**

The '004 Patent characterizes SDV competence level as “a competence level of the SDV control processor in controlling the SDV while the SDV experiences the current operational anomaly.” *'004 Patent*, 1:39-46, 10:7-13, 10:30-50.

b) ***Attard's* SDV competence level – Capital Φ**

Attard uses collected sensor data 115 to produce confidence assessments 118. *Attard* teaches vehicle confidence assessments generated in two coexisting forms:

(1) ϕ , a **vector**; and

(2) Φ , which may be “a **scalar** value, e.g., as a number [] in the range of 0 to 1.” *Attard*, 5:54-6:3; *Dec.*, 86. *Attard's* Φ is mapped as the claimed *SDV competence level* (CPCL) because it “indicates an overall value that the vehicle 101 can and/or should be operated autonomously.” *Attard*, 5:54-63, 1:44-50.

Though *Attard* does not provide detailed mathematical description regarding Φ , a POSITA would have known various approaches for its calculation. *Dec.*, 87. However, Petitioner notes claim 1 does not require any particular mathematical relationship between Φ and ϕ . Any mathematical approach for calculating *Attard's* Φ would have satisfied claim 1, including approaches in which Φ is not directly calculated using ϕ whatsoever. *Dec.*, 87.

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

A POSITA would have been motivated and found it obvious to modify *Hampiholi* to implement *Attard's* known technique of determining a CPCL using sensor readings to assist *Hampiholi-Attard's* SDV in driving in an autonomous mode, which is reliant upon sensors (e.g., cameras/GPS/LIDAR) to perform autonomous driving actions. *Dec.*, 88. For example, if a speed controller needed for SDV functionality is malfunctioning, *Attard's* known technique would have provided a corrective action in *Hampiholi-Attard*. *Dec.*, 88-89. *Hampiholi's* technique of monitoring user distraction (including through *McNew's* steering wheel sensor) would have coexisted with *Attard's* Φ technique for monitoring vehicle capabilities. *Dec.*, 89-91.

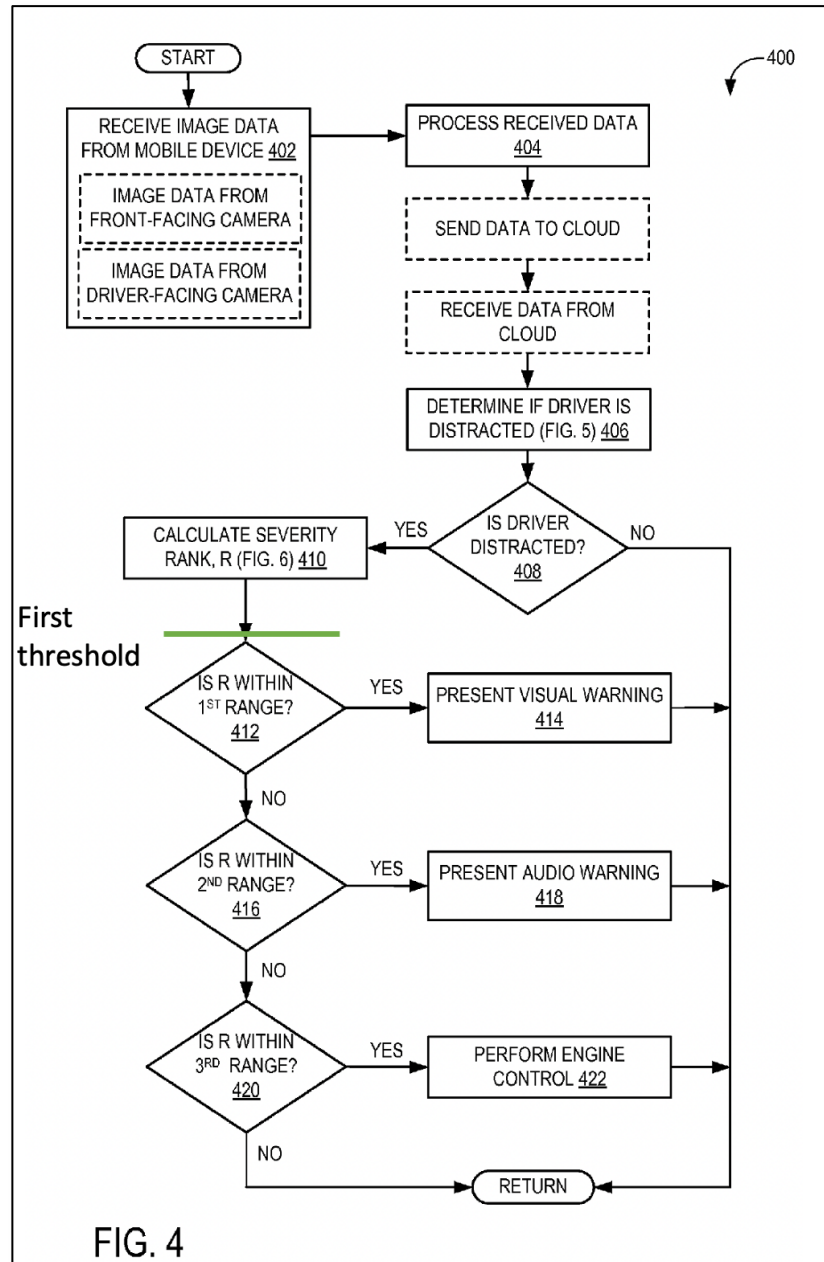
Incorporating *Attard's* technique of determining Φ (CPCL) would have resulted in a safer, more desirable SDV. *Dec.*, 88-92. This modification would have had a REOS because *Hampiholi* already teaches a vehicle and sensors, along with computer hardware and programming instructions necessary for performing automatic functions, as well as a system of sensors, to which any of *Attard's* sensors necessary for determining CPCL (if any) would have been added with a REOS. *Hampiholi*, Fig. 2, [0029], [0032]; *Dec.*, 92-93. Similarly, *Attard* teaches an autonomous vehicle, computer hardware, and programming instructions; thus, modifying *Hampiholi* would have required only straightforwardly modifying

programming instructions and/or providing hardware (if necessary) to compute Φ .

Dec., 93.

5. Claim 1(d)

Hampiholi teaches comparing severity rank R to several ranges for determining appropriate responses. *Hampiholi*, [0056]-[0057]. *Hampiholi* teaches that if R is outside the ranges, the vehicle foregoes corrective actions. *Id.* Thus, in the *Hampiholi-Attard* SDV, R is compared to *a first threshold* (e.g., lower bound of 1st range).

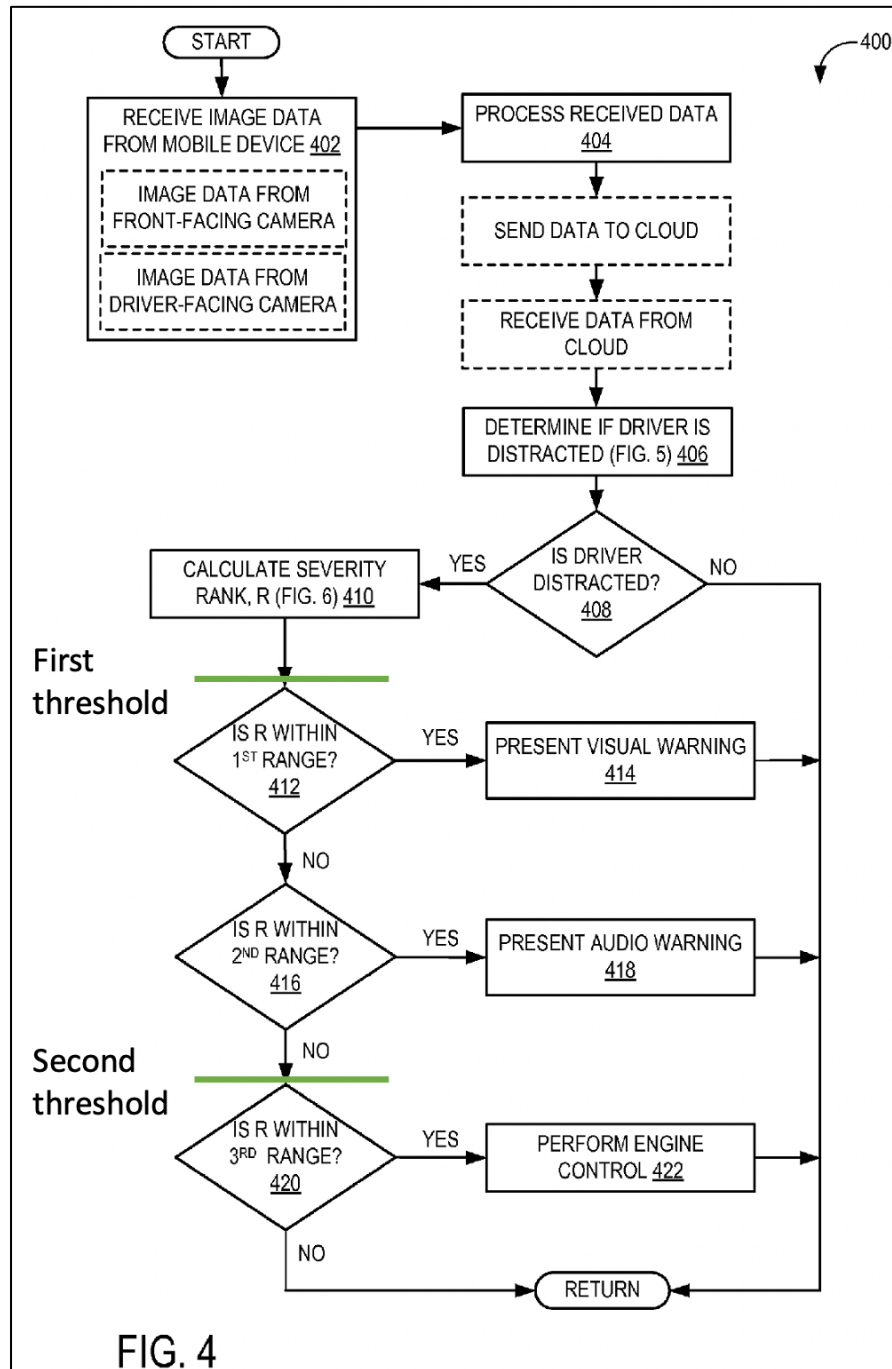


Hampiholi, FIG. 4. Dec., 94.

6. Claim 1(e)

Hampiholi teaches severity rank R is compared to a *second threshold* (e.g., block 420 – “Is R within 3rd range?”) that is different from the *first threshold* because

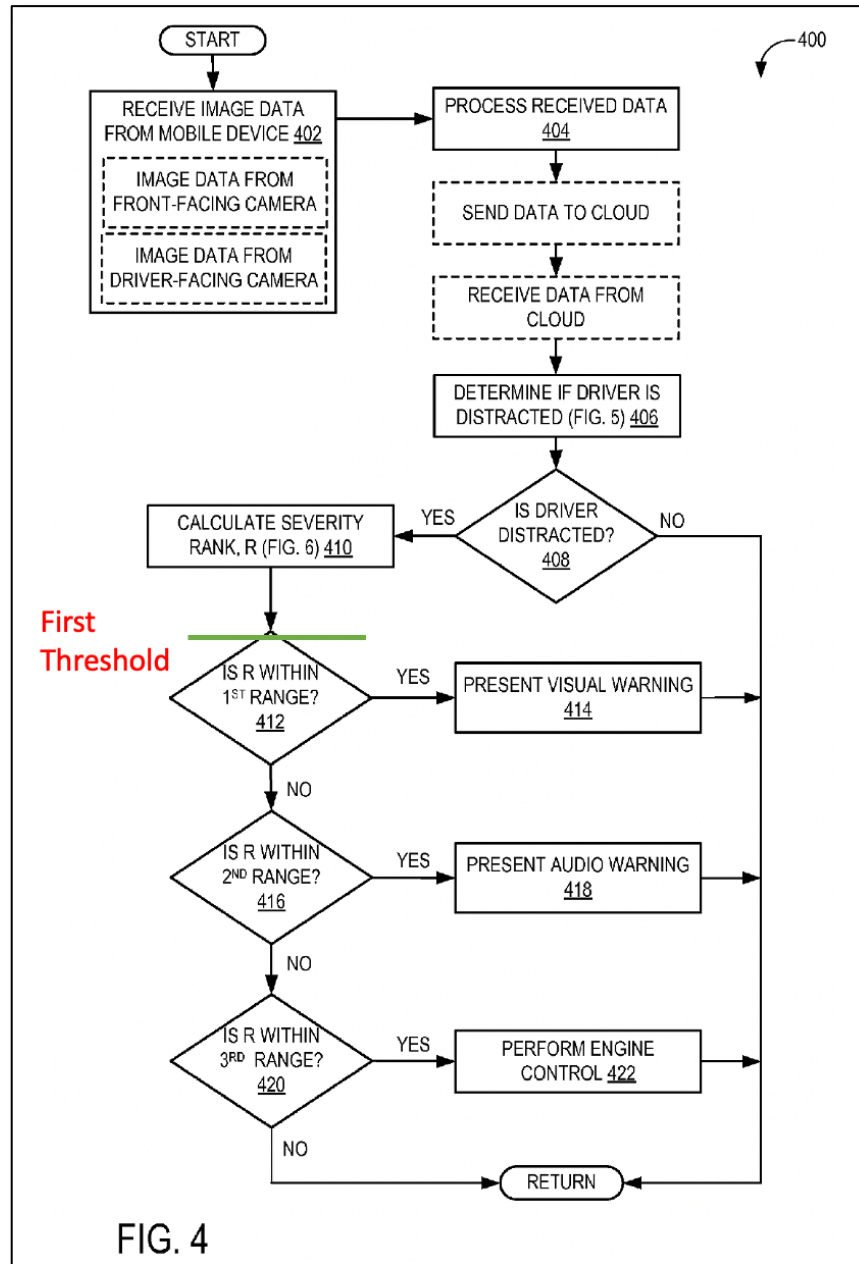
it is a higher-rank R, while the *first threshold* R is an R value below which no corrective action is taken. *Dec.*, 95.



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

7. Claim 1(f)

As discussed above, when R is outside *Hampiholi's* three ranges (412, 416, 420), it is determined no fault has occurred. A value of R “lower” than 1st range 412 corresponds to no fault because the R value “exceeds” both the first and second thresholds. Third range 420 includes values up to the maximum possible R values, thus R may be outside the three ranges only by being lower than range 412. In particular, when R is below the first threshold (i.e. high driver competence, corresponding to *exceeding* the '004 threshold) no corrective action is taken because there is no fault detected in the *Hampiholi-Attard* SDV, so the vehicle continues operating in autonomous mode. *See*, 1(d).



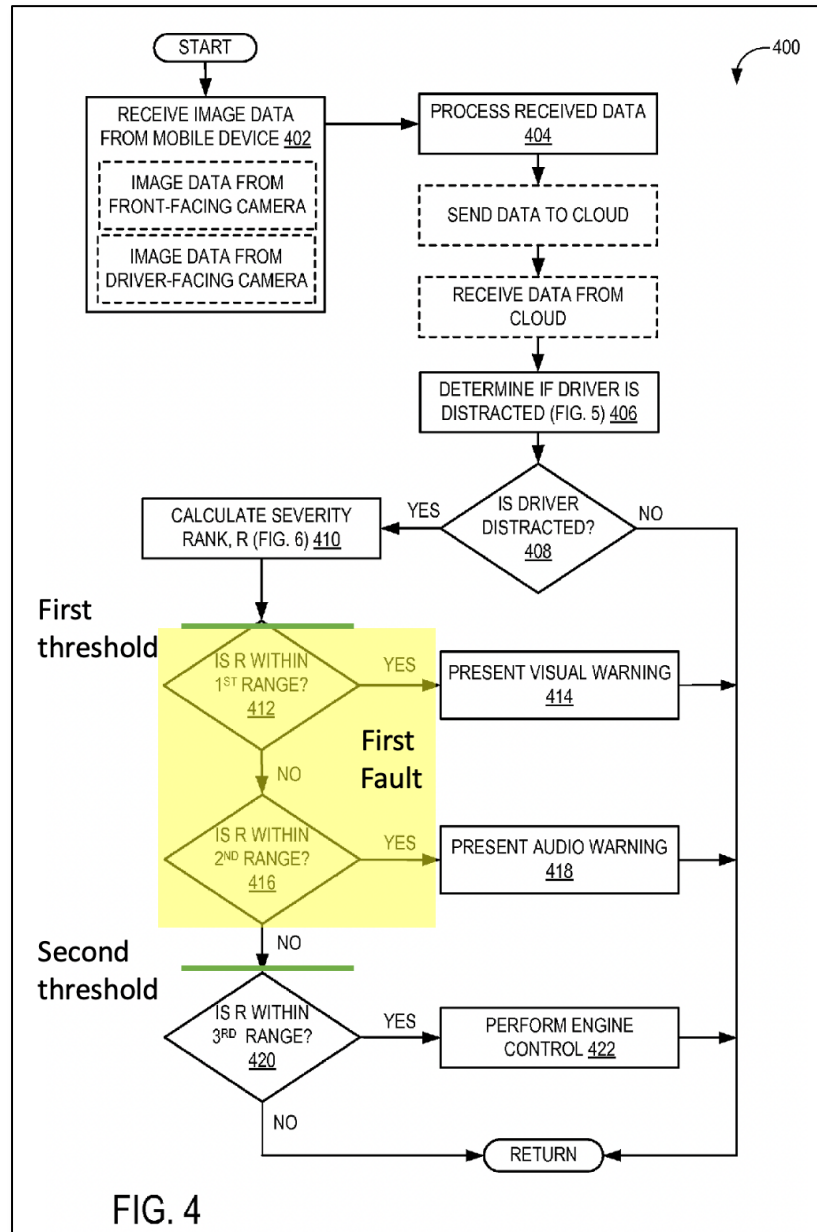
Hampiholi, FIG. 4, [0056]-[0057]. *Dec.*, 96-97.

Though *Hampiholi's* R values increase to indicate lower driver competence/attention, a POSITA would have understood that *Hampiholi* teaches surpassing, and thus “*exceeding*” the first and second thresholds, as claimed. *Dec.*, 96-100. Particularly, *Hampiholi* surpasses thresholds in the negative direction, i.e.

the quantity “exceeds” a threshold by dropping below the threshold, though the value of the parameter is becoming smaller. *Id.* A POSITA would also have had the skill and found it obvious to simply reprogram *Hampiholi’s* scale, perhaps multiplying by -1, such that the *threshold for danger* was exceeded in the positive direction. *Dec.*, 96-100.

8. Claim 1(g)

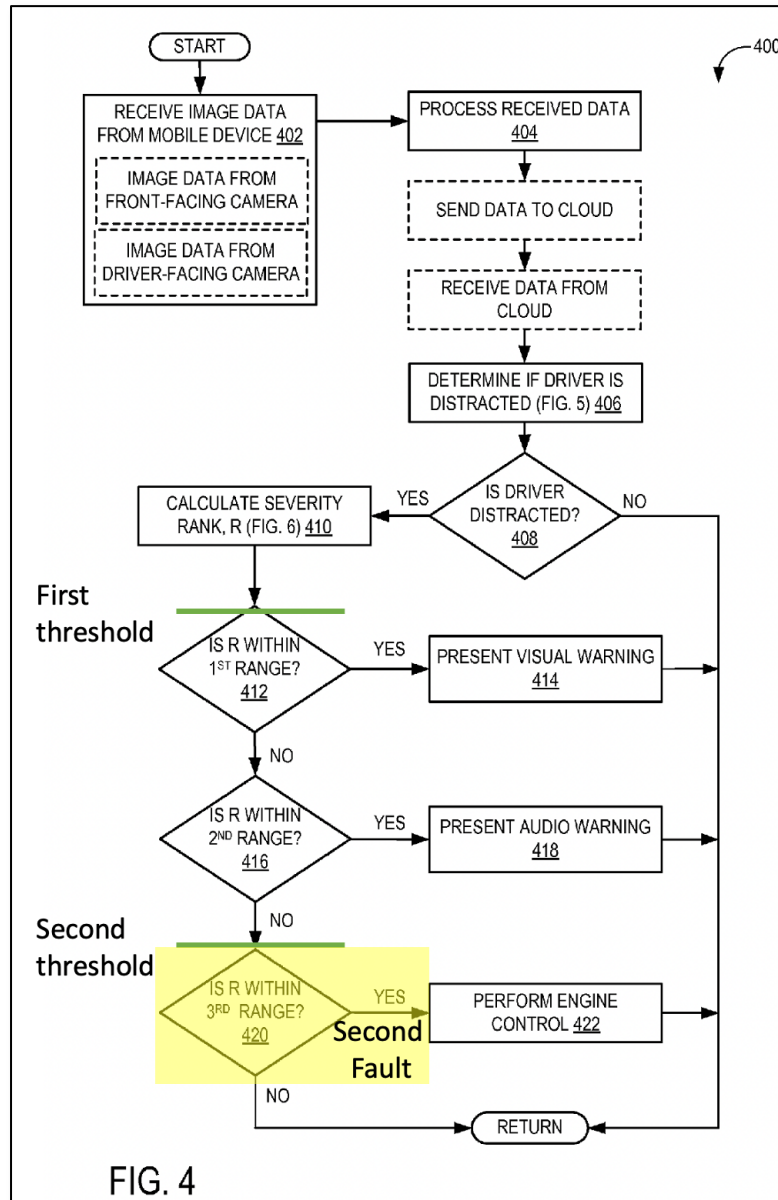
When R is below the *first threshold* (i.e., exceeds the first threshold), and *exceeds the second threshold* (i.e., less severe than the *second threshold*, i.e., between the two thresholds), then it is determined that *a first fault has occurred* and a corrective action is taken. *Dec.*, 101. The yellow range below indicates R values between the *first* and *second thresholds*. *Id.*



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

9. Claim 1(h)

When severity rank R is below the first and second thresholds (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). *Dec.*, 102.



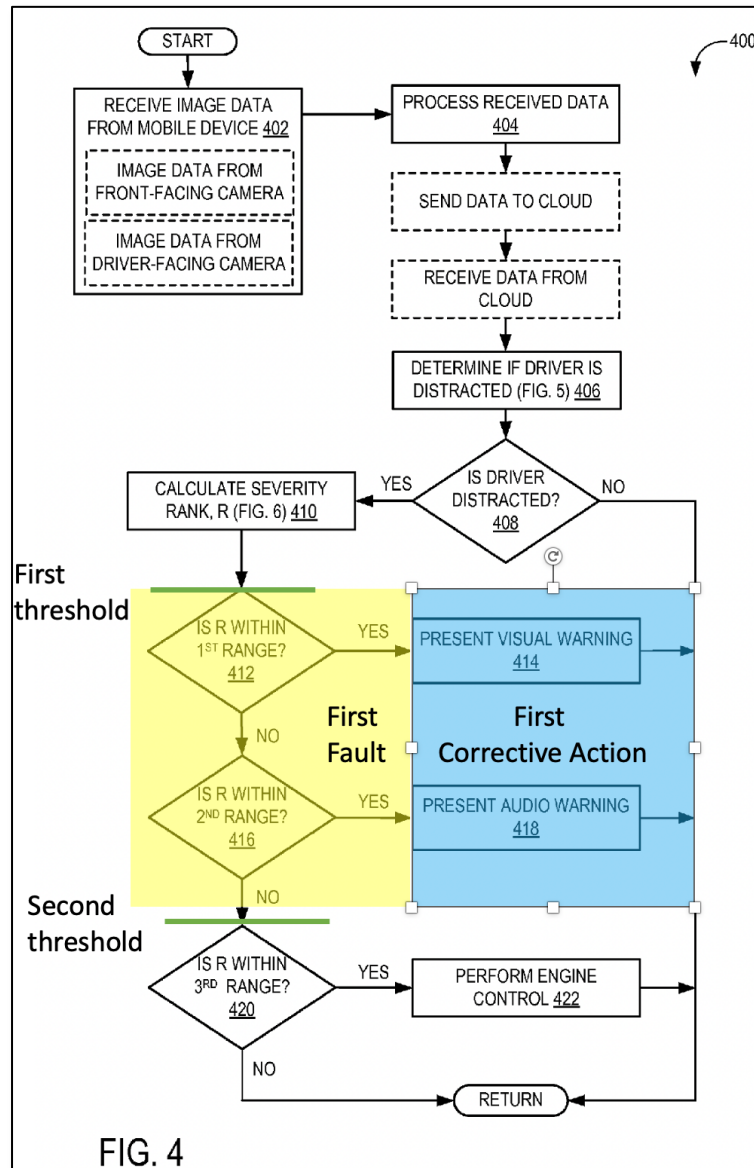
Hampiholi, Fig. 4, [0056]-[0057].

10. Claim 1(i)

a) Hampiholi-Attard's Corrective Actions

Hampiholi-Attard teaches faults based on R's value in relation to various thresholds. See, 1(d)-(h). Further, *Hampiholi* teaches taking corrective actions based on faults. See, 1(g)-1(h) citing *Hampiholi*, Fig. 4, [0056]-[0057]. Specifically,

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].

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. *Attard* further teaches that alerts can be audio,

“alternatively or additionally” a graphical interface may be used. *Attard*, 2:59-66.

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*.

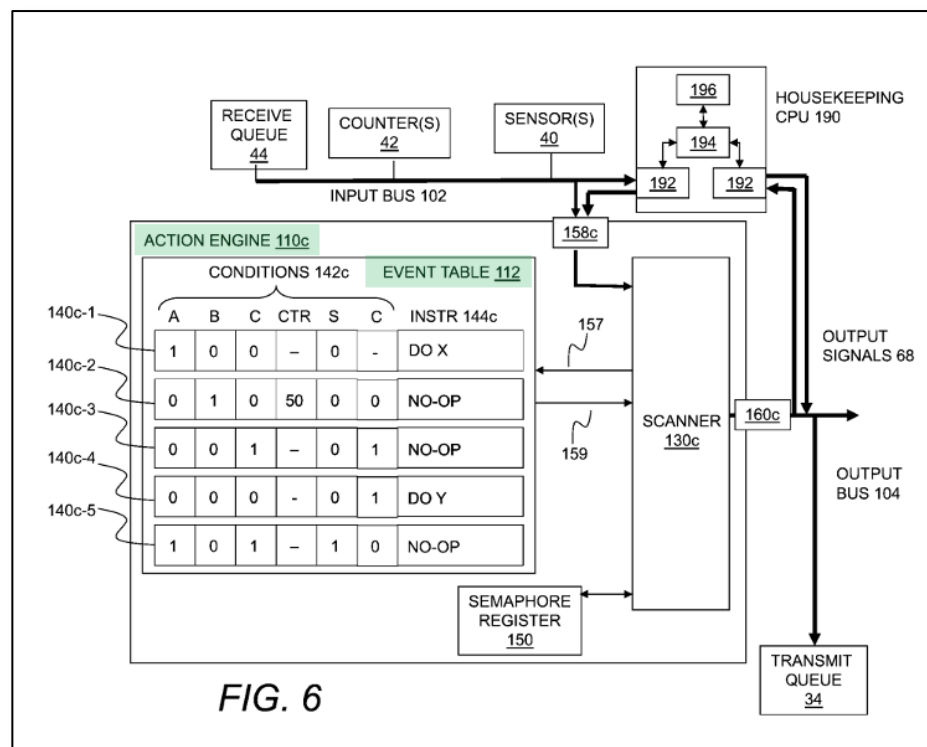
Dec., 103-105.

b) Motivation to Combine *Hampiholi-Attard*

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. *Dec.*, 106-107. A driver would have quickly understood warning icons. Further, icons conserve space on the display screen relative to purely-textual warnings, motivating the combination to a POSITA. *Id.* 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. *Id.* Displaying icons (e.g., check engine) was also well known. *Id.* 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*. *Id.*

c) *Frazer* Teaches a Fault-Remediation Table

Frazer teaches action engine 110c including event table 112 for use with autonomous vehicles. *Frazer*, 21:20-32. Event table 112 includes registers (rows 140c-1, 140c-2, etc.) containing sets of conditions 142c and instructions/actions 144c taken when conditions are met. *Frazer*, 21:20-22:22. *Frazer* teaches sensors monitoring conditions of a “dynamic environment.” *Frazer*, 21:52-56. If input signals match a condition 142c in register 140c, corresponding action(s) 144c in register 140c are executed. *Frazer*, 22:6-22.



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

A POSITA would have recognized *Frazer*'s event table 112 mirrors the '004 Patent's description of a fault-remediation table. *See*, '004 Patent, 8:27-44 compared

with *Frazer*, 21:19-43, FIG. 6. *Dec.*, 108-109. Specifically, *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 action to be taken when the conditions are manifested ("DO X"); *Dec.*, 108-109.

ACTION ENGINE 110c							
CONDITIONS 142c						EVENT TABLE 112	
	A	B	C	CTR	S	C	INSTR 144c
140c-1	1	0	0	-	0	-	DO X
140c-2	0	1	0	50	0	0	NO-OP
140c-3	0	0	1	-	0	1	NO-OP
140c-4	0	0	0	-	0	1	DO Y
140c-5	1	0	1	-	1	0	NO-OP

Frazer, FIG. 6 (excerpt).

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*. *Dec.*, 108-110.

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

A POSITA would have found it obvious and been motivated to modify the *Hampiholi-Attard* SDV's fault handling (including determining a corrective action)

with *Frazer's* teachings of organizing faults, conditions, and action(s) to take for each fault in event table 112 (*fault-remediation table*), which would have met Claim 1(i). *Dec.*, 111-117. 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. *Dec.*, 111. A POSITA would have recognized formatting data into a table was well-known to efficiently organize data for retrieval, reference, and potential modification. *Dec.*, 111-112. A POSITA would have appreciated the if/then type of fault remediation data already present in the *Hampiholi-Attard* SDV would have been 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. *Dec.*, 112. 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...” *Frazer*, 23:64-67; *Dec.*, 113.

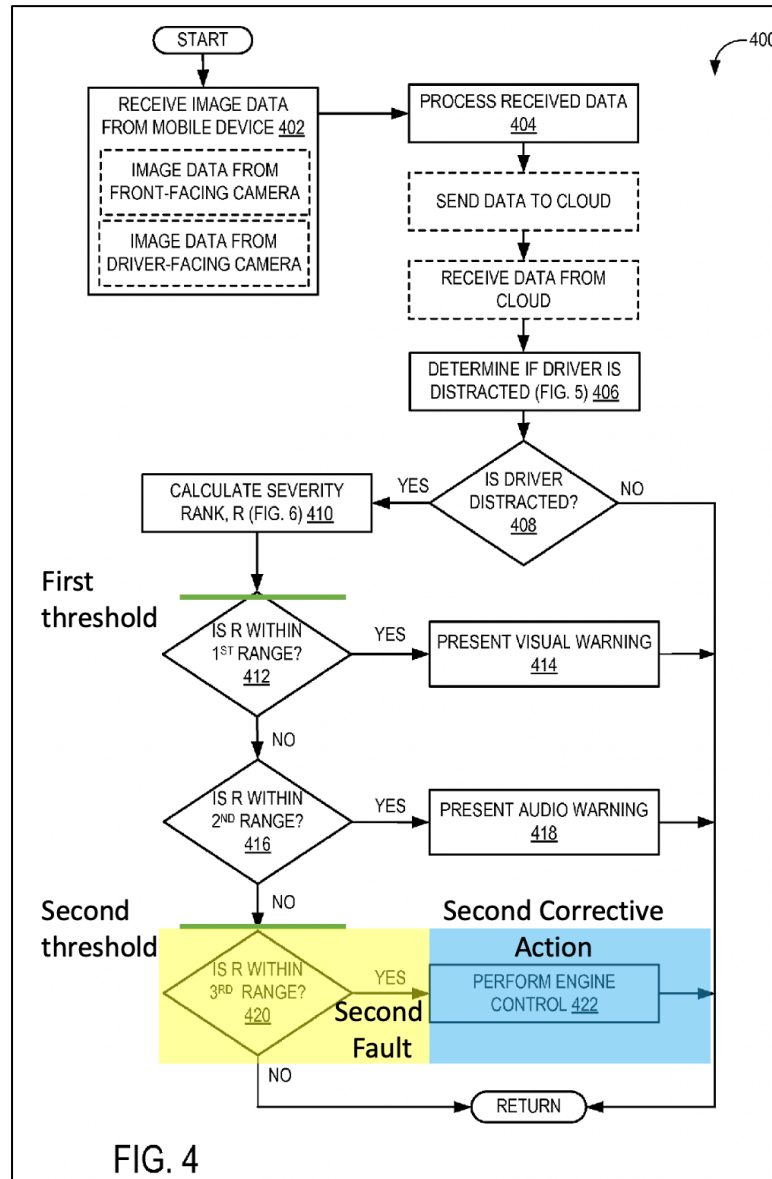
Based on *Hampiholi's* teachings that faults have associated actions (*see, e.g., Hampiholi*, [0056]-[0057]), a POSITA would have looked to references that describe specific ways to associate faults with actions and to store such information in computer memory. *Dec.*, 114. This known technique would have improved

Hampiholi-Attard's SDV (including determining a corrective action in response to a fault) in the same way as *Frazer's* autonomous/semi-autonomous vehicle. *Dec.*, 111-114.

Modifying the *Hampiholi-Attard* SDV per *Frazer* would have had a REOS. *Dec.*, 111-117. *Hampiholi*, *Attard*, and *Frazer* teach implementing programs and functions using programming instructions executed by a processor. *Hampiholi*, [0032], *Attard*, 15:12-46; *Frazer*, 21:20-50. *Dec.*, 115-117. Modifying the *Hampiholi-Attard* SDV would have merely required straightforward changes to programming instructions. *Dec.*, 115-117. A POSITA would have understood the *Hampiholi-Attard* SDV already has the necessary computer hardware. *Dec.*, 115-117.

11. Claim 1(j)

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



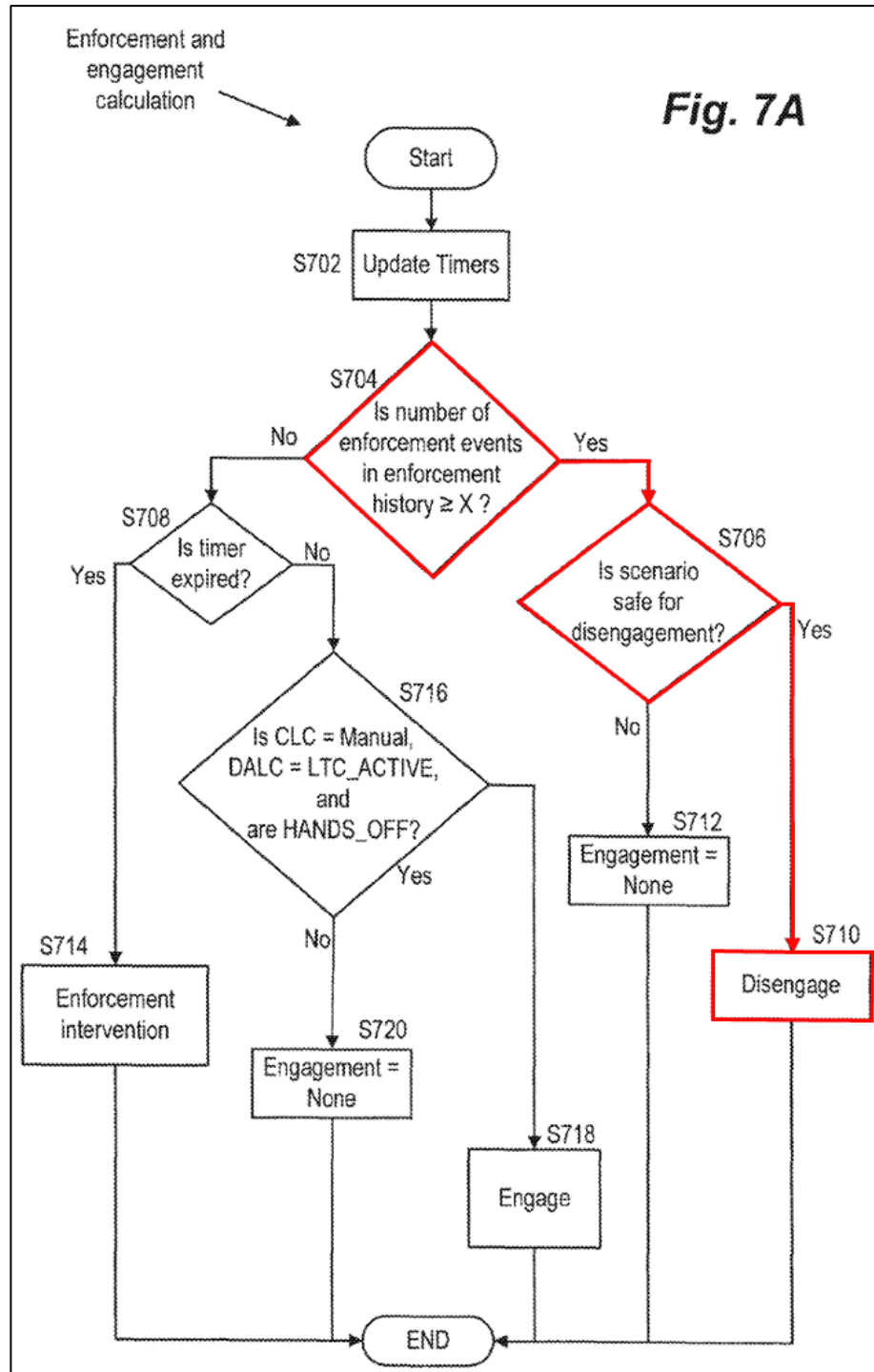
Hampiholi, Fig. 4, [0056]-[0057]; *See*, 1(h). *Hampiholi* teaches engine control operations “include automatically controlling the vehicle speed or braking...” teaching *decreasing a speed of the SDV*. *Hampiholi*, [0057].

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

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.

If a driver continues ignoring warnings, *McNew* teaches disengaging the semi-autonomous⁸ driving system if the current driving scenario is "safe enough." *McNew*, 20:7-31, 4:3-5, 8:41-44; *Dec.*, 119-120 (discussing steps S704, S706, 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:

⁸ *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. *Dec.*, 120. "Semi-autonomous" is used herein.



McNew, Fig. 7A; Dec., 119-120.

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

General considerations for combining *McNew* are addressed above. *See*, 1(a).

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*. *Dec.*, 121-125. 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. *Dec.*, 121-125. 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. *Dec.*, 121-125. 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 in a self-driving context. *Dec.*, 121-125.

A POSITA would have understood that modifying the *Hampiholi-Attard* SDV to include transferring driver controls to manual control would have had a REOS.

Dec., 121-125. This modification would have required only straightforward changes to programming instructions. *Dec.*, 125. Indeed, *McNew* teaches implementing its system in computer program instructions, and *Hampiholi-Attard's* SDV includes native manual control. *Dec.*, 125.

12. Claim 1(k)

If no fault is detected in the *Hampiholi-Attard* SDV, it operates autonomously per *Attard*. *See*, 1(d).

Specifically, *Attard's* SDV operates “steering, braking, and speed” autonomously via autonomous driving module 106 in computer 105. *Attard*, 9:63–10:12, 14:13-48. A POSITA would have understood or at least found obvious that controlling vehicle “steering” teaches controlling “steering mechanism;” controlling vehicle “braking” teaches controlling “braking system;” and controlling vehicle “speed” teaches controlling “engine throttle.” *Dec.*, 127-129.

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 as recited in 1(k). *Dec.*, 128-129.

a) Motivation to Combine

A POSITA would have been motivated to modify *Hampiholi* per *Attard's* teachings regarding autonomously controlling the *driver controls* in the *Hampiholi-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. *Dec.*, 130-132. *See*, Section V.A (Claim 1 introduction).

13. Claim 1(l)

Hampiholi-Attard-McNew-Frazer teaches this limitation. *See*, 1(g), 1(i).

14. Claim 1(m)

Hampiholi-Attard-McNew-Frazer teaches this limitation. *See*, 1(h), 1(j).

VI. GROUND 2: CLAIMS 2-5 ARE OBVIOUS OVER HAMPIHOLI, ATTARD, MCNEW, FRAZER, DERUYCK, GUNDERSON, AN, KANG, AND SCHUNDER

A. Claim 2

1. Claim 2(a)

a) '004 Patent's Weighted Voting

The '004 Patent describes weighted voting with inputs, where an “input’s weight (w) is the number of ‘votes’ associated with the input.” *'004 Patent*, 8:58-9:1.⁹

b) *Hampiholi's Inputs*

Hampiholi teaches sensors inputs, i.e., *a first plurality of inputs* for determining R (HDCL). *See*, 1(a)-(b); *Dec.*, 136-137.

c) *DeRuyck's Inputs and Weights*

Like *Hampiholi*, *DeRuyck* teaches *determining a competence level of a human driver* by analyzing driver behavior. *DeRuyck*, 3:50-52. *DeRuyck* further teaches a *weighted voting system* to determine driver behavior that uses *a plurality of weights* to weigh data sources, including driver movement data 1002. *DeRuyck*, 13:21-41, 12:2-8, 14:9-31, 17:50-18:21, 18:58-19:2. The data sources are weighted, summed, and then passed to driver behavior detector 208:

⁹ While the '004 Patent also describes a quota is sometimes utilized in a weighted voting system, “quota” is not recited in Claim 2. *'004 Patent*, 8:58-9:1, Claim 2.

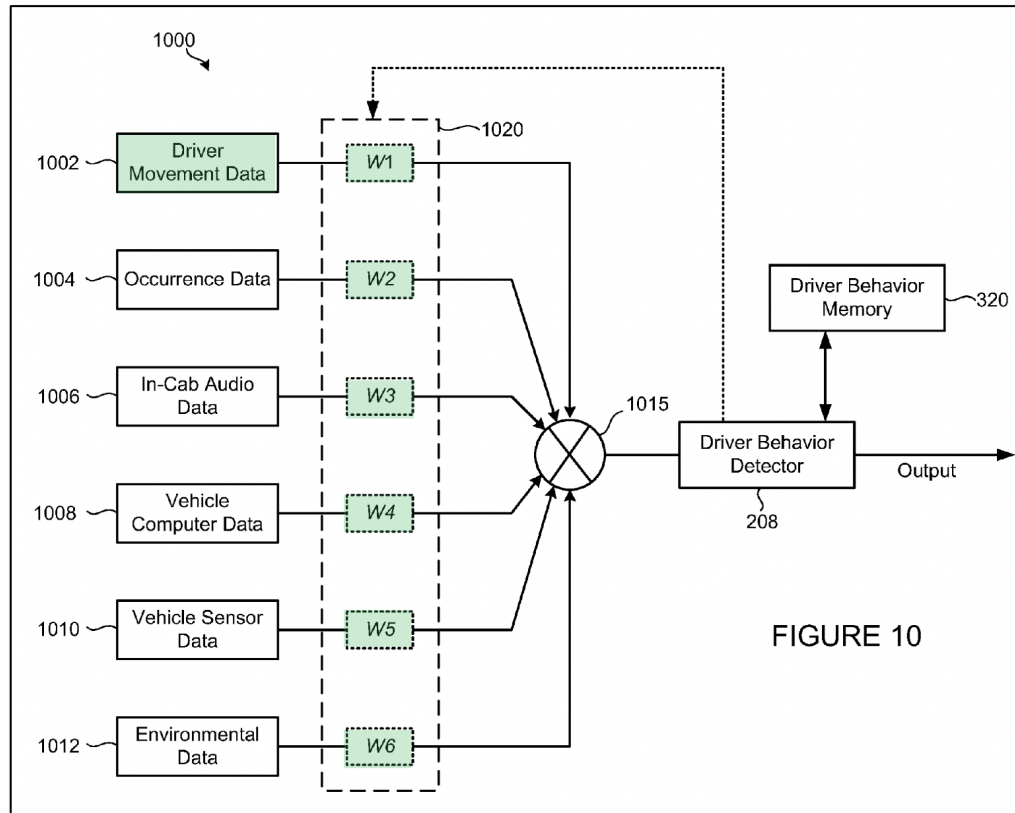


FIGURE 10

DeRuyck, Fig. 10; *Dec.*, 138-139.

d) Motivation to Combine *DeRuyck*

A POSITA would have been motivated and found it obvious to modify the *Hampiholi-Attard* SDV per *DeRuyck*'s teachings of *determining a competence level of a human driver using a weighted voting system including a plurality of weights* to weight *Hampiholi's inputs* to enable a more nuanced treatment of the driver's behavior to determine R. *Dec.*, 140-142. Modifying the *Hampiholi-Attard* SDV per *DeRuyck* would have advantageously provided additional, more flexible functionality for determining R beyond *Hampiholi's* teachings focusing on eye and head position (although *DeRuyck* also teaches such). *Dec.*, 140-142. Indeed,

modifying the *Hampiholi-Attard SDV* in this way would have enhanced *Hampiholi's* native driver distraction monitoring to include driver movements (e.g., cell phone use, watching videos or reading) per *DeRuyck. Dec.*, 140-142. This would have been use of a known technique of determining HDCL using weighted voting and readings from cameras that would have improved the *Hampiholi-Attard SDV* in the same way as *DeRuyck's* vehicle, i.e., by improving driver safety and awareness, as *DeRuyck* teaches. *DeRuyck*, 3:50-63, 8:46-61; *Dec.*, 140-142. Further, this modification would have combined prior art elements according to known methods per *DeRuyck* to yield predictable results in the modified *Hampiholi-Attard SDV. Dec.*, 140-142.

A POSITA would have had a REOS when modifying the *Hampiholi-Attard SDV* per *DeRuyck* because *Hampiholi* already teaches identifying various driver characteristics using sensors such that modifying the *Hampiholi-Attard SDV* would have required straightforward changes to programming instructions. *Dec.*, 140-142.

2. Claim 2(b)

See, 1(a).

3. Claim 2(c)

DeRuyck teaches *multiplying inputs by weights. See*, 2(a). *Gunderson* teaches *weights based on active learning data that includes information about a cohort of human drivers of other SDVs.*

a) *Gunderson's Active Learning Data*

Gunderson teaches vehicle 10 and event capture device 20 (e.g., camera) for 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].

Insight module 270 includes individual module 400 and group module 410. *Gunderson*, [0060], Fig. 10. 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*, [0060]. 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.*

A POSITA would have understood or found obvious that weighting driver behaviors in this way teaches *weights based on...information about a first cohort of human drivers of other SDVs*. Dec., 145-148.

b) Motivation to Combine *Gunderson*

A POSITA would have been motivated and found it obvious to modify the *Hampiholi-Attard* SDV per *Gunderson* to base a *first plurality of weights on active learning data* that includes information about *a cohort of human drivers of other SDVs*. Dec., 149-150. This modification would have improved the *Hampiholi-Attard* SDV to advantageously use more accurate weights when computing R. Dec., 149-150. For example, *Gunderson* teaches negative tendencies may be relatively uncommon among drivers, and the *weights* may be set to account for such behaviors. Dec., 149-150. Thus, driver behaviors trends among a group of drivers can be identified to accurately weight such trends. Dec., 149-150.

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], [0058]; Dec., 149-150. Thus, modifying the *Hampiholi-Attard* SDV per *Gunderson* would have required only straightforward changes to programming instructions well-within the skillset of POSITA. Dec., 149-150.

4. *Claim 2(d)*

a) *Attard's Weighting Teachings*

Attard teaches determining a CPCL Φ using collected data 115 from sensors 110, i.e., *a second plurality of inputs*. See, 1(c). *Attard* also teaches weighting sensor determinations when computing Φ , i.e., *a weighted voting system*. Dec., 151. To the extent it is argued *Attard* does not teach a *weighted voting system*, *An* teaches such.

b) *An's Teachings*

An teaches “cooperative autonomous driving...between a vehicle and a driver.” *An*, 1:16-23. An “autonomous driving state risk index” is computed that indicates “whether basic autonomous driving is possible in the driving environment.” *An*, 5:64-6:2.

$$\text{autonomous driving state risk index} = W1 * \text{recognition error} + W2 * \text{determination error} + W3 * \text{control error} + W4 * \text{map data error}$$

(7)

An, 6:4-8, Eq. 7. The index “is calculated by multiplying weights W1, W2, W3, W4” by the respective errors. *An*, 6:8-24. Each of *An*'s errors is an input because each is used (*input*) to the risk index equation to determine the index value. Dec., 152-153. In the *Hampiholi-Attard* SDV, *inputs* include *Attard's* camera sensor readings, which are weighted per *An*. Because *An* teaches multiplying inputs by weights, *An's* index teaches a *weighted voting system*. Dec., 152-153.

c) Motivation to Combine

A POSITA would have been motivated and found obvious to modify *Attard's* Φ computation, per *An's* teachings of weighting inputs to determine whether to drive autonomously, thereby yielding the predictable result of Φ being computed by weighting the various inputs (sensor determinations). *Dec.*, 154-155. *Attard* provides an express teaching, suggestion, and motivation for combining with *An* by teaching “weighting various determinations” for computing Φ . *Attard*, 6:28-35; *Dec.*, 154-155. Using the known technique of weighted voting would have improved *Attard's* similar system in the same way as *An's* by providing greater accuracy in computing Φ . *Dec.*, 154-155.

A POSITA would have had a REOS at least because (a) weighting inputs was well-known prior to the '004 Patent, and (b) modifying *Hampiholi-Attard* would have required only straightforward programming modifications to multiply *Attard's* determinations by weights, per *An*. *Dec.*, 154-155.

5. Claim 2(e)

See, 2(d). *Attard's second plurality of inputs* comprises collected data 115 (*sensor readings*).

6. Claim 2(f)

The *first plurality of inputs* is from *Hampiholi's* driver-related sensors, and the *second plurality of inputs* is from *Attard's* SDV sensors such that the *second inputs* include a *sensor reading* not in the *first inputs*. See, 2(a), 2(e); Dec., 157.

7. Claim 2(g)

See, 2(f).

8. Claim 2(h)

An's weights W1-W4 are not expressly taught as *based on active learning data...compris[ing] condition data...wherein the condition data shares one or more traits with a current condition of a roadway on which the SDV is currently traveling*. *Kang* teaches such.

a) Kang's Weights

Kang teaches vehicle 1 includes a road and weather information collecting unit 135 that obtains weather information (*weather condition data*) from an external source based on the vehicle's GPS information or using onboard sensors. *Kang*, 9:32-49.

Kang teaches a plurality of weights based on the type of weather condition, such as weighting clear weather 1, rain 2, and snow 3. *Kang*, 5:26-29, 13:3-18.

FIG. 7C

ENVIRONMENT INFORMATION (2)			
ROAD TYPE	WEIGHT	WEATHER	WEIGHT
LOCAL ROAD	1	CLEAR	1
UNPAVED ROAD	2	RAIN	2
GENERAL ROAD	3	SNOW	3
HIGHWAY	4		

Kang, Fig. 7C; *Dec.*, 159-161. Thus, *Kang* teaches *weights based on active learning data* that is *weather condition data*, i.e., the clear/rain/snow weights. *Id.*

b) Motivation to Combine

A POSITA would have been motivated and found obvious to further modify the *Hampiholi-Attard* SDV per *Kang* to provide *a plurality of weights based on...weather condition data* to weight inputs (e.g., collected data 115) to generate CPCL Φ . *Dec.*, 162-167. This modification would have advantageously improved the Φ computation to account for the severity of weather conditions in driving autonomously, thereby improving vehicle safety and desirability. *Dec.*, 162-167. This modification would have given more weight to inputs that indicate faults that are more likely to impede autonomous driving functionality. *Id.* This modification would have been use of a known technique of using weights based on weather

conditions and would have improved the *Hampiholi-Attard* SDV similar to *Kang's* vehicle. *Id.* Combining these prior art elements (inputs and weights) according to known methods would have yielded the predictable result of a functional and advantageous weighted voting system. *Id.*

A POSITA would have had a REOS for modifying the *Hampiholi-Attard* SDV per *Kang* to utilize *weights based on...weather condition data* in a *weighted voting system*. *Dec.*, 162-167. As discussed above, *Hampiholi-Attard* already teaches weighting a plurality of determinations (*inputs*). *Attard*, 6:16-35. *Hampiholi-Attard* and *Kang* teaches implementing their methods using computer program instructions. *Hampiholi*, [0032]; *Attard*, 15:12-46; *Kang*, 6:10-21. A POSITA would have recognized that modifying *Hampiholi-Attard* per *Kang* would have required merely straightforward changes to programming instructions well-within the skillset of a POSITA. *Dec.*, 162-167.

c) *Schunder's* Weather Condition Data

Schunder teaches a vehicle receives weather condition data (*active learning data*) from a server, which receives weather condition data from other vehicles on the same roadway. *Schunder*, 5:31-38, 7:15-22. Thus, the combination would have utilized *weights* based on weather conditions, such as *Kang's* weather-based weights, and *Schunder's* weather condition data from other vehicles. *Dec.*, 168-171.

Further, *Schunder* teaches *the weather condition data shares one or more traits with the current weather condition of the roadway on which the SDV is currently traveling. Dec., 168-171. Namely, Schunder teaches prioritizing/weighting weather data sent to the requesting vehicle based on its location, including the roadway the requesting vehicle is traveling. Schunder, 9:38-54; Dec., 168-171. Because vehicles on the same roadway as the requesting vehicle send weather data “at a time in close proximity to a present time,” this weather data shares one or more traits with the current weather condition of the roadway. Dec., 168-171.*

d) Motivation to Combine

A POSITA would have been motivated and found obvious to modify the *Hampiholi-Attard* SDV per *Schunder* to utilize *active learning data* from other vehicles to receive more accurate weather reports for a vehicle traveling a roadway. *Dec., 172-175. The weather conditions experienced by a vehicle in one location may share one or more traits with another vehicle or cohort of vehicles (including other SDVs) along the same roadway. Id. Schunder teaches several advantages including more accurate weather data for weather reports because the weather data is gathered by many vehicles and informing other vehicles on the same roadway of future weather conditions on the road. Id.*

Modifying the *Hampiholi-Attard* SDV per *Schunder* to gather active learning data regarding weather conditions from other vehicles would have been use of *Schunder's* known technique to improve the *Hampiholi-Attard* SDV in the same way as *Schunder. Dec.*, 172-175. Indeed, modifying *Attard's* server 125 per *Schunder's* or simply substituting *Schunder's* server and its functionality for *Attard's* would have obtained predictable results of more accurate weather condition reporting. *Dec.*, 172-175.

A POSITA would have had a REOS when making this modification. Indeed, *Hampiholi-Attard* teaches receiving weather information and sensors to capture weather-related data. *Hampiholi*, [0043], [0063]; *Attard*, 4:42-45. The modification would have merely required straightforward changes to programming instructions of the vehicle and potentially adding sensors to capture additional weather-related data. *Dec.*, 172-175.

B. Claim 3

1. Claim 3(a)

See, 1(k). *Attard*, 1:65-2:6 (“[M]aintaining a distance from other vehicles.”); *Dec.*, 176.

2. Claim 3(b)

DeRuyck teaches a plurality of weights W1-W6 1020, and *Gunderson* teaches weights based on active learning data. *See*, 2(a)-(c). *DeRuyck* teaches “values W of the weights 1020 can be initially set to a default value and refined over time based

on experience by the driver behavior detector 208.” *DeRuyck*, 13:21-41. A POSITA would have understood that *DeRuyck* would have stored weights in memory to persistently use weights over time and because *DeRuyck* teaches setting initial values and refining the values over time. *Dec.*, 177. Further, *DeRuyck* teaches implementing its system (including weights) using a computer system with memory for storage (e.g., storing programming instructions such as weights). *DeRuyck*, 27:3-28; *Dec.*, 177. Further, *Gunderson* teaches memory for storing weights. *Gunderson*, [0031]. Thus, in the *Hampiholi-Attard* SDV, the first plurality of weights would have been obtained by querying a database. *Dec.*, 177.

3. Claim 3(c)

For the same reasons discussed for 3(b), the modified *Hampiholi-Attard* SDV teaches this limitation. *See*, 3(b). A POSITA would have been motivated and found it obvious to use a well-known technique to organize data in memory (i.e., *database*) by storing and organizing *An*’s weights in memory, per *Gunderson*. *Dec.*, 178.

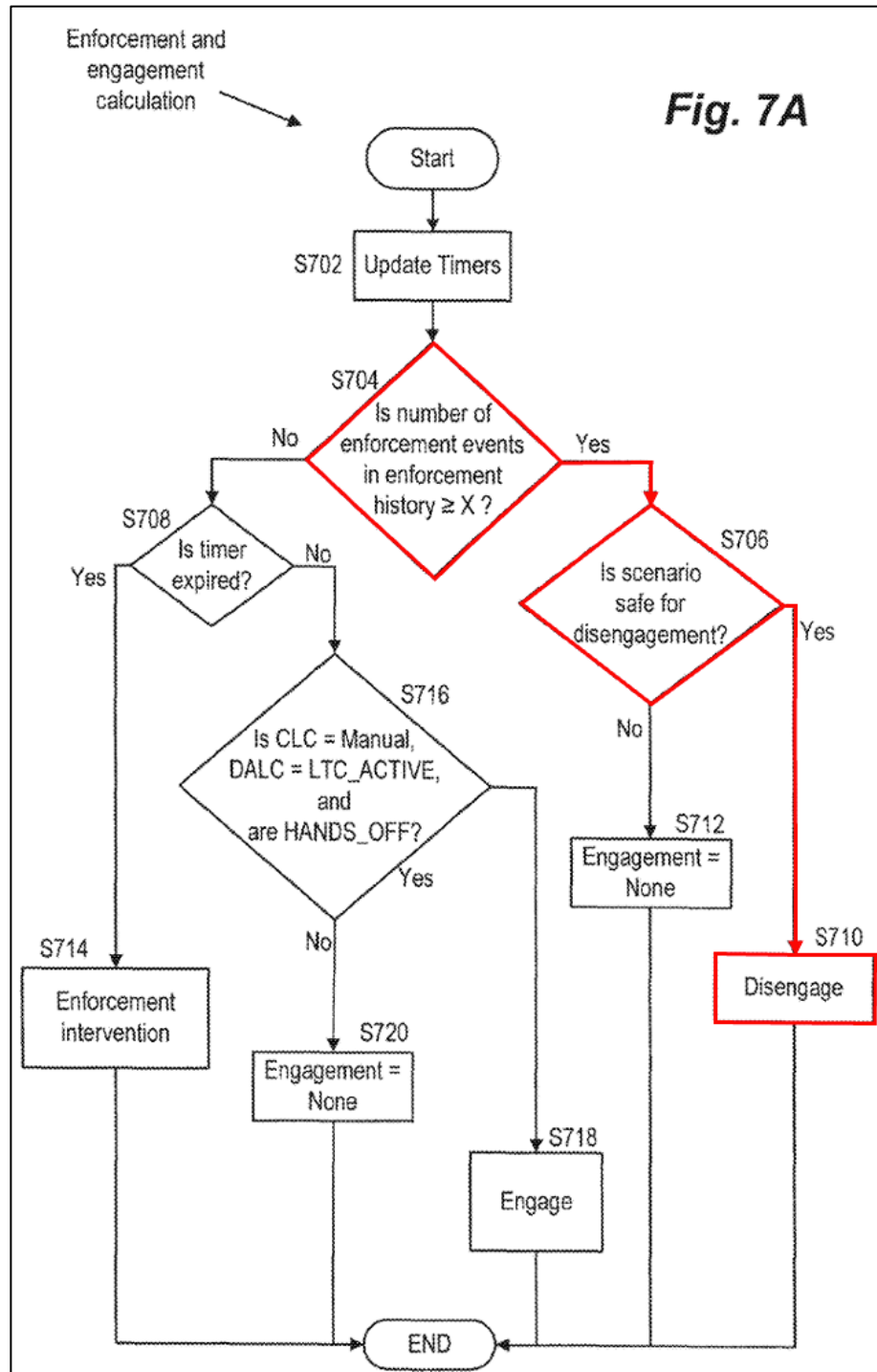
C. Claim 4

1. Claim 4(a)

a) McNew’s Teachings

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, a corrective action of shutting down semi-autonomous driving occurs. *McNew*, 19:57-20:25, 6:9-28.



McNew, FIG. 7A.

The enforcement event is a *first fault* because it is an event where the driver does not respond to a warning. *Dec.*, 179-181. Therefore, because *McNew* logs the number of enforcement events, *McNew* teaches *tracking a number of times the first fault has occurred*. *Dec.*, 179-181.

b) Motivation to Combine

A POSITA would have found it obvious and been motivated to modify the *Hampiholi-Attard* SDV further with *McNew*'s teachings of *tracking 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. *Dec.*, 182-183. 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. Per Mr. Wilson, it was well known that level 3 and below SDVs required driver supervision. *Dec.*, 182-183. Further motivations are provided with respect to 1(j).

There would have been a REOS because the modification merely would have required a straightforward software/programming change to track the number of times the HDCL drops below the first threshold. *Dec.*, 182-183. For example, *McNew* teaches such a simple modification, i.e., a “log of enforcement events...that can be stored in memory.” *McNew*, 19:62-65. It would have been 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. *Dec.*, 182-183.

2. Claim 4(b)

a) McNew's Teachings

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. *Dec.*, 184. Thus, the *Hampiholi-Attard* SDV modified by *McNew* teaches or renders obvious 4(b) because determining the driver is ignoring warnings includes logging the number of enforcement events (*number of times the first fault has occurred*). *Dec.*, 184.

b) Motivation To Combine

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. *Dec.*, 185-186.

A POSITA would have been motivated to modify *Hampiholi-Attard* in this manner at least because of the obvious safety benefit such a modification would provide. *Dec.*, 185-186. As discussed in the Claim 1 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*, 1; *Hampiholi*,

[0057]. While *Hampiholi* considers driver's historical information in computing R, *Hampiholi* does not track how the driver has responded to prior warnings. *Dec.*, 185-186. *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. *Dec.*, 185-186. A POSITA would have had a REOS for the modification as discussed in 4(a).

D. Claim 5

1. Claim 5(a)

a) *McNew's Teachings*

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 *first fault* that is an attention/steering warning. *See*, 4(a). Therefore, *McNew's* disclosure of a timer that tracks the response time to this warning teaches 5(a). *Dec.*, 187.

b) Motivation to Combine

See, 4(a). *Dec.*, 188.

2. Claim 5(b)

a) *McNew's Teachings*

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. *Dec.*, 189. Thus, the *Hampiholi-Attard* SDV modified by *McNew* teaches or renders obvious 5(b) because determining the driver is ignoring warnings includes tracking the length of time the driver has ignored the warning (*length of time the first fault has occurred*). *Dec.*, 189.

b) Motivation To Combine

See, 4(b), 5(a).

VII. GROUND 3: CLAIMS 6-7 ARE OBVIOUS OVER HAMPIHOLI, ATTARD, MCNEW, FRAZER, AND SAKO

As discussed regarding Claim 1, the *Hampiholi-Attard* SDV determines a CPCL, taking corrective actions when necessary. *See*, 1(c), 1(i). Claims 6 and 7 require taking the corrective action of transferring control to manual when the CPCL is below a threshold and the vehicle is not driving on a public highway. As mapped, *Attard* teaches taking corrective actions when its CPCL (Φ) falls below a threshold ($\Phi_{\min}$). 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.

A POSITA would have been motivated and found it obvious to modify the *Hampiholi-Attard* SDV to transfer from autonomous mode to manual mode when the vehicle exits a public highway, per *Sako*, teaching Claims 6 and 7. A POSITA

would have recognized the SDV would have most safely operated autonomously on a public highway, 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 if the SDV's CPCL was low. *Dec.*, 191-192. Such a modification is merely the combination of known prior art elements (*Attard*'s self-driving, Φ , and $\Phi_{\min}$ and *Sako*'s functionality) according to known methods to yield predictable results of an SDV transferring to manual mode when exiting a public highway. *Dec.*, 191-192. Further, because the hardware necessary (including GPS) was already present in *Hampiholi-Attard*, these modifications would have required only reprogramming of the *Hampiholi-Attard* software using skills available to a POSITA, leading to a REOS. *Id.*

A. Claim 6

1. Claim 6(a)

Sako teaches determining what roadway type an SDV is on using GPS readings. *Sako*, 34:62-35:21 (teaching detecting a public “highway” *first roadway type* vs “a general road” *second roadway type*); *Dec.*, 193. The *Hampiholi-Attard* SDV already includes GPS, processor, and memory. *See*, 1(a). A motivation to combine the *Hampiholi-Attard* SDV with *Sako* is provided above.

2. *Claim 6(b)*

Attard teaches corrective actions including a “warning...to take over steering” that is triggered when Φ is below $\Phi_{\min}$. *Attard*, 7:18-51, 10:18-52; *Dec.*, 194-195. *Attard* explains Φ accounts for “attributes of a surrounding environment.” *Attard*, 10:24-27.

A POSITA would have been motivated and found it obvious to include *Sako*’s determination of moving from highway to general road while in automatic mode as part of *Attard*’s “attributes of a surrounding environment” incorporated into Φ , teaching or rendering obvious 6(b). *Dec.*, 194-195; *Sako*, 34:62-35:21; *Attard*, 10:18-52. A POSITA would have recognized the SDV’s ability to operate autonomously (Φ) would have differed based on the roadway type, with “general roads” being more difficult for the SDV to traverse autonomously than “public highways.” *Dec.*, 194-195. Thus, a POSITA would have found obvious from *Sako*’s teachings that the modified *Hampiholi-Attard* SDV would have had a *first autonomous mode* for use with a first road type (e.g., public highways) and a second autonomous mode for use with a different road type (e.g., general roads). *Dec.*, 194-195. In addition, a POSITA would recognize that a vehicle in a second “autonomous mode” different than *Sako*’s “automatic mode” (such as a longitudinal control only mode) would not need to revert to a manual mode as this second mode is commonly

utilized on all roads. *Dec.*, 194-195. Further motivation to combine the *Hampiholi-Attard* SDV with *Sako* is above.

3. Claim 6(c)

See, 6(b) describing a “general road” *second roadway type* and *third threshold* $\Phi_{\min}$. Note the *third threshold* is compared to the CPCL and not to the HDCL unlike the first and second thresholds of Claim 1.

4. Claim 6(d)

The *Hampiholi-Attard* SDV determines corrective actions using *Frazer's* fault remediation table. *See*, 1(i). 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. *Dec.*, 197. Further motivation to combine the *Hampiholi-Attard* SDV with *Sako* is provided above.

B. Claim 7

1. Claim 7(a)

See, 6(a); *Dec.*, 198.

2. Claim 7(b)

See, 6(a).

3. Claim 7(c)

See, 1(Pre), 1(k), 6(b). This “first autonomous mode” is identical to *Sako*’s “automatic driving mode in which autonomous traveling is carried out.” *Sako*, 1:61-64.

4. Claim 7(d)

See, 6(b). A POSITA would understand that the CPCL is continuously evaluated in all driving modes in order to enable/require a transition if needed. *Dec.*, 201.

VIII. GROUND 4: CLAIM 8 IS OBVIOUS OVER HAMPIHOLI, ATTARD, MCNEW, FRAZER, AND COELINGH

1. Claim 8(a)

Attard teaches “a camera data collector 110 in a first vehicle 110 may be faulty,” which teaches *sensing an operational state* (“faulty”) *of a first camera sensor*. *Attard*, 14:46-48, 14:64-15:1; *Dec.*, 202.

2. Claim 8(b)

Attard teaches “weighting various determinations” from collected data 115 to generate confidence assessments 118. *Attard*, 6:28-35. Collected data 115 includes camera sensor readings. *Attard*, 4:1-17; *Dec.*, 203-204. Collected data 115 from the first camera data collector 110 forms *a first plurality of inputs*. *Dec.*, 203-204. *Attard* teaches weighting collected data from a plurality of distinct sensors, teaching or rendering obvious *a first plurality of weights*. *Dec.*, 203-204. Furthermore, because

Attard's weighting is used to generate confidence assessments 118 (i.e., ϕ), *Attard* teaches using a weighted voting system to determin[e] whether the first camera sensor is currently experiencing an operational anomaly (i.e., is faulty). Dec., 203-204.

3. Claim 8(c)

See, 8(b). The collected data 115 from first camera data collector 110 is a first plurality of inputs.

4. Claim 8(d)

See, 8(b). *Attard* teaches or renders obvious multiplying at least one of the sensor readings from camera data collector 110 by a weight from among the first plurality of weights. Dec., 206.

5. Claim 8(e)

Attard teaches receiving V2V (vehicle-to-vehicle) data, i.e., active learning data. *Attard*, 13:1-3.

a) Coelingh's Teachings

Coelingh teaches an autonomous vehicle sensor diagnosis system that is “arranged to retrieve from [a] database information on sensor performance levels for sensors in other vehicles.” *Coelingh*, 4:9-23, 7:23-38 (camera sensors). The sensor information includes “that the sensor performance is degraded,” i.e., information about a cohort of other SDVs experiencing a camera sensor anomaly.” *Coelingh*, 3:40-44.

b) Motivation to Combine

A POSITA would have been motivated and found it obvious to combine the teachings of *Attard* and *Coelingh* in the *Hampiholi-Attard* SDV such that *Attard*'s weights are *based on first active learning data*, i.e., *Coelingh*'s data regarding sensor performance levels from other vehicles. *Dec.*, 209-211.

This modification merely applies known techniques according to known methods to yield predictable results. *Attard* teaches a known technique of weighting camera sensor data, while *Coelingh* teaches utilizing autonomous vehicle sensor data from a cohort of SDVs to determine sensor performance. A POSITA would have recognized the predictable result of such a combination, e.g., that *Attard* weights the sensor data based on a reliability thereof, per *Coelingh*. *Dec.*, 209-211. *Coelingh* provides an express teaching, suggestion, and motivation for the combination teaching “both safety and comfort are increased” and the estimation of expected sensor performance “may be very accurate” utilizing *Coelingh*'s teachings. *Coelingh*, 2:16-24, 4:24-29.

A POSITA would have had a REOS in the modification because *Coelingh*, like *Hampiholi*, teaches implementing its teachings in programming instructions such that the modification would have required a straightforward software change to *Hampiholi*. Compare *Coelingh*, 7:52-8:24 with *Hampiholi*, [0032]. For example,

the modification would have involved modifying *Hampiholi*'s storage device 208 to include *Coelingh*'s database 8 that stores the sensor information. *Dec.*, 209-211.

6. Claim 8(f)

Attard teaches a faulty camera data collector 110, i.e., *determining that a third fault has occurred when the first camera sensor is currently experiencing an operational anomaly*. See, 8(a), 8(f); *Attard*, 14:36-41.

IX. GROUND 5: CLAIM 9 IS OBVIOUS OVER HAMPIHOLI, ATTARD, MCNEW, FRAZER, COELINGH, DERUYCK, GUNDERSON, AN, KANG, AND SCHUNDER

1. Claim 9(a)

Hampiholi teaches a second plurality of inputs, and *DeRuyck* teaches a second plurality of weights. See, 2(a).

2. Claim 9(b)

See, 2(b).

3. Claim 9(c)

See, 2(c).

4. Claim 9(d)

See, 2(d).

5. Claim 9(e)

See, 2(e). *Attard*'s third plurality of inputs comprises collected data 115.

6. Claim 9(f)

Attard's collected data 115 includes non-camera data 115, e.g., radar data, which is not in the first plurality of inputs and is not in the second plurality of inputs. Dec., 218.

7. Claim 9(g)

Hampiholi's sensor data (second plurality of inputs) used to determine the HDCL includes sensor readings not used for determining the camera anomaly (first plurality of inputs) nor for determining the CPCL (third plurality of inputs). Dec., 219.

8. Claim 9(h)

See, 2(h).

X. GROUND 6: CLAIM 29 IS OBVIOUS OVER HAMPIHOLI, ATTARD, MCNEW, FRAZER, AND HADA

A. Claim 29

1. Claim 29(Pre)

See, 1(Pre).

2. Claim 29(a)

See, 1(a). *Hampiholi* teaches receiving sensor readings from a plurality/system of sensors.

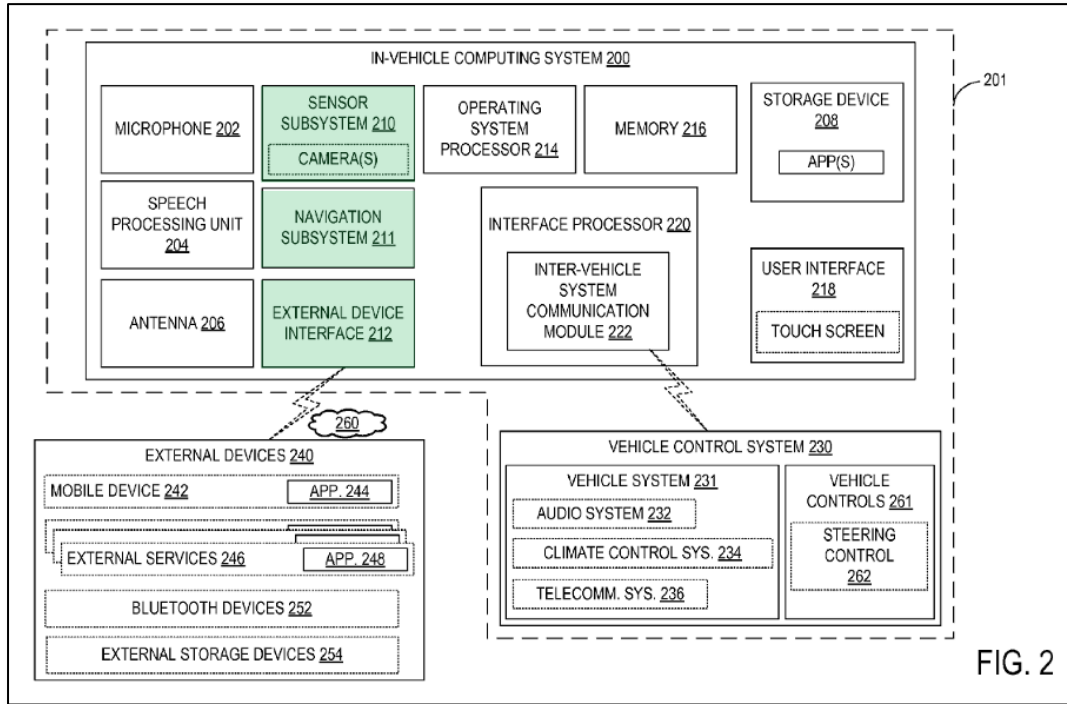
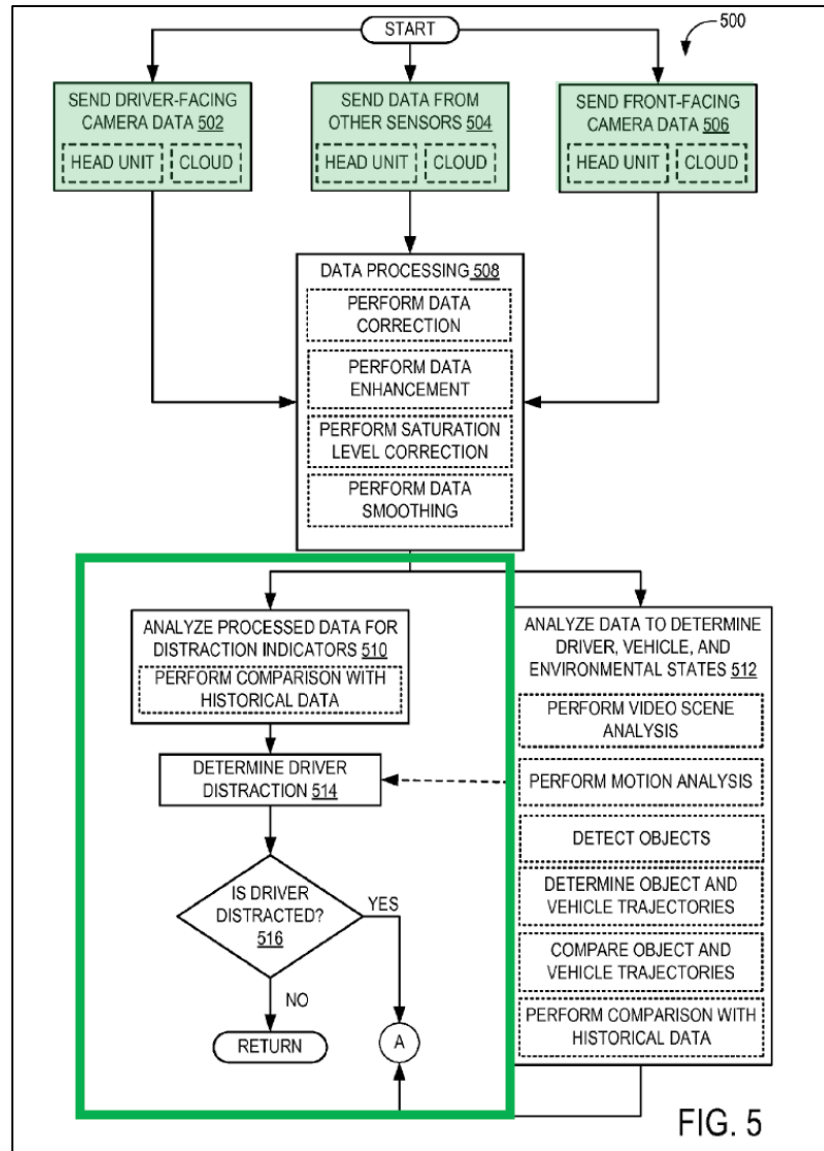


FIG. 2

Hampiholi, Fig. 2, [0031], [0034]; *Dec.*, 222.

3. *Claim 29(a)(i)*

See, 1(a). *Hampiholi* teaches a driver-facing camera included in mobile/wearable device 302, which communicates with the in-vehicle computing system. *Hampiholi*, [0058]-[0059].



Hampiholi, FIG. 5; Dec., 223.

4. Claim 29(a)(ii)

Attard teaches or renders obvious a camera directed away from the SDV. Namely, *Attard* teaches “sensors...for detecting conditions outside the vehicle” including “image capture devices”, i.e., a camera. *Attard*, 4:8-17, 14:63-67. A

POSITA would have understood that a camera that “detect[s] conditions outside the vehicle” to teach the camera is *directed away from the vehicle*. Dec., 224.

5. Claim 29(a)(iii)

See, 1(a).

6. Claim 29(a)(iv)

See, 1(a).

7. Claim 29(a)(v)

See, 29(a). *Hampiholi* teaches or renders obvious a *thermometer*, teaching an “inter vehicle system communication module 22 that outputs data “provided by individual information sources” including “**thermometers.**” *Hampiholi*, [0031]; Dec., 227.

8. Claim 29(a)(vi)

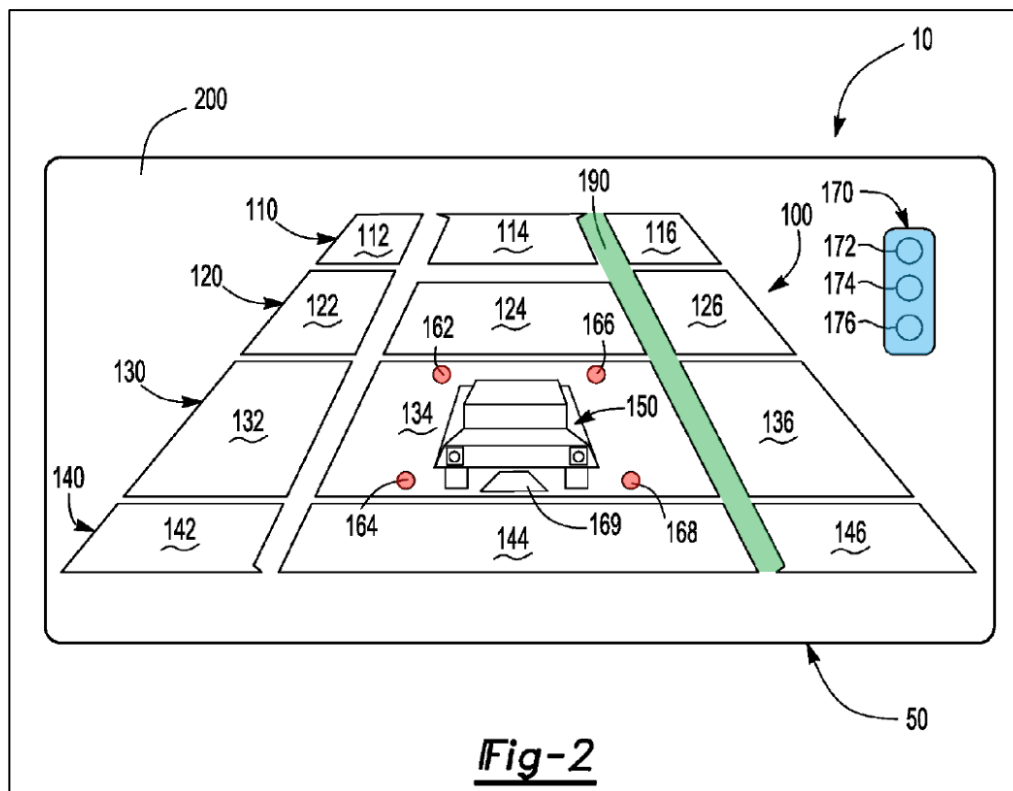
See, 1(a).

9. Claim 29(b)

See, 1(i). *Hampiholi* teaches an in-vehicle display. *Hampiholi*, [0020]-[0021]. Specifically, *Hampiholi* teaches displaying notifications, messages, and navigational assistance on the display of the vehicle’s user interface. *Hampiholi*, [0044]. To the extent it is argued that *Hampiholi*’s teachings are insufficient, a POSITA would have been motivated to modify *Hampiholi* per *Hada*’s teachings. Dec., 229.

a) ***Hada* Teaches Displaying Sensor Readings on a Display Screen**

Hada teaches proximity sensors for detecting nearby vehicles, cameras for detecting lane markings, RADAR, and other sensors. *Hada*, 5:23-43. *Hada* teaches displaying sensor readings on a display screen 50. *Hada*, 9:18-36, 9:53-10:60, 6:28-42, 6:64-7:7, 7:35-54, *generally* 1:39-2:34, 3:17-4:59. *Hada*'s display 50 displays readings from sensors, including location and color of a **stoplight**, nearby **vehicles**, and **lane markings**:



Hada, Fig. 2.

b) Motivation to Combine

A POSITA would have been motivated and found it obvious to modify the *Hampiholi-Attard* SDV to display one or more sensor readings per *Hada*. *Dec.*, 230-232. *Hada* teaches displaying sensor readings advantageously improves vehicle safety at least for vehicles in manual mode, thereby motivating the combination. *Hada*, 1:5-36, 3:17-21, 3:55-61, 5:23-36; *Dec.*, 231-232. This modification would have been use of a known technique of displaying sensor readings to improve the *Hampiholi-Attard* SDV in the same way as *Hada*. *Dec.*, 231-232.

A POSITA would have had a REOS modifying the *Hampiholi-Attard* SDV because *Hampiholi* already includes sensors and a display. *Dec.*, 231-232. Thus, a POSITA would have understood that modifying the *Hampiholi-Attard* SDV would have merely required straightforward changes to programming instructions. *Dec.*, 231-232.

10. Claim 29(c)

See, 29(b). *Hada* teaches determining a position of another vehicle currently on a roadway near the SDV.

11. Claim 29(d)

Hampiholi-Attard teaches CPCL. *See*, 1(c). Further *Attard* teaches *the competence level of the SDV is a function of a degree of uncertainty in the determined position of the other vehicle.*

a) *Attard's Teachings*

Attard teaches that confidence estimates can be based on “radar return signals [that] may be attenuated due to atmospheric moisture such that [a] radar module reports low confidence in estimating the range, range-rate or azimuth of neighboring vehicles.” *Attard*, 6:57-60. The radar attenuation manifests itself as uncertainty in the estimation of the range or azimuth of neighboring vehicles, i.e., *a degree of uncertainty in the determined position of the other vehicle. Dec.*, 235-236. A POSITA would have understood that uncertainty in the location of obstacles/vehicles directly affects the ability of an autonomous system to avoid those objects, and thus affects the competence level of the system. *Dec.*, 235-236. A motivation to combine *Hampiholi-Attard* is above. *See*, 1(c).

12. *Claim 29(e)*

See, 1(k).

13. *Claim 29(f)*

See, 3(a).

14. *Claim 29(g)*

See, 1(b).

15. *Claim 29(h)*

See, 1(g), 1(i).

16. *Claim 29(i)*

See, 1(h), 1(j).

See, 1(g), 1(i).

See, 1(h), 1(j).

A. Claim 30

a) *Hada's* Teachings

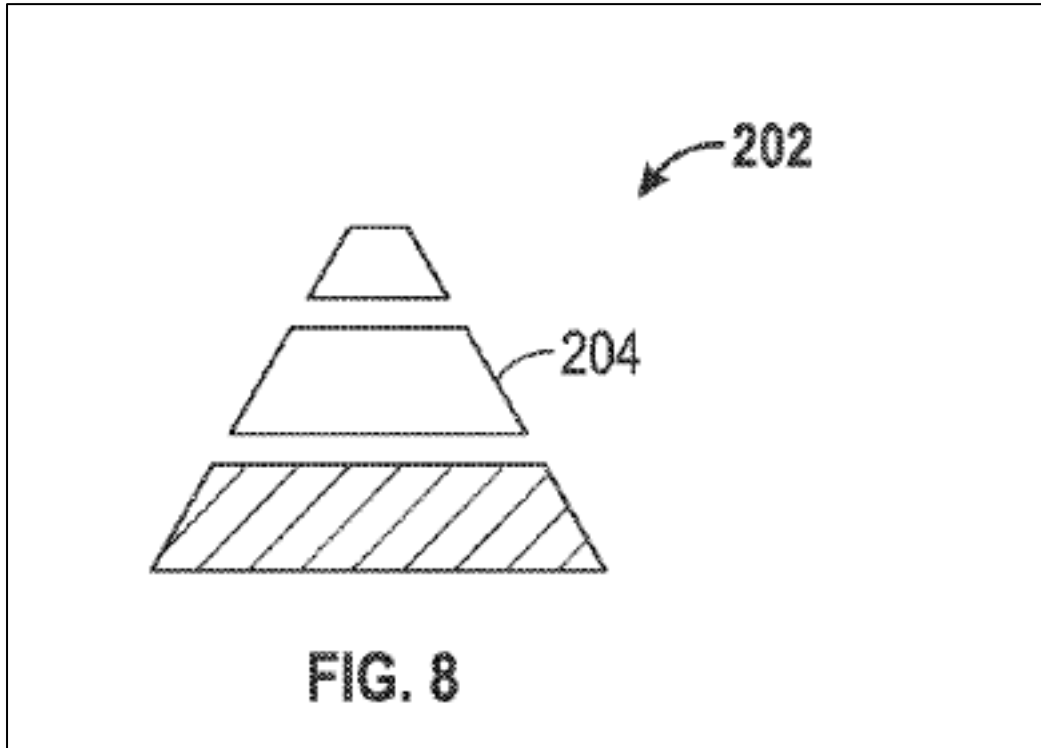
For example, *Hada* depicts the location of the user's vehicle (V) and the positions of other nearby vehicles (V1, V2). The hatched lines in the grid indicate the position of the other vehicles.



Hada, Figs. 11A-11D. Thus, the *Hampiholi-Attard* SDV modified by *Hada* displays, on the display screen, a graphical representation of the position of the other vehicle relative to the SDV. Dec., 244-247.

b) *Tsimhoni-647's* Teachings

Tsimhoni-647 teaches a “control system...for automatically controlling operation of a vehicle.” *Tsimhoni-647*, 1:45-46. *Tsimhoni-647* computes a “confidence value...relating to how ‘secure’ or ‘confident’ the control system 100 is” in controlling the vehicle. *Tsimhoni-647*, 5:16-21. A trajectory icon 204 is displayed that “indicate[s] the confidence level.” *Tsimhoni-647*, 6:3-7. Filled trapezoids represent higher confidence, while unfilled trapezoids represent lower confidence. *Tsimhoni's-647* trajectory icon 204 is, therefore, *a graphical representation of the competence level of the SDV*. Dec., 248-250.



Tsimhoni-647, FIG. 8.

c) Motivation to Combine

A POSITA would have been motivated and found it obvious to modify the *Hampiholi-Attard* SDV further with *Tsimhoni-647*'s teachings of displaying a competence level, which is merely the combination of known prior art elements according to known methods to yield the predictable result of the *Hampiholi-Attard* SDV depicting a confidence icon, per *Tsimhoni-647. Dec.*, 251-252. A POSITA would have recognized the benefits of such a modification, by visually indicating to the driver when they may need to take over driving, due to, e.g., Φ becoming low, which is expressly envisioned by *Tsimhoni-647; Dec.*, 251-252. This use of a known technique of displaying a graphical representation of the CPCL on a display would

have improved the *Hampiholi-Attard* SDV in the same way as *Tsimhoni-647*'s vehicle. *Dec.*, 251-252.

A POSITA would have had a REOS because such a modification would have required a straightforward software/programming instruction change to the *Hampiholi-Attard* SDV to display information already being computed by the system, i.e., *Attard*'s Φ . *Dec.*, 251-252. Additionally, *Hampiholi*, *Attard*, and *Tsimhoni-647* all teach implementations via processors executing programming instructions, further leading to a REOS. *Hampiholi*, [0032]; *Attard*, 15:12-46; *Tsimhoni-647*, 3:11-15. *Dec.*, 251-252.

XII. GROUND 8: CLAIMS 31-32 ARE OBVIOUS OVER HAMPIHOLI, ATTARD, MCNEW, FRAZER, HADA, TSIMHONI-647, DERUYCK, GUNDERSON, AN, KANG, AND SCHUNDER

A. Claim 31

1. Claim 31(a)

See, 2(a).

2. Claim 31(b)

See, 2(b).

3. Claim 31(c)

See, 2(c).

4. Claim 31(d)

See, 2(d).

5. Claim 31(e)

See, 2(e).

6. Claim 31(f)

See, 2(f).

7. Claim 31(g)

See, 2(h).

B. Claim 32

1. Claim 32(a)

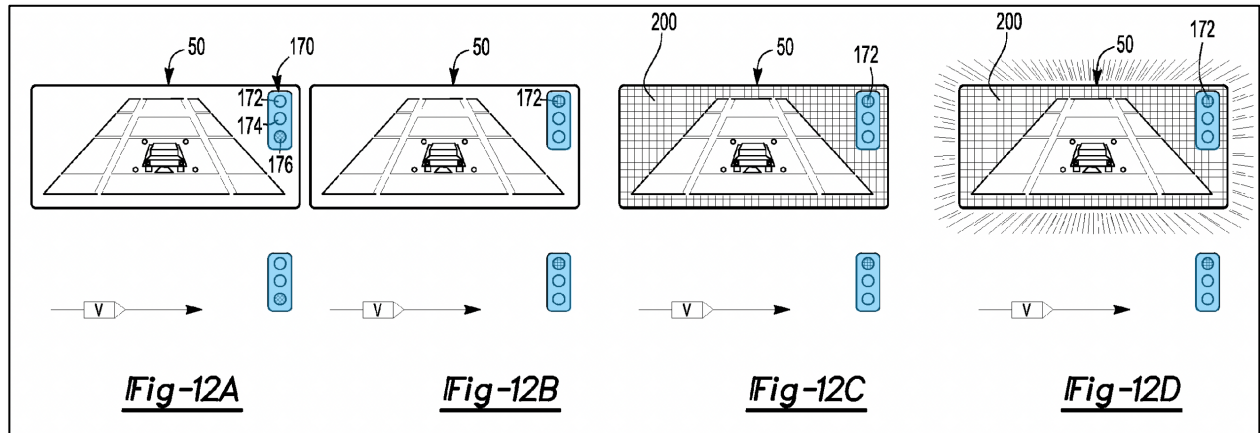
Hampiholi-Attard teaches a fault when a lane-tracking system cannot “see the lane-markings.” *Attard*, 8:10-13. A POSITA would have understood that *Hampiholi-Attard* thus determines, using one or more sensor readings of the sensor readings, the position of a lane marking on the roadway. *Dec.*, 260.

To the extent it is argued that *Attard* does not teach such, *Hada* teaches determining the position of lane markings on the roadway using sensor readings. *Hada*, 2:12-34, 3:17-30, 4:32-59, 5:37-43.

A POSITA would have been motivated to modify the *Hampiholi-Attard* SDV per *Hada*’s teachings and would have had a REOS for the same reasons discussed for Claim 29. *See*, 29. Detecting lanes and utilizing a camera for a lane departure warning system would have been use of a known technique to improve vehicle safety in the *Hampiholi-Attard* SDV in the same way as in *Hada*. *Dec.*, 262.

2. Claim 32(b)

Hada teaches determining the position of a traffic signal using sensor readings. *Hada*, 6:19-27, 2:24-34, 3:17-30, 3:55-58, 6:64-7:7, 10:1-23.

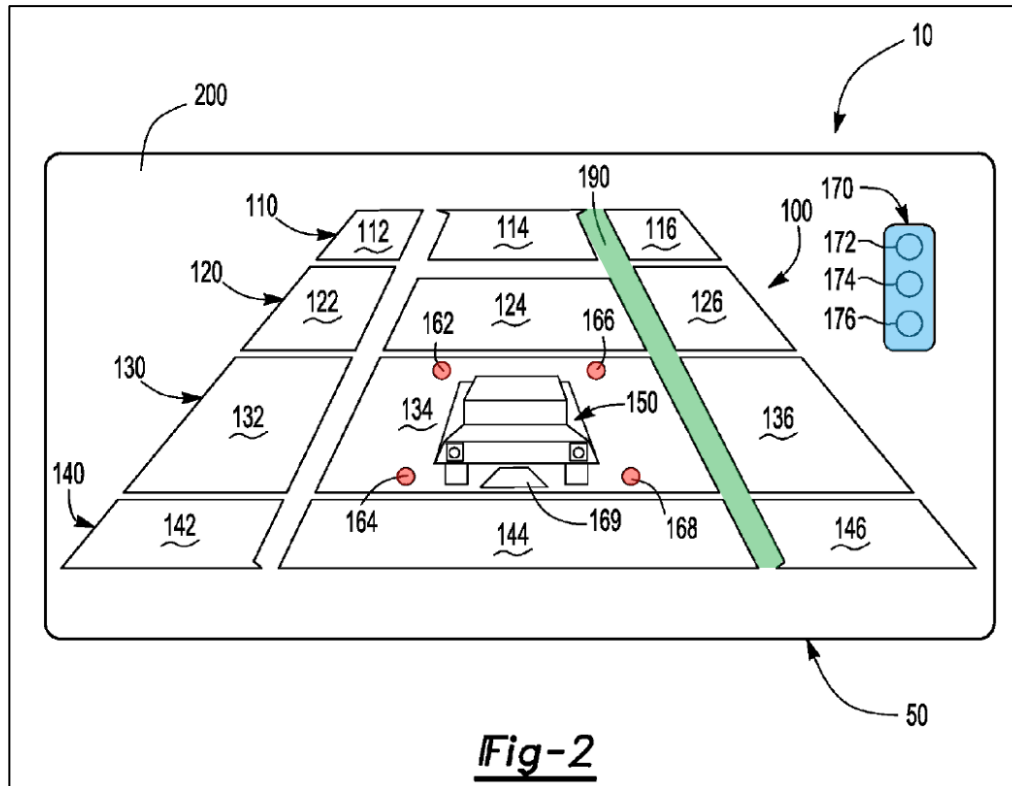


Hada, Figs. 12A-12D, Fig. 2.

A POSITA would have been motivated to modify the *Hampiholi-Attard* SDV per *Hada*'s teachings and would have had a REOS for the reasons discussed for Claim 29. *See*, 29. *Dec.*, 263-264.

3. Claim 32(c)

Hada's display 50 displays a simultaneous graphical representation of the position of: *other vehicle[s]*; *lane marking[s] on the roadway*; and *a traffic signal*.



Hada, Fig. 2. As discussed, the *Hampiholi-Attard* SDV is modified per *Hada* and *Tsimhoni-647* so the CPCL is also depicted. *See*, 29-30. A POSITA would have understood the *Hampiholi-Attard* SDV's display would have been capable of simultaneously displaying: the position of other vehicles; lane markings; a traffic signal; and the CPCL. *Dec.*, 265-266.

A POSITA would have been motivated to modify the *Hampiholi-Attard* SDV per *Hada's* and *Tsimhoni-647's* teachings and had a REOS for the same reasons discussed for 29-30. *See*, 29-30. *Dec.*, 265-267.

XIII. GROUND 9: CLAIMS 33-34 ARE OBVIOUS OVER HAMPIHOLI, ATTARD, MCNEW, FRAZER, HADA, TSIMHONI-647, DERUYCK, GUNDERSON, AN, KANG, SCHUNDER, AND NAGASAKA

A. Claim 33

1. Claim 33(a)

Attard teaches module 106 autonomously controls lane changing without requiring the human driver to control the driver controls. *Attard*, 9:63-10:8; *Dec.*, 268. *See*, 1, 29 for motivation to modify *Hampiholi* per *Attard*.

2. Claim 33(b)

Hampiholi teaches turn signals. *Hampiholi*, [0041]. *Attard* teaches automatically switching lanes. *See*, 33(a). To the extent it is argued *Hampiholi-Attard* does not expressly teach 33(b), a POSITA would have understood that SDVs were required by driving laws to signal their intentions, including when driving in autonomous mode without human driver controlling signals, rendering 33(b) obvious¹⁰. *Dec.*, 269.

Additionally or alternatively, *Nagasaka* teaches an SDV autonomously engaging a turn signal prior to autonomously changing lanes. *Nagasaka*, 9:64-10:3, 10:60-67 (Lane change module 137 activates a signaling system 175 to indicate lane change), 12:58-13:3, 17:61-67. A POSITA would have understood from *Nagasaka*'s teachings that such is done *without requiring the human driver to control the turn*

¹⁰ *See*, **Ex. 1051**.

signal because *Nagasaka's* control of the turn signal is performed by lane change module 137 activating signaling system 175, which are part of the autonomous vehicle. Thus, the turn signals are controlled without human driver input. *Nagasaka*, 1:17-18, 3:11-17. *Dec.*, 270.

A POSITA would have been motivated to modify the *Hampiholi-Attard* SDV per *Nagasaka* to autonomously utilize turn signals before the SDV switches lanes to improve safety for the occupant/driver of the SDV and nearby vehicles and to comply with driving laws that require a vehicle to signal its intention before changing lanes. *Dec.*, 271-272. Modifying the *Hampiholi-Attard* SDV would have been use of known technique to improve the *Hampiholi-Attard* SDV in the same way as *Nagasaka*. Further, combining prior art elements according to known methods would have yielded predictable result of the *Hampiholi-Attard* SDV engaging a turn signal before switching lanes. *Dec.*, 271-272.

A POSITA would have had a REOS because modifying the *Hampiholi-Attard* SDV's programming instructions to achieve said autonomously engaging a turn signal would have been straightforward and within a POSITA's skillset. *Dec.*, 271-272.

3. *Claim 33(c)*

See, 1, 6, 29. The *Hampiholi-Attard* SDV includes a fault-remediation table, which includes corrective actions associated with a CPCL. *Dec.*, 273.

4. Claim 33(d)

See, 1, 6, 29. In the *Hampiholi-Attard* SDV , the third corrective action would have been taken when the programmed conditions are met, e.g., when the CPCL is equivalent to or below the first CPCL. *Dec.*, 274. *See*, 29(h)-(i) for exemplary corrective actions to take.

B. Claim 34**1. Claim 34(a)**

See, 1(j), 29(i). A POSITA would have understood the same corrective actions would also have been obvious to take *when the competence level of the SDV is equivalent to or below the first SDV competence level*. *Dec.*, 275.

2. Claim 34(b)

See, 1(a)-(b), 29(a)(i). *Hampiholi* teaches a camera directed at the human driver and determines the HDCL as a function of readings from said camera.

XIV. GROUND 10: CLAIMS 35-36 ARE OBVIOUS OVER HAMPIHOLI, ATTARD, MCNEW, FRAZER, HADA, TSIMHONI-647, DERUYCK, GUNDERSON, AN, KANG, SCHUNDER, NAGASAKA, AND DUNCAN

A. Claim 35**1. Claim 35(a)**

Duncan teaches or renders obvious retrieving a human driver profile from a database. *Duncan*, [0101]; *Dec.*, 277.

A POSITA would have been motivated to modify the *Hampiholi-Attard* SDV per *Duncan* to store/retrieve a driver profile in/from persistent storage. *Dec.*, 277-279. 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. *Dec.*, 277-279. This modification would have been use of a known technique that would have improved the *Hampiholi-Attard* SDV in the same way as *Duncan*. *Dec.*, 277-279.

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. *Dec.*, 277-279. A POSITA would have had to provide straightforward modifications to programming instructions to store and retrieve driver profile information that the *Hampiholi-Attard* SDV already collects. *Dec.*, 277-279.

2. Claim 35(b)

See, 1, 6, 29, 34. The *Hampiholi-Attard* SDV includes a fault-remediation table per *Frazer*, which includes any number of corrective actions associated with an HDCL. This corrective action would have been taken when the programmed conditions are met, i.e., when the HDCL is equivalent to or below the first human driver profile quota. *Dec.*, 280. *See*, 1(j), 29(h)-(i) for exemplary corrective actions to take, including disabling an autonomous driving mode. *Dec.*, 280.

3. Claim 35(c)

See, 1(j), 29(i), 34(a), 35(a)-(b). A POSITA would have understood that a corrective action would have been obvious to take *when the human driver profile is equivalent to or below the first human driver profile quota. Dec.*, 281.

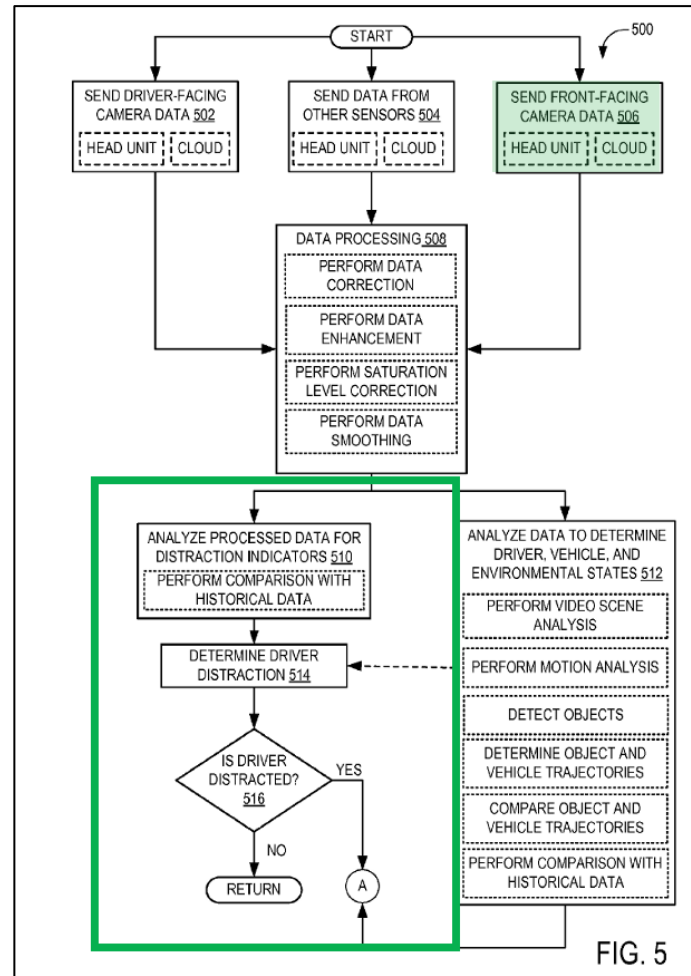
B. Claim 36

1. Claim 36(a)

See, 34-35. It would have been obvious to a POSITA for a human driver profile to be a function of previous sensor readings from the driver-facing camera because the *Hampiholi-Attard* SDV already teaches determining R using said camera, and *Duncan* teaches creating a driver profile using sensor readings, storing and retrieving a driver profile from memory. *Duncan*, [0007], [0031], [0037], [0052], [0067], [0079], [0101]. *See*, 35.

2. Claim 36(b)

Hampiholi teaches collecting front-facing camera data for determining the HDCL. *Hampiholi*, [0061].



Hampiholi, FIG. 5. To the extent another camera is required, *Attard* teaches forward-facing cameras. *See*, 1, 29.

3. Claim 36(c)

McNew teaches a steering wheel sensor, and its data is used in the *Hampiholi-Attard* SDV to determine R. Thus, the human driver profile is a function of a previous sensor reading from the steering wheel sensor. *See*, 1(b); *Dec.*, 284.

4. Claim 36(d)

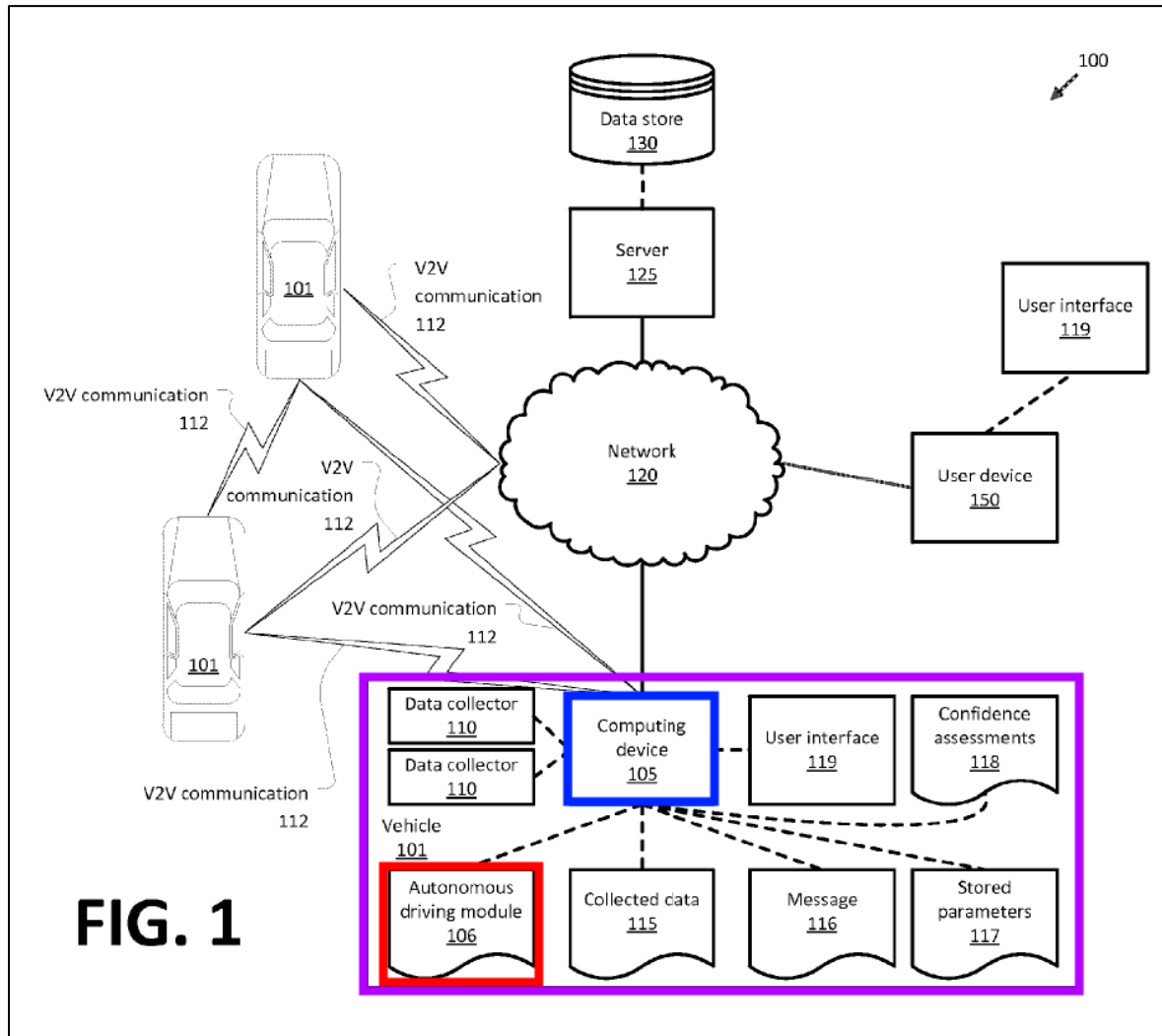
See, 1(Pre). *Hampiholi* teaches a speedometer. *Hampiholi* teaches determining driver distraction level. *See*, 1, 29. A POSITA would have understood that speedometer data would also have been utilized when generating the human driver profile. *See*, 1(b); *Dec.*, 285.

XV. GROUND 11: CLAIMS 37-39 ARE OBVIOUS OVER ATTARD, HAMPIHOLI, MCNEW, AND FRAZER**A. Claim 37****1. Claim 37(Pre)**

To the extent the preamble is limiting, *Attard* teaches *a computer program product* that manages fault handling in an *SDV* including *controlling a driving mode* by changing from an autonomous mode to a manual mode (or semi-autonomous mode) in response to a fault. *See*, 1(Pre). Further, *Attard* teaches *computer readable storage medium* such as non-volatile memory and programming code stored thereon that is *readable and executable by a processor*.

a) Attard's Computer Program Product Comprises Non-Transitory Computer-Readable Memory and Processor

Attard's teaches **vehicle 101** includes **computer 105** and **autonomous driving module 106**:



Attard, Fig. 1, 1:41-52.

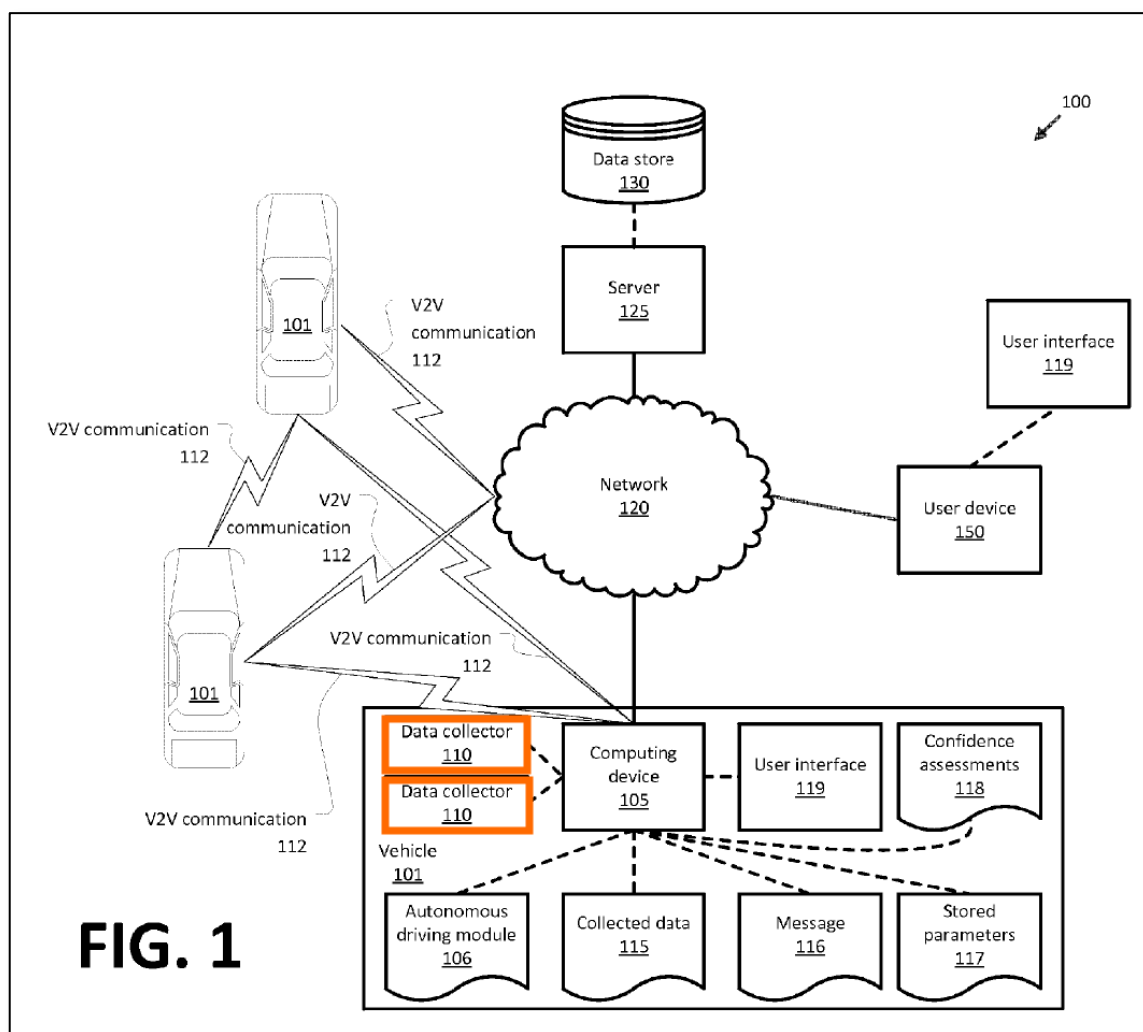
Attard teaches autonomous operations of vehicle 101 are stored as a set of instructions in vehicle 101's memory and executable by a processor of computer 105. *Attard*, 2:27-32, 3:15-22. A POSITA would have understood or found obvious that *Attard* teaches a computer program product for controlling a driving mode of vehicle 101, which comprises non-volatile memory and a processor for executing programming instructions. *Dec.*, 286-289.

2. Claim 37(a)

a) Attard's System of Sensors and Sensor Readings

Attard's computer 105 receives collected data 115 (*sensor readings*) from sensors 110 (*system of sensors*), which include cameras, GPS, LIDAR, etc. *Attard*, 4:1-31. Attard's sensors 110 transmit collected data 115 to computer 105. *Attard*, 4:32-45.

Attard teaches collected data 115 includes data gathered by sensors 110 and data derived from the sensor readings. *Attard*, 4:32-45.



Attard, Fig. 1, *Dec.*, 290-293.

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

The '004 Patent describes an “operational state” of a vehicle including states (e.g. presence/absence of snow tires), conditions (e.g. road conditions), and measured parameters detected via sensors. '004 *Patent*, 5:57-6:6.

Attard's sensors 110 similarly “pertain[] to a particular vehicle 101 and/or vehicle 101 sub-system, environmental attribute, or condition.” *Attard*, 10:42-52. Because *Attard's* collected data 115 (*sensor readings*) detect conditions external and internal to vehicle 101, *Attard's sensor readings describe a current operational state of a SDV. Dec.*, 294-296.

3. *Claim 37(a)(i)*

See, 29(a)(ii).

4. *Claim 37(a)(ii)*

See, 1(a), 29(a)(iii).

5. *Claim 37(a)(iii)*

See, 1(a).

6. *Claim 37(a)(iv)*

See, 29(a)(v).

a) Motivation to Combine *Attard-Hampiholi*

A POSITA would have found it obvious and been motivated to combine *Attard* with *Hampiholi's thermometer* teachings as such is merely the combination of known prior art elements according to known methods to yield the predictable result of *Attard's* vehicle 101 including a thermometer to measure temperature. *Dec.*, 301. Thermometers have been present in cars for years such that a POSITA would have had a REOS in modifying *Attard* based on *Hampiholi's* teachings. *Dec.*, 301.

7. Claim 37(a)(v)

See, 1(a). *See*, 37(a)(iv) for the motivation to combine *Attard-Hampiholi*. *Dec.*, 302.

8. Claim 37(b)

Attard teaches *determining a CPCL*. *See*, 1(c). *Attard* further teaches *the operational state of the SDV*. *See*, 1(a), 37(a). Because *Attard's* CPCL, Φ , is determined based on data 115 from sensors 110, which are also used to determine *the operational state of the SDV*, *Attard* teaches Φ is *a function of the operational state of the SDV*. For example, per Claim 39, the *operational state* is *a current weather condition*, which is taught by *Attard* as incorporated into Φ such that Φ is *a function of the operational state* (weather condition). *Attard*, 6:4-35; *Dec.*, 303.

9. Claim 37(c)

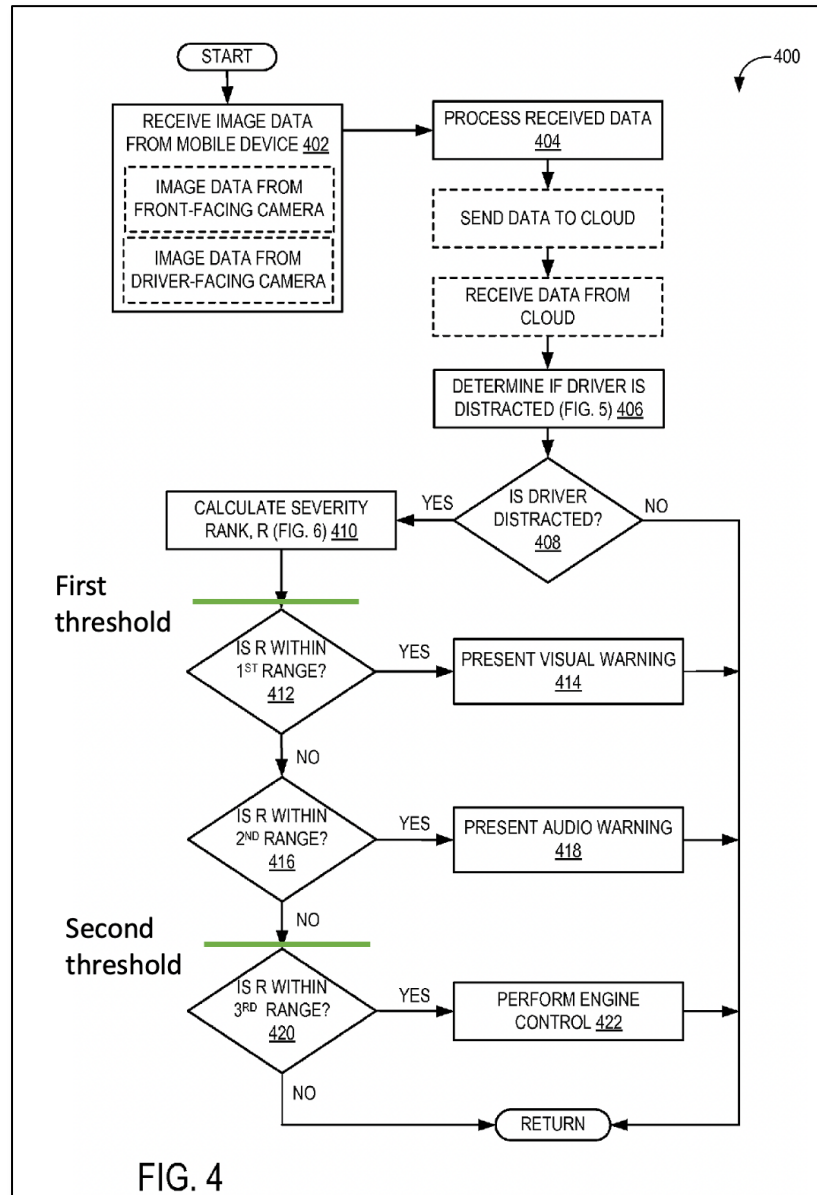
Attard teaches comparing Φ to $\Phi_{\min}$ to determine whether to activate an interface 119. *Attard*, 7:18-28, 5:21-29, 10:52-11:4. Per 37(e), when the CPCL is above the first threshold, the SDV drives autonomously. *Attard*, likewise, teaches or renders obvious vehicle 101 driving autonomously when Φ is above $\Phi_{\min}$. *Attard*, 10:18-27, *Dec.*, 304. Therefore, $\Phi_{\min}$ is a *first threshold* to which Φ is compared.

10. Claim 37(d)

Attard teaches determining a confidence interval into which Φ falls. *Attard*, 12:5-11, 10:53-61; *Dec.*, 305. However, *Attard* does not explicitly teach *comparing Φ to a second threshold* that is below $\Phi_{\min}$. *Hampiholi* teaches such threshold comparisons.

a) Hampiholi's Teachings

As discussed with respect to Claim 1, *Hampiholi* teaches comparing R to different ranges to determine which range R belongs and a corrective action to take. *See*, 1; *Hampiholi*, [0057]. Exemplary first/second thresholds are below:



Hampiholi, FIG. 4.

A POSITA would have found it obvious to modify *Attard* based on *Hampiholi*'s teachings, yielding *comparing the competence level...to a second threshold, wherein the first threshold is higher than the second threshold, where the competence level is of the control processor, per Attard. Dec.*, 306-307.

b) Motivation to Combine *Attard-Hampiholi*

A POSITA would have found it obvious and been motivated to modify *Attard* with *Hampiholi*'s decision making process of comparing a *competence level* to *threshold[s]* to determine a corrective action. Such a modification is merely the combination of known prior art elements according to known methods to yield predictable results of specific actions being taken when Φ falls within a specific confidence interval, i.e., above or below a threshold. *Dec.*, 308-309. *Attard* expressly teaches Φ can be bucketed into different confidence intervals. *Attard*, 11:63-12:11, 14:63-15:4. However, *Attard* lacks an express teaching of which actions are taken when Φ falls within a specific confidence interval and the relationship between the various thresholds. *Dec.*, 308-309. *Hampiholi* teaches such, where *Hampiholi*'s severity rank R is analogous to *Attard*'s Φ ; i.e., both are competence levels. *Dec.*, 308-309.

A POSITA would have had a REOS in modifying *Attard* per *Hampiholi* because decision making based on thresholding was well known prior to the '004 Patent. Further, *Hampiholi* merely provides implementation details for associating *Attard*'s actions to specific confidence intervals for Φ . *Dec.*, 308-309. Further, both *Attard* and *Hampiholi* teach implementing their methods in programming instructions. *See*, 1(Pre), 1(c); *Attard*, 15:12-46; *Hampiholi*, [0032].

11. Claim 37(e)

When Φ is above $\Phi_{\min}$, *Attard* does not send a message and autonomous driving continues. Specifically, the comparison of Φ to $\Phi_{\min}$ occurs at steps 220 and 225 and, if Φ is above $\Phi_{\min}$, the process loops and autonomous driving is maintained. *Dec.*, 310.

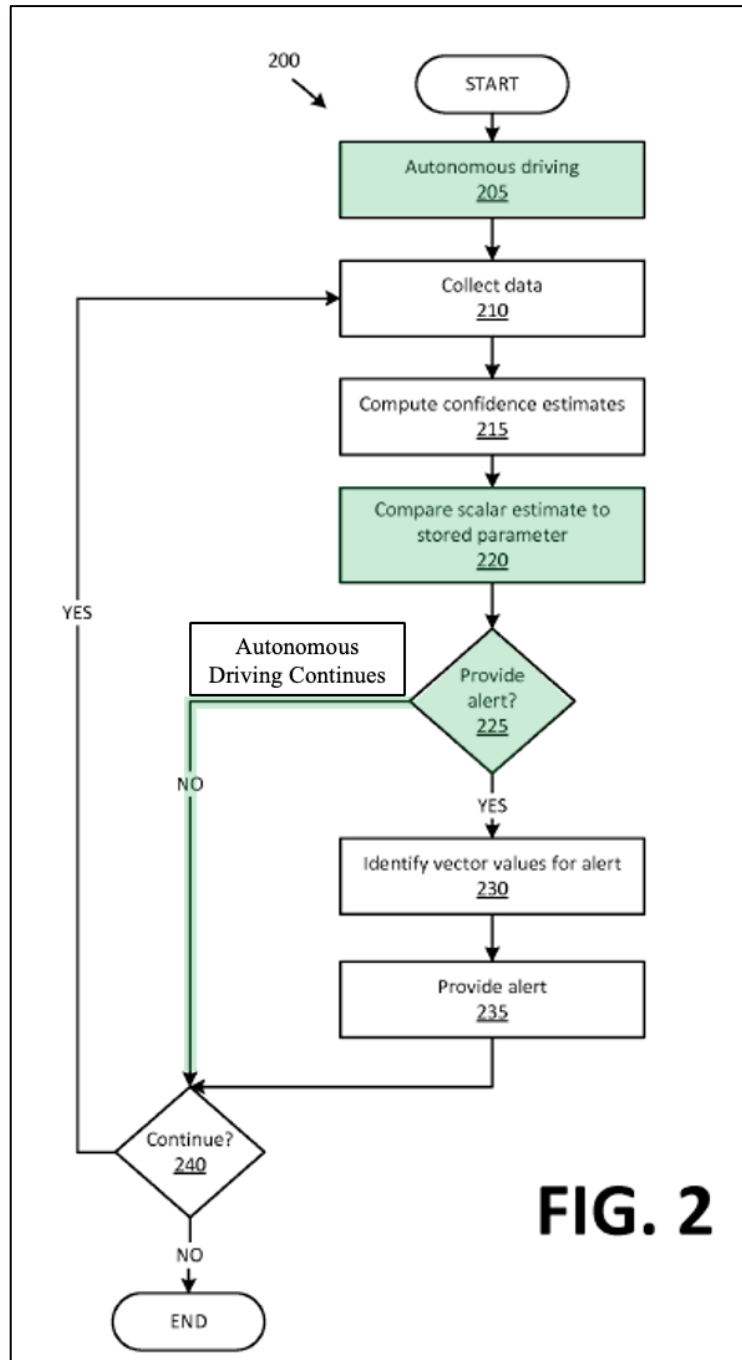


FIG. 2

Attard, FIG. 2.

12. Claim 37(f)

Hampiholi teaches determining a first fault has occurred when the competence level...is between the first threshold and the second threshold. Dec.,

311-312. *See*, 1(g). In the *Attard-Hampiholi* SDV, Φ is compared against *Hampiholi's* thresholds to determine actions to take, thereby rendering obvious 37(f). *Dec.*, 311-312.

13. Claim 37(g)

When Φ falls below *Hampiholi's second threshold*, it is determin[ed] that a *second fault has occurred*. *Dec.*, 313. *See*, 1(h).

14. Claim 37(h)

Attard-Hampiholi in view of *Frazer* teaches 37(h), i.e., *Frazer's* action 144c is a *corrective action listed in a fault remediation table*. *Frazer's* teachings are discussed in 1(i)-1(j) and incorporated herein.

a) Motivation to Combine

A POSITA would have found it obvious and been motivated to modify *Attard's* fault handling with *Frazer's* teachings of organizing faults, conditions, and action(s) to take for fault in a *fault-remediation table*, yielding *performing a corrective action listed in a fault-remediation table*. *Dec.*, 314-322. A POSITA would have found it obvious and been motivated to determine which *corrective action* to take using *Frazer's* table to enable easy access and quick determination of actions to take responsive to detected faults. *Dec.*, 315. A POSITA would have recognized formatting data into a table was well-known and widely-used for efficiently organizing data for retrieval, reference, and modification. *Dec.*, 316.

Finally, 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.” *Frazer*, 23:64-67; *Dec.*, 317.

The combination constitutes application of a known technique (*Frazer’s* tables) to a known method (*Attard’s* fault handling method) ready for improvement to yield predictable results. Based on *Attard’s* teachings that faults have associated actions (*Attard*, 14:63–15:4), a POSITA would have looked to other references that describe specific ways to associate faults with actions and to store such information in computer memory, e.g., *Frazer. Dec.*, 318.

Modifying *Attard* per *Frazer* would have had a REOS. *Dec.*, 314-322. *Attard* and *Frazer* teach implementing programs and functions using programming instructions. *Attard*, 15:12-46; *Frazer*, 21:20-50. *Dec.*, 319-322. Modifying *Attard* would have merely required straightforward changes to programming instructions. *Dec.*, 319-322. A POSITA would have understood or found obvious *Attard* already has the necessary computer hardware for implementing an *Frazer’s* table. *Id.* Modifying *Attard* per *Frazer* would have been use of known technique of using a fault-remediation table to group faults, conditions indicating the faults, and actions to take when the fault conditions are met. *Id.* This known technique would have improved *Attard’s* autonomous vehicle in the same way as *Frazer’s* autonomous vehicle. *Id.*

15. Claim 37(h)(i)

When Φ is below $\Phi_{\min}$, (*when the first fault occurs*), *Attard* teaches interface 119 formulates message 116 *Attard*, 7:24-28. The message 116 is *a warning message*, and the interface 119 is *a display screen*. *Attard*, 7:33-38, 3:53-55. *Dec.*, 323.

16. Claim 37(h)(ii)**a) When the Second Fault Occurs**

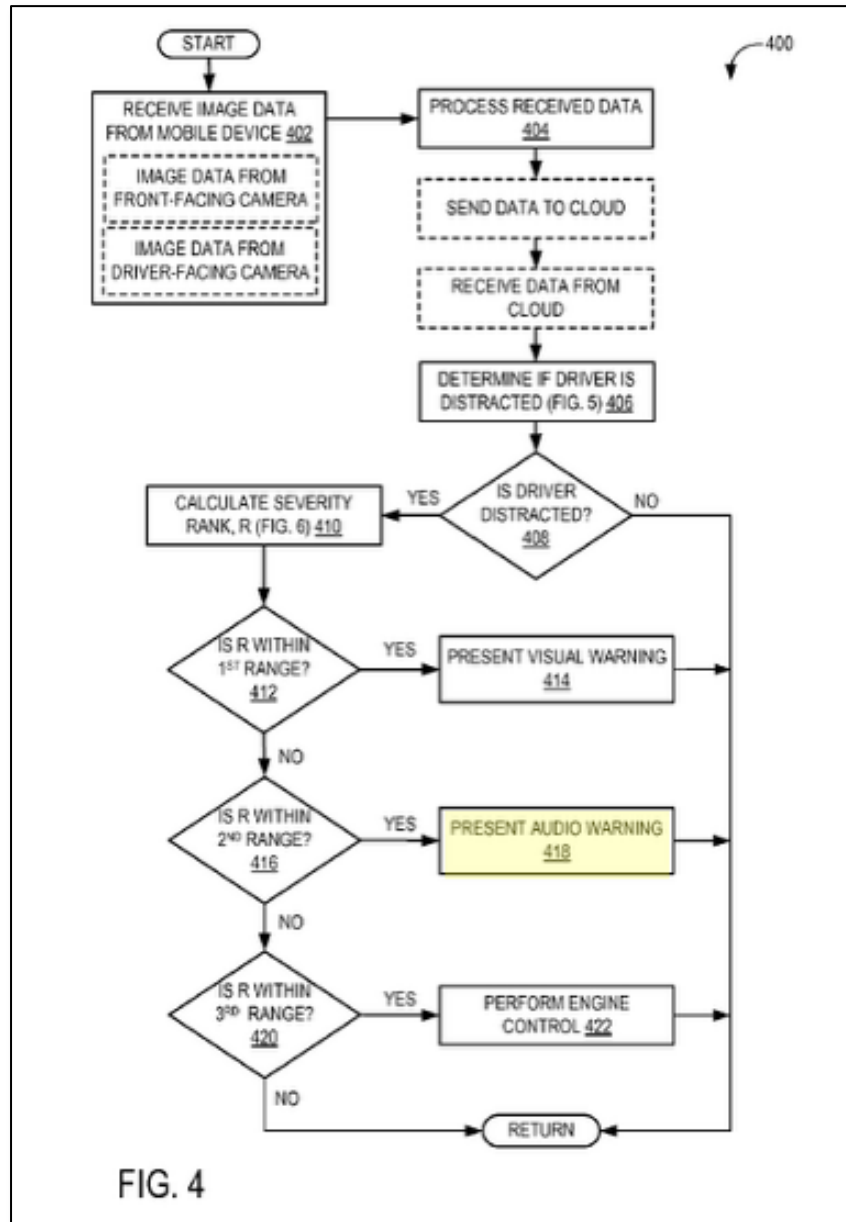
In the *Attard-Hampiholi* SDV, the *second fault occurs* when Φ is below the *second threshold*, per *Hampiholi*, and a transfer to manual is recommended per *Attard*. See, 37(g); *Dec.*, 324. A POSITA would have found it obvious to modify the *Attard-Hampiholi* SDV to collectively (1) sound a warning; (2) display a message; (3) display an icon; and (4) transfer to manual to improve vehicle safety. *Dec.*, 324. A POSITA would have been motivated to activate multiple alarms of differing modalities to increase the odds the driver responds when Φ is low and *Attard's* vehicle should not be driven autonomously, thereby improving the safety of the SDV. *Dec.*, 324. Additional motivations to combine *Attard* with *Hampiholi's* teachings of *sounding a warning sound* and *McNew's* teachings of *transferring the driver controls to manual control* are below.

A POSITA would have had a REOS in modifying the *Attard-Hampiholi* SDV in this manner because, while *Attard* lacks an explicit teaching of performing all

actions collectively, *Attard's* vehicle is equipped for all modalities. *Attard*, 7:30-38; *Dec.*, 324-325. It would have required a minor software change to the *Attard-Hampiholi* SDV to take these actions when Φ is below the second threshold, e.g., by modifying the *Attard-Hampiholi-Frazer* fault-remediation table accordingly. *Dec.*, 324-325.

b) Warning Sound

Hampiholi teaches sounding an “audio warning” when R is in the second range.



Hampiholi, [0057].

While *Hampiholi* depicts the audio warning as occurring above the second threshold, *Hampiholi* teaches that “[a]ny suitable action may be mapped to any suitable severity ranking” such that *Hampiholi* is not limited to presenting an audio warning only when R is in the second range. *Hampiholi*, [0066]; *Dec.*, 326-327.

c) Motivation to Combine

A POSITA would have found it obvious to modify *Attard's* teachings of displaying a message (discussed below) further with *Hampiholi's* teachings of sounding a warning sound when a fault occurs. The *second fault* occurs when the CPCL is below a second threshold, e.g., the SDV is encountering a situation it cannot handle and needs the driver to take over. Thus, a POSITA would have found it obvious to modify *Attard* per *Hampiholi* to sound a warning to grab the driver's attention, predictably improving the safety of *Attard's* vehicle. A POSITA would have understood the necessity to alert the driver and, therefore, would have been motivated to transmit multiple alert types to the driver to ensure the driver takes over driving. *Dec.*, 324-325, 328-329.

Such a modification would have had a REOS because (a) sounding audio alerts to alert drivers was well-known; (b) *Attard* and *Hampiholi* both teach associating faults with actions; and (c) modifying *Attard* would have required a minor software change to sound a warning sound when the second fault occurs. *Dec.*, 328-329.

d) Displaying a Warning Message

See, 37(h)(i).

e) Displaying an Icon

Attard teaches messages 116 can displayed icons: “interface 119...may display alerts, messages...to convey a degree of urgency, e.g....use of **icons**.” *Attard*, 7:33-38.

f) Transfer to Manual

See, 1(j).

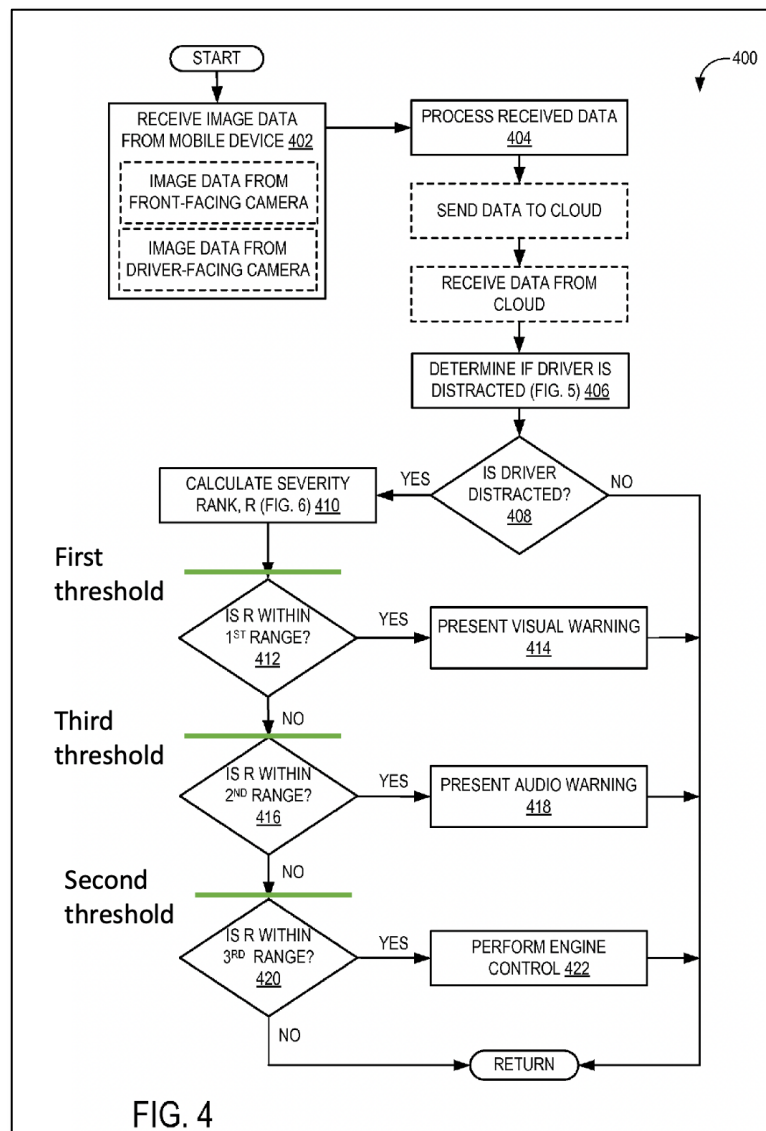
g) Motivation to Combine *Attard-Hampiholi-Frazer-McNew*

A POSITA would have been motivated and found it obvious to include transferring driver controls to manual as a corrective action in the *Attard-Hampiholi* SDV responsive to particular faults per *McNew. Dec.*, 333-338. Indeed, a POSITA would have been motivated because *Attard* includes a specific suggestion to do so via repeated disclosures of recommending transferring controls to manual. *Attard*, 2:55-3:4. Modifying the *Attard-Hampiholi* SDV in this way would have been use of known technique of taking a particular corrective action (transition to manual control) responsive to a fault to improve the *Attard-Hampiholi* SDV in the same way as *McNew's. Dec.*, 333-335.

A POSITA would have understood that modifying *Attard-Hampiholi* to include a corrective action of transferring controls to manual would have had a REOS. *Dec.*, 333-338. Modifying *Attard-Hampiholi* per *McNew* would have required only straightforward changes to programming instructions. *Dec.*, 337-338.

B. Claim 38**1. Claim 38(a)**

Hampiholi teaches comparison to a third threshold [that] is between the first threshold and the second threshold.



Hampiholi, FIG. 4. Dec., 339.

2. *Claim 38(b)*

In the *Attard-Hampiholi* SDV, a third fault is determin[ed] when Φ is between the third threshold and the second threshold, i.e., when Φ is in the 2nd range. *Dec.*, 340.

C. **Claim 39**

1. *Claim 39(a)*

Attard teaches sensors 110 determine road conditions. *Attard*, 4:42-56, 7:14-17. A POSITA would have understood *Attard*'s disclosures of detecting road attributes using sensors 110 to teach *determining a current condition of a roadway*. *Attard*'s road condition is a *current condition* because it is detected by *Attard*'s SDV, which is traveling on the roadway. *Dec.*, 341.

2. *Claim 39(b)*

Attard teaches actions responsive to a fault that include “pull over and stop” and “limp home” operations. *Attard*, 2:46-54. Either operation *autonomously alter[s] a route being taken by the SDV*. *Dec.*, 342.

a) **Motivation to Combine**

The *Attard-Hampiholi* SDV does not expressly teach performing the limp home or pull over operations *when the third fault occurs*. However, a POSITA would have found it obvious and been motivated to modify *Attard* accordingly because *Attard* teaches “the nature of a fault may indicate an action” thus suggesting that

either the pull over or limp home operations would be an indicated action taken *when the third fault occurs*. *Attard*, 14:63-64. *Dec.*, 343-345.

Such a modification is merely the combination of known elements according to known methods to yield predictable results. *Attard* teaches (A) operations that *autonomously alter[] a route being taken by the SDV* and (B) association of faults with actions. *Attard*, 2:46-54, 14:63-64. While *Attard* lacks the explicit connection between such actions and Φ being between a third threshold and a second threshold, a POSITA would have found it obvious to modify *Attard* to associate, e.g., a pull-to-shoulder operation with the *third fault*. *Dec.*, 343-345.

Such a modification would have had a REOS because it would have simply required reprogramming *Attard-Hampiholi* to associate the pull-to-shoulder operation with the third fault, e.g., using *Frazer's* table. *Dec.*, 343-345.

XVI. CONCLUSION

For the foregoing reasons, Petitioner respectfully requests *inter partes* review of the Challenged Claims.

Respectfully submitted,

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COUNSEL FOR PETITIONER

XVII.MANDATORY NOTICES UNDER 37 C.F.R. § 42.8(A)(1)**A. Real Party-In-Interest**

Petitioner is the real party-in-interest. 37 C.F.R. § 42.8(b)(1).

B. Related Matters

The '004 Patent is presently the subject of a patent infringement lawsuit filed against Petitioner: *Granite Vehicle Ventures LLC v. Tesla, Inc.*, 2:24-cv-01007, No. 1 (E.D. Tex.) Dec. 6, 2024.

C. Lead and Back-Up Counsel

Petitioners provide the following designation and service information for lead and back-up counsel. 37 C.F.R. § 42.8(b)(3) and (b)(4).

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D. 37 C.F.R. § 42.8(b)(4) – Service Information

Please address all correspondence to the lead and back-up counsel as shown above. Petitioner consents to electronic service by e-mail at the e-mail addresses provided above.

CLAIM LISTING APPENDIX**U.S. Patent No. 12,037,004 for Claims 1-9, 29-39**

Claim Designation	Claim Language
Claim 1(Pre)	A computer program product for controlling a driving mode of a self-driving vehicle (SDV), the computer program product comprising a non-transitory computer readable storage medium having instructions that, when executed, cause at least one data processing apparatus to perform operations comprising:
Claim 1(a)	receiving a plurality of sensor readings from a system of sensors, wherein the system of sensors comprises: a steering wheel sensor, a speedometer, a GPS sensor, and a camera;
Claim 1(b)	determining a competence level of a human driver using one or more of the sensor readings;
Claim 1(c)	determining a competence level of the SDV using one or more of the sensor readings;
Claim 1(d)	comparing the competence level of the human driver to a first threshold;
Claim 1(e)	comparing the competence level of the human driver to a second threshold, wherein the second threshold is different from the first threshold;
Claim 1(f)	determining that no fault has occurred when the competence level of the human driver exceeds the first threshold and exceeds the second threshold;
Claim 1(g)	determining that a first fault has occurred when the competence level of the human driver exceeds the second threshold and is below the first threshold;
Claim 1(h)	determining that a second fault has occurred when the competence level of the human driver is below the first threshold and is below the second threshold;
Claim 1(i)	determining, using a fault remediation table, a first corrective action associated with the first fault, wherein the first corrective action comprises sounding a warning sound and displaying an icon on a display screen;
Claim 1(j)	determining, using the fault remediation table, a second corrective action associated with the second fault, wherein the second corrective action comprises decreasing a speed of the SDV and transferring driver controls to manual control;

Claim Designation	Claim Language
Claim 1(k)	autonomously controlling the driver controls without requiring the human driver to control the driver controls when no fault has occurred, wherein the driver controls comprise: engine throttle, steering mechanism, and braking system;
Claim 1(l)	taking the first corrective action when the first fault has occurred; and
Claim 1(m)	taking the second corrective action when the second fault has occurred.
Claim 2(a)	The computer program product of claim 1, further comprising: determining the competence level of the human driver comprises using a weighted voting system with a first plurality of inputs and a first plurality of weights, wherein:
Claim 2(b)	the first plurality of inputs comprises one or more of the sensor readings;
Claim 2(c)	at least one of the first plurality of inputs is multiplied by a weight from among the first plurality of weights, wherein the first plurality of weights are based on first active learning data, the first active learning data comprising information about a first cohort of human drivers of other SDVs;
Claim 2(d)	determining the competence level of the SDV comprises using the weighted voting system with a second plurality of inputs and a second plurality of weights, wherein:
Claim 2(e)	the second plurality of inputs comprises one or more of the sensor readings;
Claim 2(f)	the second plurality of inputs comprises at least one sensor reading that is not in the first plurality of inputs;
Claim 2(g)	the first plurality of inputs comprises at least one sensor reading that is not in the second plurality of inputs; and
Claim 2(h)	at least one of the second plurality of inputs is multiplied by a weight from among the second plurality of weights, wherein the second plurality of weights are based on second active learning data, the second active learning data comprising condition data from a second cohort of other SDVs, wherein the condition data shares one or more traits with a current condition of a roadway on which the SDV is currently traveling.

Claim Designation	Claim Language
Claim 3(a)	The computer program product of claim 2, further comprising: when no fault has occurred, autonomously maintaining a buffer of space from other vehicles around the SDV without requiring the human driver to control the driver controls;
Claim 3(b)	obtaining the first plurality of weights by querying a database; and
Claim 3(c)	obtaining the second plurality of weights by querying the database.
Claim 4(a)	The computer program product of claim 3, further comprising: tracking a number of times the first fault has occurred; and
Claim 4(b)	determining the competence level of the human driver using the number of times the first fault has occurred.
Claim 5(a)	The computer program product of claim 3, further comprising: tracking a length of time during which the first fault has occurred; and
Claim 5(b)	determining the competence level of the human driver using the length of time during which the first fault has occurred.
Claim 6(a)	The computer program product of claim 1, further comprising: determining, using one or more of the sensor readings, whether the SDV is travelling on a first roadway type or a second roadway type of a plurality of roadway types;
Claim 6(b)	determining the competence level of the SDV comprises determining whether the SDV is currently operating in a first autonomous mode of a plurality of autonomous modes;
Claim 6(c)	determining that a third fault has occurred when the SDV is currently travelling on the second roadway type and the competence level of the SDV is below a third threshold; and
Claim 6(d)	determining, using the fault remediation table, a third corrective action associated with the third fault, wherein the third corrective action comprises transferring the driver controls to manual control.
Claim 7(a)	The computer program product of claim 6, further comprising: the first roadway type comprises a public highway;
Claim 7(b)	the second roadway type does not comprise a public highway;
Claim 7(c)	operating in the first autonomous mode comprises autonomously controlling the driver controls without requiring the human driver to control the driver controls; and

Claim Designation	Claim Language
Claim 7(d)	determining the competence level of the SDV comprises determining that the competence level of the SDV is below the third threshold when the SDV is not currently operating in the first autonomous mode.
Claim 8(a)	The computer program product of claim 1, further comprising: sensing an operational state of a first camera sensor;
Claim 8(b)	determining, using a weighted voting system with a first plurality of inputs and a first plurality of weights, whether the first camera sensor is currently experiencing an operational anomaly;
Claim 8(c)	the first plurality of inputs comprises sensor readings from the first camera sensor;
Claim 8(d)	at least one of the first plurality of inputs is multiplied by a weight from among the first plurality of weights,
Claim 8(e)	wherein the first plurality of weights are based on first active learning data, the first active learning data comprising information about a cohort of other SDVs experiencing a camera sensor operational anomaly;
Claim 8(f)	determining that a third fault has occurred when the first camera sensor is currently experiencing an operational anomaly.
Claim 9(a)	The computer program product of claim 8, further comprising: determining the competence level of the human driver comprises using the weighted voting system with a second plurality of inputs and a second plurality of weights, wherein;
Claim 9(b)	the second plurality of inputs comprises one or more of the sensor readings;
Claim 9(c)	at least one of the second plurality of inputs is multiplied by a weight from among the second plurality of weights, wherein the second plurality of weights are based on second active learning data, the second active learning data comprising sensor readings about a first cohort of human drivers of other SDVs:
Claim 9(d)	determining the competence level of the SDV comprises using the weighted voting system with a third plurality of inputs and a third plurality of weights, wherein:
Claim 9(e)	the third plurality of inputs comprises one or more of the sensor readings;

Claim Designation	Claim Language
Claim 9(f)	the third plurality of inputs comprises at least one sensor reading that is not in the first plurality of inputs and is not in the second plurality of inputs;
Claim 9(g)	the second plurality of inputs comprises at least one sensor reading that is not in the first plurality of inputs and is not in the third plurality of inputs; and
Claim 9(h)	at least one of the third plurality of inputs is multiplied by a weight from among the third plurality of weights, wherein the third plurality of weights are based on third active learning data, the third active learning data comprising sensor readings about condition data from a second cohort of other SDVs, wherein the condition data shares one or more traits with a current condition of a roadway on which the SDV is currently traveling.
Claim 29(Pre)	A computer program product for controlling a driving mode of a self-driving vehicle (SDV), the computer program product comprising a non-transitory computer readable storage medium having program code embodied therewith, the program code readable and executable by a processor to perform a method comprising:
Claim 29(a)	receiving a plurality of sensor readings from a system of sensors, the system of sensors comprising:
Claim 29(a)(i)	a camera directed at a human driver;
Claim 29(a)(ii)	a camera directed away from the SDV;
Claim 29(a)(iii)	a sensor configured to detect input from a steering wheel;
Claim 29(a)(iv)	a GPS sensor;
Claim 29(a)(v)	a thermometer; and
Claim 29(a)(vi)	a speedometer;
Claim 29(b)	displaying, on a display screen, one or more sensor readings of the sensor readings;
Claim 29(c)	determining, using one or more sensor readings of the sensor readings, a position of another vehicle currently on a roadway;
Claim 29(d)	determining a competence level of the SDV using one or more of the sensor readings, wherein the competence level of the SDV is a function of a degree of uncertainty in the determined position of the other vehicle;

Claim Designation	Claim Language
Claim 29(e)	autonomously controlling driver controls without requiring the human driver to control the driver controls, wherein the driver controls comprise: engine throttle, a steering mechanism, and braking system;
Claim 29(f)	autonomously maintaining a buffer of space between the SDV and the other vehicle;
Claim 29(g)	determining a competence level of a human driver using one or more of the sensor readings;
Claim 29(h)	determining, using a fault remediation table, a first corrective action associated with a first human competence level, wherein the first corrective action comprises sounding a warning sound and displaying an icon on a display screen;
Claim 29(i)	determining, using the fault remediation table, a second corrective action associated with a second human competence level, wherein the second corrective action comprises decreasing a speed of the SDV and transferring driver controls to manual control;
Claim 29(j)	taking the first corrective action when the competence level of the human driver satisfies a first competence quota; and
Claim 29(k)	taking the second corrective action when the competence level of the human driver satisfies a second competence quota.
Claim 30(a)	The computer program product of claim 29, further comprising: displaying, on the display screen, a graphical representation of the position of the other vehicle relative to the SDV and a graphical representation of the competence level of the SDV.
Claim 31(a)	The computer program product of claim 29, further comprising: determining the competence level of the human driver comprises using a weighted voting system with a first plurality of inputs and a first plurality of weights, wherein:
Claim 31(b)	the first plurality of inputs comprises one or more sensor readings of the sensor readings;
Claim 31(c)	at least one of the first plurality of inputs is multiplied by a weight from among the first plurality of weights, wherein the first plurality of weights are based on first active learning data, the first active learning data comprising information about a first cohort of human drivers of other SDVs; and

Claim Designation	Claim Language
Claim 31(d)	determining the competence level of the SDV comprises using the weighted voting system with a second plurality of inputs and a second plurality of weights, wherein:
Claim 31(e)	the second plurality of inputs comprises one or more of the sensor readings;
Claim 31(f)	the second plurality of inputs comprises at least one sensor reading that is not in the first plurality of inputs; and
Claim 31(g)	at least one of the second plurality of inputs is multiplied by a weight from among the second plurality of weights, wherein the second plurality of weights are based on second active learning data, the second active learning data comprising condition data from a second cohort of other SDVs, wherein the condition data shares one or more traits with a current condition of the roadway on which the SDV is currently traveling.
Claim 32(a)	The computer program product of claim 31, further comprising: determining, using one or more sensor readings of the sensor readings, the position of a lane marking on the roadway;
Claim 32(b)	determining, using one or more sensor readings of the sensor readings, the position of a traffic signal; and
Claim 32(c)	displaying, on the display screen, a simultaneous graphical representation of the position of the other vehicle, the position of the lane marking on the roadway, the position of the traffic signal, and the competence level of the SDV.
Claim 33(a)	The computer program product of claim 32, further comprising: autonomously changing lanes without requiring the human driver to control the driver controls;
Claim 33(b)	autonomously engaging a turn signal of the SDV prior to autonomously changing lanes without requiring the human driver to control the turn signal;
Claim 33(c)	determining, using the fault remediation table, a third corrective action associated with a first SDV competence level; and
Claim 33(d)	taking the third corrective action when the competence level of the SDV is equivalent to or below the first SDV competence level.
Claim 34(a)	The computer program product of claim 33, further comprising: the third corrective action comprises decreasing a speed of the SDV and transferring the driver controls to manual control; and

Claim Designation	Claim Language
Claim 34(b)	the competence level of the human driver is a function of a sensor reading from the camera directed at the human driver.
Claim 35(a)	The computer program product of claim 34, further comprising: retrieving a human driver profile from a database;
Claim 35(b)	determining, using the fault remediation table, a fourth corrective action associated with a first human driver profile quota, wherein the fourth corrective action comprises disabling an autonomous driving mode; and
Claim 35(c)	taking the fourth corrective action when the human driver profile is equivalent to or below the first human driver profile quota.
Claim 36(a)	The computer program product of claim 35, further comprising: the human driver profile is a function of a previous sensor reading from the camera directed at the human driver;
Claim 36(b)	the human driver profile is a function of a previous sensor reading from the camera directed away from the SDV;
Claim 36(c)	the human driver profile is a function of a previous sensor reading from the sensor configured to detect input from the steering wheel; and
Claim 36(d)	the human driver profile is a function of a previous sensor reading from the speedometer.
Claim 37(Pre)	A computer program product for controlling a driving mode of a self-driving vehicle (SDV), the computer program product comprising a non-transitory computer readable storage medium having program code embodied therewith, the program code readable and executable by a processor to perform a method comprising:
Claim 37(a)	receiving one or more sensor readings from a system of sensors, wherein the system of sensors comprises one or more sensors that detect an operational state of the SDV, the one or more sensors comprising:
Claim 37(a)(i)	a camera directed away from the SDV;
Claim 37(a)(ii)	a sensor configured to detect input from a steering wheel;
Claim 37(a)(iii)	a GPS sensor;
Claim 37(a)(iv)	a thermometer; and
Claim 37(a)(v)	a speedometer;

Claim Designation	Claim Language
Claim 37(b)	determining a competence level of a control processor as a function of the operational state of the SDV;
Claim 37(c)	comparing the competence level of the control processor to a first threshold;
Claim 37(d)	comparing the competence level of the control processor to a second threshold, wherein the first threshold is higher than the second threshold;
Claim 37(e)	autonomously controlling driver controls without requiring a human driver to control the driver controls when the competence level of the control processor is above the first threshold;
Claim 37(f)	determining a first fault has occurred when the competence level of the control processor is between the first threshold and the second threshold;
Claim 37(g)	determining a second fault has occurred when the competence level of the control processor is below the second threshold; and
Claim 37(h)	performing a corrective action listed in a fault remediation table, comprising:
Claim 37(h)(i)	displaying a warning message on a display screen when the first fault occurs; and
Claim 37(h)(ii)	sounding a warning sound, displaying a warning message, displaying an icon on the display screen, and transferring the driver controls to manual control when the second fault occurs.
Claim 38(a)	The computer program product of claim 37, further comprising: comparing the competence level of the control processor to a third threshold, wherein the third threshold is between the first threshold and the second threshold; and
Claim 38(b)	determining a third fault has occurred when the competence level of the control processor is between the third threshold and the second threshold.
Claim 39(a)	The computer program product of claim 38, further comprising: the operational state of the SDV comprises a current weather condition of a roadway on which the SDV is currently traveling; and
Claim 39(b)	autonomously altering a route being taken by the SDV when the third fault occurs.

APPENDIX OF EXHIBITS

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 1003	Declaration of Christopher Wilson
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	U.S. Patent No. 9,688,145 to Kang (“ <i>Kang</i> ”)
Exhibit 1010	U.S. Patent No. 9,451,030 to Schunder et al. (“ <i>Schunder</i> ”)
Exhibit 1011	U.S. Patent No. 9,714,037 to DeRuyck et al. (“ <i>DeRuyck</i> ”)
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> ”)
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.” <i>IEEE Transactions</i>

	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	Intentionally Left Blank
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 (“ <i>Sako</i> ”)
Exhibit 1041	U.S. Patent No. 10,086,844 (“ <i>Coelingh</i> ”)
Exhibit 1042	U.S. Patent No. 9,475,491 (“ <i>Nagasaka</i> ”)
Exhibit 1043	U.S. Patent No. 8,305,444 (“ <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	Intentionally Left Blank
Exhibit 1047	Intentionally Left Blank
Exhibit 1048	Intentionally Left Blank
Exhibit 1049	U.S. Patent Application Publication No. 2016/0107655 to Desnoyer et al. (“ <i>Desnoyer</i> ”)

Exhibit 1050	U.S. Patent No. 9,242,647 to Tsimhoni et al. (“ <i>Tsimhoni-647</i> ”)
Exhibit 1051	California Vehicle Code 22108. https://leginfo.legislature.ca.gov/faces/codes_displaySection.xhtml?lawCode=VEH&sectionNum=22108 . Enacted by Stats. 1959, Ch. 3. (“22108”)
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.green-carcongress.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	Intentionally Left Blank
Exhibit 1057	Mercedes S-Class Operator’s Manual (“ <i>Mercedes S-Class Manual</i> ”)
Exhibit 1058	Disclosure of Asserted Claims <i>Granite Vehicle Ventures LLC v. Tesla, Inc.</i> , 2:24-cv-01007, No. 1 (E.D. Tex.)

CERTIFICATION OF WORD COUNT

The undersigned certifies pursuant to 37 C.F.R. §42.24 that the foregoing Petition for *Inter Partes* Review, excluding any table of contents, mandatory notices under 37 C.F.R. §42.8, certificates of service or word count, or appendix of exhibits, contains 13,950 words according to the word-processing program used to prepare this document (Microsoft Word).

Dated: May 28, 2025

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CERTIFICATE OF SERVICE ON PATENT OWNER
UNDER 37 C.F.R. § 42.105

Pursuant to 37 C.F.R. §§ 42.6(e) and 42.105(b), the undersigned certifies that on May 28, 2025, a complete and entire copy of this Petition for *Inter Partes* Review and Exhibits were provided via Federal Express to the Patent Owner by serving the correspondence address of record for the '004 Patent:

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Further, a courtesy copy of this Petition for *Inter Partes* Review was sent via email to Patent Owner's litigation counsel:

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