

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. IPR2025-00944

OF U.S. PATENT NO. 11,738,765

DECLARATION OF CHRISTOPHER WILSON

TABLE OF CONTENTS

I.	INTRODUCTION.....	27
A.	EDUCATIONAL BACKGROUND AND PROFESSIONAL EXPERIENCE	27
II.	METHODOLOGY; MATERIALS CONSIDERED	30
III.	OVERVIEW AND LEGAL STANDARDS	33
A.	PERSON OF ORDINARY SKILL IN THE ART	33
B.	OBVIOUSNESS	34
C.	ANALOGOUS ART.....	40
D.	CLAIM CONSTRUCTION	40
IV.	LEVEL OF A PERSON OF ORDINARY SKILL.....	41
V.	BACKGROUND OF THE TECHNOLOGY	42
A.	HISTORY OF AUTONOMOUS VEHICLES	42
B.	FAULTS	44
C.	DRIVING MODES	49
D.	ASSESSING COMPETENCE LEVELS	50
1.	<i>Driver Competence</i>	50
2.	<i>SDV Competence</i>	52
E.	SDV INFRASTRUCTURE.....	53
1.	<i>SDV Hardware</i>	54
a)	Sensors	55
b)	Displays	57
c)	Braking and Steering	58
2.	<i>SDV Software</i>	58
VI.	OVERVIEW OF THE PRIOR ART	61
A.	ATTARD	61
B.	FRAZER	61
C.	McNEW	62
D.	HAMPIHOLI	63

E.	KANG.....	64
F.	SCHUNDER	64
G.	DERUYCK	65
H.	GUNDERSON	66
I.	AN	66
VII.	 GROUNDS OF UNPATENTABILITY	67
VIII.	 GROUND 1: CLAIMS 1, 2, AND 17 ARE OBVIOUS OVER ATTARD, FRAZER AND MCNEW	68
A.	CLAIM 1	68
1.	<i>Claim 1(Pre): “A computer program product for controlling a driving mode of a self-driving vehicle (SDV), the computer program product comprising a non-transitory computer readable storage medium having program code embodied therewith, the program code readable and executable by a processor to perform a method comprising:”</i>	<i>68</i>
a)	Attard Teaches Controlling a Driving Mode.....	68
b)	Attard’s Computer Program Product Comprises Non-Transitory Computer-Readable Memory and Processor	72
2.	<i>Claim 1(a): “receiving sensor readings from a system of sensors, wherein the sensor readings describe a current operational state of a SDV;”</i>	<i>74</i>
a)	Attard’s System of Sensors and Sensor Readings.....	74
b)	Attard’s Sensor Readings Describe a Current Operational State of an SDV	77
3.	<i>Claim 1(b): “determining based on the sensor readings, by one or more processors, whether a fault has occurred;”</i>	<i>78</i>
a)	’765 Patent’s Fault Description.....	78
b)	Attard’s Fault Teachings	79
c)	Vector Components φ_i	83
4.	<i>Claim 1(c): “determining, by the one or more processors, whether the fault exceeds a threshold for danger;”</i>	<i>87</i>
a)	Overall Confidence Assessment Φ	89

5.	<i>Claim 1(d): “determining a corrective action associated with the fault using a fault-remediation table;”</i>	90
a)	Attard Teaches a Corrective Action Associated with a Fault.....	90
b)	Frazer Teaches a Fault-Remediation Table.....	91
c)	Motivation to Combine Attard-Frazer.....	94
6.	<i>Claim 1(e): “the SDV implementing the corrective action;”</i>	100
7.	<i>Claim 1(f): “wherein, the sensor readings comprise a reading from a GPS sensor;”</i>	102
8.	<i>Claim 1(g): “the fault comprises a current weather condition of the roadway on which the SDV is currently traveling;”</i>	102
9.	<i>Claim 1(h): “determining whether the fault exceeds a threshold for danger comprises determining a control processor competence level;”</i>	104
a)	’765 Patent’s CPCL	105
b)	Attard’s CPCL – Φ	105
10.	<i>Claim 1(i): “the corrective action comprises transferring driver controls to manual control and alerting a human driver to take over immediately.”</i>	109
a)	Attard Teaches Alerting a Human Driver to Take Over Immediately.....	109
b)	McNew Teaches Transferring Driver Controls to Manual Control.....	111
c)	Motivation to Combine Attard-Frazer-McNew	114
B.	CLAIM 2	118
1.	<i>Claim 2(Pre)</i>	118
2.	<i>Claim 2(a): “...wherein the sensor readings comprise a reading from a GPS sensor;”</i>	118
3.	<i>Claim 2(b): “...the fault comprises a road condition, wherein the road condition comprises an absence of lane markings;”</i>	118

4.	<i>Claim 2(c): “determining whether the fault exceeds a threshold for danger comprises determining a control processor competence level;”</i>	119
5.	<i>Claim 2(d): “the corrective action comprises transferring driver controls to manual control and alerting a human driver to take over immediately.”</i>	119
C.	CLAIM 17	119
1.	<i>Claim 17(Pre)</i>	119
2.	<i>Claim 17(a): “receiving sensor readings...”</i>	119
3.	<i>Claim 17(b): “determining ... whether a fault has occurred;”</i>	119
4.	<i>Claim 17(c): “determining... whether the fault exceeds a threshold for danger;”</i>	119
5.	<i>Claim 17(d): “determining a corrective action associated with the fault using a fault-remediation table;”</i>	119
6.	<i>Claim 17(f): “...a GPS sensor;”</i>	119
7.	<i>Claim 17(g): “...a current weather condition of the roadway...;”</i>	120
8.	<i>Claim 17(h): “...determining a control processor competence level;”</i>	120
9.	<i>Claim 17(i): “... transferring driver controls to manual control and alerting a human driver to take over.”</i>	120
IX.	GROUND 2: CLAIM 7 IS OBVIOUS OVER HAMPIHOLI AND ATTARD	120
A.	THE HAMPIHOLI-ATTARD SELF-DRIVING VEHICLE	120
B.	CLAIM 7	122
1.	<i>Claim 7(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:”</i>	122
a)	<i>Hampiholi-Attard Teaches Controlling a Driving Mode</i>	123

b)	Hampiholi’s Computer Program Product Comprises Non-Transitory Computer-Readable Memory and Processor	124
2.	<i>Claim 7(a): “determining a competence level of a human driver, wherein the competence level describes a competence level of the human driver in controlling the SDV;”</i>	<i>125</i>
3.	<i>Claim 7(b): “receiving sensor readings from a system of sensors about the competence level of the human driver;”</i>	<i>129</i>
a)	Hampiholi’s System of Sensors	129
4.	<i>Claim 7(c): “wherein the SDV is operable to provide autonomous control of driver controls comprising: engine throttle, steering mechanism, braking system, and navigation;”</i>	<i>133</i>
a)	Motivation to Combine	135
5.	<i>Claim 7(d): “determining a competence level of a processor;”</i>	<i>137</i>
a)	Motivation to Combine Hampiholi-Attard.....	138
6.	<i>Claim 7(e): “determining a corrective action; the SDV implementing the corrective action.”</i>	<i>140</i>
X.	GROUND 3: CLAIMS 3-4, 18-19 ARE OBVIOUS OVER ATTARD, FRAZER, MCNEW, AN, KANG, AND SCHUNDER	143
A.	CLAIM 3	143
1.	<i>Claim 3(Pre)</i>	<i>143</i>
2.	<i>Claim 3(a): “determining the control processor competence level comprises using a weighted voting system, the weighted voting system comprising:”</i>	<i>143</i>
a)	’765 Patent’s Weighted Voting	143
b)	Attard’s Weighted Voting System	143
c)	An’s Teachings.....	144
d)	Motivation to Combine Attard-Frazer-McNew-An	146
3.	<i>Claim 3(a)(i): “a first plurality of inputs and a first plurality of weights, wherein the first plurality of inputs comprise sensor readings from a first camera sensor; and”</i>	<i>147</i>

4.	<i>Claim 3(b): “multiplying at least one of the first plurality of inputs by a weight from among the first plurality of weights;”</i>	149
5.	<i>Claim 3(b)(i)): “wherein the first plurality of weights are based on active learning data; and wherein the active learning data includes weather condition data”</i>	150
a)	Kang’s Weights	150
b)	Motivation to Combine Attard-Frazer-McNew-An-Kang	152
6.	<i>Claim 3(b)(ii)): “[wherein the active learning data includes weather condition data] from a cohort of other SDVs, wherein the weather condition data shares one or more traits with the current weather condition of the roadway on which the SDV is currently traveling.”</i>	155
a)	Schunder’s Weather Condition Data	157
b)	Motivation to Combine Attard-Frazer-McNew-An-Kang-Schunder	159
B.	CLAIM 4	164
1.	<i>Claim 4(Pre)</i>	164
2.	<i>Claim 4(a): “when the fault does not exceed the threshold for danger, the SDV autonomously controls the driver controls, wherein said driver controls comprise: engine throttle, steering mechanism, braking system, and navigation;”</i>	165
3.	<i>Claim 4(b): “the SDV autonomously maintains a buffer of space from other vehicles around the SDV and the SDV autonomously controls the steering of the SDV while autonomously controlling the driver controls, without requiring the human driver to operate the driver controls; and”</i>	165
4.	<i>Claim 4(c): “when the fault exceeds the threshold for danger, the SDV takes the corrective action.”</i>	166
C.	CLAIM 18	167
1.	<i>Claim 18(Pre): “The computer program product of claim 17, further comprising:”</i>	167

2.	<i>Claim 18(a): “determining the control processor competence level comprises using a weighted voting system, the weighted voting system comprising:”</i>	167
3.	<i>Claim 18(a)(i): “: a first plurality of inputs and a first plurality of weights, wherein the first plurality of inputs comprise sensor readings from a first camera sensor; and”</i>	167
4.	<i>Claim 18(b): “multiplying at least one of the first plurality of inputs by a weight from among the first plurality of weights;”</i>	167
5.	<i>Claim 18(b)(i): “wherein the first plurality of weights are based on active learning data; and”</i>	167
6.	<i>Claim 18(b)(ii): “wherein the active learning data includes weather condition data from a cohort of other SDVs, wherein the weather condition data shares one or more traits with the current weather condition of the roadway on which the SDV is currently traveling.”</i>	167
D.	CLAIM 19	168
1.	<i>Claim 19(Pre): “The computer program product of claim 18, further comprising:”</i>	168
2.	<i>Claim 19(a): “when the fault does not exceed the threshold for danger, the SDV autonomously controls the driver controls, wherein said driver controls comprise: engine throttle, steering mechanism, braking system, and navigation;”</i>	168
3.	<i>Claim 19(b): “the SDV autonomously maintains a buffer of space from other vehicles around the SDV and the SDV autonomously controls the steering of the SDV while autonomously controlling the driver controls, without requiring the human driver to operate the driver controls; and”</i>	168
4.	<i>Claim 19(c): “when the fault exceeds the threshold for danger, the SDV takes the corrective action.”</i>	168
XI.	GROUND 4: CLAIMS 5, 20 ARE OBVIOUS OVER ATTARD, FRAZER, MCNEW, AN, KANG, SCHUNDER, DERUYCK, AND GUNDERSON	168
A.	CLAIM 5	168
1.	<i>Claim 5(Pre)</i>	168

2.	<i>Claim 5(a): “determining a competence level of a human driver, comprising using the weighted voting system, the weighted voting system further comprising:”</i>	169
3.	<i>Claim 5(a)(i): “a second plurality of inputs and a second plurality of weights, wherein the second plurality of inputs comprise sensor readings from a second camera sensor; and”</i>	171
	a) DeRuyck’s Plurality of Inputs and Weights	171
	b) Motivation to Combine Attard-Frazer-McNew-An-Kang-Schunder-DeRuyck	172
4.	<i>Claim 5(b): “multiplying at least one of the second plurality of inputs by a weight from among the second plurality of weights;”</i>	176
5.	<i>Claim 5(c): “wherein the second plurality of weights are based on active learning data that includes information about a cohort of human drivers of other SDVs.”</i>	176
	a) Gunderson’s Active Learning Data	176
	b) Motivation to Combine Attard-Frazer-McNew-An-Kang-Schunder-DeRuyck-Gunderson	180
B.	CLAIM 20	183
1.	<i>Claim 20(Pre): “The computer program product of claim 19, further comprising:”</i>	183
2.	<i>Claim 20(a): “determining a competence level of a human driver, comprising using the weighted voting system, the weighted voting system further comprising:”</i>	183
3.	<i>Claim 20(a)(i): “a second plurality of inputs and a second plurality of weights, wherein the second plurality of inputs comprise sensor readings from a second camera sensor”</i>	183
4.	<i>Claim 20(b): “multiplying at least one of the second plurality of inputs by a weight from among the second plurality of weights;”</i>	184
5.	<i>Claim 20(c): “wherein the second plurality of weights are based on active learning data that includes information about a cohort of human drivers of other SDVs.”</i>	184

**XII. GROUND 5: CLAIM 6 IS OBVIOUS OVER ATTARD, FRAZER,
AND HAMPIHOLI.....184**

A.	CLAIM 6	184
1.	<i>Claim 6(Pre)</i>	<i>184</i>
2.	<i>Claim 6(a): “a sensor system comprising a plurality of sensors;”</i>	<i>184</i>
3.	<i>Claim 6(b): “vehicle controls comprising: engine throttle, steering mechanism, and braking system;”</i>	<i>184</i>
4.	<i>Claim 6(c): “a computer system comprising a processor coupled to a non-transitory computer readable storage medium containing program code, the program code readable and executable by a processor;”</i>	<i>185</i>
5.	<i>Claim 6(d): “the computer system is capable of receiving a sensor reading from the system of sensors;”</i>	<i>185</i>
6.	<i>Claim 6(e): “the computer system is capable of operating the vehicle controls;”</i>	<i>186</i>
7.	<i>Claim 6(f): “the computer system is capable of determining the operational state of the self-driving vehicle (SDV);”</i>	<i>186</i>
8.	<i>Claim 6(g): “the computer system is capable of determining a vehicle fault;”</i>	<i>186</i>
9.	<i>Claim 6(h): “the computer system is capable of determining a competence level of the processor;”</i>	<i>186</i>
10.	<i>Claim 6(i): “the computer system is capable of determining competence level of a human driver;”</i>	<i>186</i>
11.	<i>Claim 6(j): “the computer system is capable of determining a corrective action using the competence level of the processor and the competence level of the human driver;”</i>	<i>186</i>
a)	Motivation to Combine Attard-Frazer-Hampiholi	190
12.	<i>Claim 6(k): “the computer system is capable of implementing the corrective action; and”</i>	<i>194</i>
13.	<i>Claim 6(l): “the computer system is capable of issuing an alert indicating the corrective action;”</i>	<i>194</i>
14.	<i>Claim 6(m): “the system of sensors comprises a GPS sensor;”</i>	<i>194</i>

15. Claim 6(n): “the operational state of the self-driving vehicle comprises a first road condition;” 194
16. Claim 6(o): “the vehicle fault comprises an absence of a sensor reading;” 194
17. Claim 6(p): “the corrective action comprises querying a database for the proper action to take.” 194

XIII. GROUND 6: CLAIM 8 IS OBVIOUS OVER HAMPIHOLI, ATTARD, FRAZER, DERUYCK, SCHUNDER.....195

- A. CLAIM 8 195
1. Claim 8(Pre): “The computer program product of claim 7, wherein:” 195
 2. Claim 8(a): “the sensor readings comprise a reading from a GPS sensor and a reading from a speedometer;” 195
 3. Claim 8(b): “determining the competence level of the processor comprises weighted voting;” 195
 4. Claim 8(c): “determining the competence level of the human driver comprises weighted voting;” 195
 5. Claim 8(d): “determining the corrective action comprises using active learning data, said active learning data including information from other SDVs;” 196
 6. Claim 8(e): “the corrective action comprises querying a database for the proper action to take.” 196

XIV. GROUND 7: CLAIMS 10-11 ARE OBVIOUS OVER HAMPIHOLI, ATTARD, DERUYCK, AND GUNDERSON 196

- A. CLAIM 10 196
1. Claim 10(Pre): “The computer program product of claim 7, further comprising:” 196
 2. Claim 10(a): “determining the competence level of the human driver comprises using a weighted voting system, the weighted voting system comprising: a plurality of inputs and a plurality of weights,” 197
 3. Claim 10(b): “The plurality of inputs comprising sensor readings from a camera sensor; and” 197

4.	<i>Claim 10(c): “multiplying at least one of the plurality of inputs by a weight from among the plurality of weights;”</i>	197
5.	<i>Claim 10(d): “wherein the plurality of weights are based on active learning data that includes information about a cohort of human drivers of other SDVs.”</i>	197
B.	CLAIM 11	197
1.	<i>Claim 11(Pre): “The computer program product of claim 10, further comprising:”</i>	197
2.	<i>Claim 11(a): “when the competence level of the human driver is above a first threshold, the SDV autonomously controls the driver controls without requiring the human driver to operate the driver controls;”</i>	197
3.	<i>Claim 11(b): “the SDV autonomously maintains a buffer of space from other vehicles around the SDV and the SDV autonomously controls the steering of the SDV while the SDV autonomously controls the driver controls, without requiring the human driver to operate the driver controls;”</i>	202
4.	<i>Claim 11(c): “when the competence level of the human driver is below a second threshold, determining that a first fault has occurred;”</i>	202
5.	<i>Claim 11(d): “determining the corrective action comprises determining a first corrective action corresponding to the first fault; and”</i>	204
6.	<i>Claim 11(e): “the first corrective action comprises issuing an alert while the SDV provides autonomous control of the driver controls without requiring the human driver to operate the driver controls.”</i>	205
XV.	GROUND 8: CLAIM 12 IS OBVIOUS OVER HAMPIHOLI, ATTARD, DERUYCK, GUNDERSON, AND MCNEW	206
A.	CLAIM 12	206
1.	<i>Claim 12(Pre): “The computer program product of claim 11, further comprising:”</i>	206
2.	<i>Claim 12(a): “when the competence level of the human driver is below a third threshold after taking the first corrective action, determining that a second fault has occurred;”</i>	206

3. *Claim 12(b): “determining the corrective action further comprises determining a second corrective action corresponding to the second fault; and”* 207
4. *Claim 12(c): “the second corrective action comprises transferring driver controls to manual control and alerting the human driver to take over.”* 208

XVI. GROUND 9: CLAIM 13 IS OBVIOUS OVER HAMPIHOLI, ATTARD, MCNEW, AN, KANG, AND SCHUNDER.....210

- A. CLAIM 13 210
1. *Claim 13(Pre): “The computer program product of claim 7, further comprising:”* 210
 2. *Claim 13(a): “determining the competence level of the processor comprises using a weighted voting system, the weighted voting system comprising,”* 210
 3. *Claim 13(a)(i): “: a plurality of inputs and a plurality of weights, wherein the plurality of inputs comprise sensor readings from a camera sensor; and”* 210
 4. *Claim 13(b): “multiplying at least one of the plurality of inputs by a weight from among the plurality of weights;”* 210
 5. *Claim 13(b)(i): “wherein the plurality of weights are based on active learning data; and”* 210
 6. *Claim 13(b)(ii): “wherein the active learning data includes condition data from a 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.”* 211

XVII. GROUND 10: CLAIMS 14-15 ARE OBVIOUS OVER HAMPIHOLI, ATTARD, MCNEW, DERUYCK, GUNDERSON, AN, KANG, AND SCHUNDER 211

- A. CLAIM 14 211
1. *Claim 14(Pre): “The computer program product of claim 7, further comprising:”* 211
 2. *Claim 14(a)(i): “determining the competence level of the human driver comprises using a weighted voting system...”* .211

3. *Claim 14(a)(ii): “...with a first plurality of inputs and a first plurality of weights, wherein: the first plurality of inputs comprises sensor readings from a first camera sensor; and”*211
4. *Claim 14(a)(iii): “at least one of the first plurality of inputs is multiplied by a weight from among the first plurality of weights,”* 211
5. *Claim 14(a)(iv): “wherein the first plurality of weights are based on first active learning data, the first active learning data comprising information about a cohort of human drivers of other SDVs;”* 212
6. *Claim 14(b): “determining the competence level of the processor comprises using the weighted voting system...”*....212
7. *Claim 14(b)(i): “with a second plurality of inputs and a second plurality of weights, wherein: the second plurality of inputs comprises sensor readings from a second camera sensor; and”* 212
8. *Claim 14(b)(ii): “at least one of the second plurality of inputs is multiplied by a weight from among the second plurality of weights,”* 212
9. *Claim 14(b)(iii): “wherein the second plurality of weights are based on second active learning data,”* 212
10. *Claim 14(b)(iv): “the second active learning data comprising condition data from a 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;”* 213
11. *Claim 14(c): “the first camera sensor is different from the second camera sensor, the first plurality of inputs is different from the second plurality of inputs, and the first plurality of weights is different from the second plurality of weights;”*....213
12. *Claim 14(d): “when the competence level of the human driver is above a first threshold, the SDV autonomously controls the driver controls without requiring the human driver to operate the driver controls;”* 214
13. *Claim 14(e): “the SDV autonomously maintains a buffer of space from other vehicles around the SDV and the SDV*

	<i>autonomously controls the steering of the SDV while the SDV autonomously controls the driver controls, without requiring the human driver to operate the driver controls;”</i>	214
14.	<i>Claim 14(f): “when the competence level of the human driver is below a second threshold, determining that a first fault has occurred;”</i>	214
15.	<i>Claim 14(g): “determining the corrective action comprises determining a first corrective action corresponding to the first fault; and”</i>	214
16.	<i>Claim 14(h): “the first corrective action comprises issuing an alert while the SDV autonomously controls the driver controls without requiring the human driver to operate the driver controls.”</i>	215
B.	CLAIM 15	215
1.	<i>Claim 15(Pre): “The computer program product of claim 14, further comprising:”</i>	215
2.	<i>Claim 15(a): “when the competence level of the human driver is below a third threshold, after taking the first corrective action, determining that a second fault has occurred;”</i>	215
3.	<i>Claim 15(b): “determining the corrective action further comprises determining a second corrective action corresponding to the second fault; and”</i>	215
4.	<i>Claim 15(c): “the second corrective action comprises transferring driver controls to manual control and alerting the human driver to take over.”</i>	215
XVIII.	GROUND 11: CLAIM 16 IS OBVIOUS OVER HAMPIHOLI, ATTARD, MCNEW, DERUYCK, GUNDERSON, AN, KANG, SCHUNDER, AND FRAZER	215
A.	CLAIM 16	215
1.	<i>Claim 16(Pre): “The computer program product of claim 15, further comprising:”</i>	215
2.	<i>Claim 16(a): “when the competence level of the processor is below a fourth threshold, determining that a third fault has occurred;”</i>	216

3. *Claim 16(b): “determining the corrective action further comprises determining a third corrective action corresponding to the third fault;” 216*
4. *Claim 16(c): “determining the corrective action further comprises using a fault remediation table; and” 217*
5. *Claim 16(d): “the fault remediation table comprises the first fault, the second fault, and the third fault.” 217*

XIX. CONCLUSION.....219

CLAIM LISTING

Claim Designation	Claim Language
Claim 1(Pre)	A computer program product for controlling a driving mode of a self-driving vehicle (SDV), the computer program product comprising a non-transitory computer readable storage medium having program code embodied therewith, the program code readable and executable by a processor to perform a method comprising:
Claim 1(a)	receiving sensor readings from a system of sensors, wherein the sensor readings describe a current operational state of a SDV;
Claim 1(b)	determining based on the sensor readings, by one or more processors, whether a fault has occurred;
Claim 1(c)	determining, by the one or more processors, whether the fault exceeds a threshold for danger;
Claim 1(d)	determining a corrective action associated with the fault using a fault-remediation table;
Claim 1(e)	the SDV implementing the corrective action;
Claim 1(f)	wherein, the sensor readings comprise a reading from a GPS sensor;
Claim 1(g)	the fault comprises a current weather condition of the roadway on which the SDV is currently traveling;
Claim 1(h)	determining whether the fault exceeds a threshold for danger comprises determining a control processor competence level;
Claim 1(i)	the corrective action comprises transferring driver controls to manual control and alerting a human driver to take over immediately.
Claim 2(Pre)	The computer program product of claim 1,
Claim 2(a)	wherein: the sensor readings comprise a reading from a GPS sensor;
Claim 2(b)	the fault comprises a road condition, wherein the road condition comprises an absence of lane markings;
Claim 2(c)	determining whether the fault exceeds a threshold for danger comprises determining a control processor competence level;
Claim 2(d)	the corrective action comprises transferring driver controls to manual control and alerting a human driver to take over immediately.

Claim Designation	Claim Language
Claim 3(Pre)	The computer program product of claim 1, further comprising:
Claim 3(a)	determining the control processor competence level comprises using a weighted voting system, the weighted voting system comprising:
Claim 3(a)(i)	a first plurality of inputs and a first plurality of weights, wherein the first plurality of inputs comprise sensor readings from a first camera sensor; and
Claim 3(b)	multiplying at least one of the first plurality of inputs by a weight from among the first plurality of weights;
Claim 3(b)(i)	wherein the first plurality of weights are based on active learning data; and wherein the active learning data includes weather condition data
Claim 3(b)(ii)	from a cohort of other SDVs, wherein the weather condition data shares one or more traits with the current weather condition of the roadway on which the SDV is currently traveling.
Claim 4(Pre)	The computer program product of claim 3, further comprising:
Claim 4(a)	when the fault does not exceed the threshold for danger, the SDV autonomously controls the driver controls, wherein said driver controls comprise: engine throttle, steering mechanism, braking system, and navigation;
Claim 4(b)	the SDV autonomously maintains a buffer of space from other vehicles around the SDV and the SDV autonomously controls the steering of the SDV while autonomously controlling the driver controls, without requiring the human driver to operate the driver controls; and
Claim 4(c)	when the fault exceeds the threshold for danger, the SDV takes the corrective action.
Claim 5(Pre)	The computer program product of claim 4, further comprising:
Claim 5(a)	determining a competence level of a human driver, comprising using the weighted voting system, the weighted voting system further comprising:
Claim 5(a)(i)	a second plurality of inputs and a second plurality of weights, wherein the second plurality of inputs comprise sensor readings from a second camera sensor; and
Claim 5(b)	multiplying at least one of the second plurality of inputs by a weight from among the second plurality of weights;

Claim Designation	Claim Language
Claim 5(c)	wherein the second plurality of weights are based on active learning data that includes information about a cohort of human drivers of other SDVs.
Claim 6(Pre)	A self-driving vehicle (SDV) comprising:
Claim 6(a)	a sensor system comprising a plurality of sensors;
Claim 6(b)	vehicle controls comprising: engine throttle, steering mechanism, and braking system;
Claim 6(c)	a computer system comprising a processor coupled to a non-transitory computer readable storage medium containing program code, the program code readable and executable by a processor;
Claim 6(d)	the computer system is capable of receiving a sensor reading from the system of sensors;
Claim 6(e)	the computer system is capable of operating the vehicle controls;
Claim 6(f)	the computer system is capable of determining the operational state of the self-driving vehicle (SDV);
Claim 6(g)	the computer system is capable of determining a vehicle fault;
Claim 6(h)	the computer system is capable of determining a competence level of the processor;
Claim 6(i)	the computer system is capable of determining competence level of a human driver;
Claim 6(j)	the computer system is capable of determining a corrective action using the competence level of the processor and the competence level of the human driver;
Claim 6(k)	the computer system is capable of implementing the corrective action; and
Claim 6(l)	the computer system is capable of issuing an alert indicating the corrective action;
Claim 6(m)	the system of sensors comprises a GPS sensor;
Claim 6(n)	the operational state of the self-driving vehicle comprises a first road condition;
Claim 6(o)	the vehicle fault comprises an absence of a sensor reading;
Claim 6(p)	the corrective action comprises querying a database for the proper action to take.

Claim Designation	Claim Language
Claim 7(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 7(a)	determining a competence level of a human driver, wherein the competence level describes a competence level of the human driver in controlling the SDV;
Claim 7(b)	receiving sensor readings from a system of sensors about the competence level of the human driver,
Claim 7(c)	wherein the SDV is operable to provide autonomous control of driver controls comprising: engine throttle, steering mechanism, braking system, and navigation; determining a competence level of a processor;
Claim 7(d)	determining a competence level of a processor;
Claim 7(e)	determining a corrective action; the SDV implementing the corrective action.
Claim 8(Pre)	The computer program product of claim 7, wherein:
Claim 8(a)	the sensor readings comprise a reading from a GPS sensor and a reading from a speedometer;
Claim 8(b)	determining the competence level of the processor comprises weighted voting;
Claim 8(c)	determining the competence level of the human driver comprises weighted voting;
Claim 8(d)	determining the corrective action comprises using active learning data, said active learning data including information from other SDVs;
Claim 8(e)	the corrective action comprises querying a database for the proper action to take.
Claim 10(Pre)	The computer program product of claim 7, further comprising:
Claim 10(a)	determining the competence level of the human driver comprises using a weighted voting system, the weighted voting system comprising: a plurality of inputs and a plurality of weights,
Claim 10(b)	the plurality of inputs comprising sensor readings from a camera sensor; and

Claim Designation	Claim Language
Claim 10(c)	multiplying at least one of the plurality of inputs by a weight from among the plurality of weights;
Claim 10(d)	wherein the plurality of weights are based on active learning data that includes information about a cohort of human drivers of other SDVs.
Claim 11(Pre)	The computer program product of claim 10, further comprising:
Claim 11(a)	when the competence level of the human driver is above a first threshold, the SDV autonomously controls the driver controls without requiring the human driver to operate the driver controls;
Claim 11(b)	the SDV autonomously maintains a buffer of space from other vehicles around the SDV and the SDV autonomously controls the steering of the SDV while the SDV autonomously controls the driver controls, without requiring the human driver to operate the driver controls;
Claim 11(c)	when the competence level of the human driver is below a second threshold, determining that a first fault has occurred;
Claim 11(d)	determining the corrective action comprises determining a first corrective action corresponding to the first fault; and
Claim 11(e)	the first corrective action comprises issuing an alert while the SDV provides autonomous control of the driver controls without requiring the human driver to operate the driver controls.
Claim 12(Pre)	The computer program product of claim 11, further comprising:
Claim 12(a)	when the competence level of the human driver is below a third threshold after taking the first corrective action, determining that a second fault has occurred;
Claim 12(b)	determining the corrective action further comprises determining a second corrective action corresponding to the second fault; and
Claim 12(c)	the second corrective action comprises transferring driver controls to manual control and alerting the human driver to take over.
Claim 13(Pre)	The computer program product of claim 7, further comprising:

Claim Designation	Claim Language
Claim 13(a)	determining the competence level of the processor comprises using a weighted voting system, the weighted voting system comprising:
Claim 13(a)(i)	a plurality of inputs and a plurality of weights, wherein the plurality of inputs comprise sensor readings from a camera sensor; and
Claim 13(b)	multiplying at least one of the plurality of inputs by a weight from among the plurality of weights;
Claim 13(b)(i)	wherein the plurality of weights are based on active learning data; and wherein the active learning data includes condition data
Claim 13(b)(ii)	from a 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 14(Pre)	The computer program product of claim 7, further comprising:
Claim 14(a)(i)	determining the competence level of the human driver comprises using a weighted voting system
Claim 14(a)(ii)	with a first plurality of inputs and a first plurality of weights, wherein: the first plurality of inputs comprises sensor readings from a first camera sensor; and
Claim 14(a)(iii)	at least one of the first plurality of inputs is multiplied by a weight from among the first plurality of weights,
Claim 14(a)(iv)	wherein the first plurality of weights are based on first active learning data, the first active learning data comprising information about a cohort of human drivers of other SDVs;
Claim 14(b)	determining the competence level of the processor comprises using the weighted voting system
Claim 14(b)(i)	with a second plurality of inputs and a second plurality of weights, wherein: the second plurality of inputs comprises sensor readings from a second camera sensor; and
Claim 14(b)(ii)	at least one of the second plurality of inputs is multiplied by a weight from among the second plurality of weights,
Claim 14(b)(iii)	wherein the second plurality of weights are based on second active learning data, the second active learning data comprising condition data

Claim Designation	Claim Language
Claim 14(b)(iv)	from a 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 14(c)	the first camera sensor is different from the second camera sensor, the first plurality of inputs is different from the second plurality of inputs, and the first plurality of weights is different from the second plurality of weights;
Claim 14(d)	when the competence level of the human driver is above a first threshold, the SDV autonomously controls the driver controls without requiring the human driver to operate the driver controls;
Claim 14(e)	the SDV autonomously maintains a buffer of space from other vehicles around the SDV and the SDV autonomously controls the steering of the SDV while the SDV autonomously controls the driver controls, without requiring the human driver to operate the driver controls;
Claim 14(f)	when the competence level of the human driver is below a second threshold, determining that a first fault has occurred;
Claim 14(g)	determining the corrective action comprises determining a first corrective action corresponding to the first fault; and
Claim 14(h)	the first corrective action comprises issuing an alert while the SDV autonomously controls the driver controls without requiring the human driver to operate the driver controls.
Claim 15(Pre)	The computer program product of claim 14, further comprising:
Claim 15(a)	when the competence level of the human driver is below a third threshold, after taking the first corrective action, determining that a second fault has occurred;
Claim 15(b)	determining the corrective action further comprises determining a second corrective action corresponding to the second fault; and
Claim 15(c)	the second corrective action comprises transferring driver controls to manual control and alerting the human driver to take over.
Claim 16(Pre)	The computer program product of claim 15, further comprising:

Claim Designation	Claim Language
Claim 16(a)	when the competence level of the processor is below a fourth threshold, determining that a third fault has occurred;
Claim 16(b)	determining the corrective action further comprises determining a third corrective action corresponding to the third fault;
Claim 16(c)	determining the corrective action further comprises using a fault remediation table; and
Claim 16(d)	the fault remediation table comprises the first fault, the second fault, and the third fault.
Claim 17(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 17(a)	receiving sensor readings from a system of sensors, wherein the sensor readings describe a current operational state of a SDV;
Claim 17(b)	determining based on the sensor readings, by one or more processors, whether a fault has occurred;
Claim 17(c)	determining, by the one or more processors, whether the fault exceeds a threshold for danger;
Claim 17(d)	determining a corrective action associated with the fault using a fault-remediation table; and
Claim 17(e)	the SDV implementing the corrective action;
Claim 17(f)	wherein: the sensor readings comprise a reading from a GPS sensor;
Claim 17(g)	the fault comprises a current weather condition of a roadway on which the SDV is currently traveling;
Claim 17(h)	determining whether the fault exceeds the threshold for danger comprises determining a control processor competence level; and
Claim 17(i)	the corrective action comprises transferring driver controls to manual control and alerting a human driver to take over.
Claim 18(Pre)	The computer program product of claim 17, further comprising:

Claim Designation	Claim Language
Claim 18(a)	determining the control processor competence level comprises using a weighted voting system, the weighted voting system comprising:
Claim 18(a)(i)	a first plurality of inputs and a first plurality of weights, wherein the first plurality of inputs comprise sensor readings from a first camera sensor; and
Claim 18(b)	multiplying at least one of the first plurality of inputs by a weight from among the first plurality of weights;
Claim 18(b)(i)	wherein the first plurality of weights are based on active learning data; and wherein the active learning data includes weather condition data
Claim 18(b)(ii)	from a cohort of other SDVs, wherein the weather condition data shares one or more traits with the current weather condition of the roadway on which the SDV is currently traveling.
Claim 19(Pre)	The computer program product of claim 18, further comprising:
Claim 19(a)	when the fault does not exceed the threshold for danger, the SDV autonomously controls the driver controls, wherein said driver controls comprise: engine throttle, steering mechanism, braking system, and navigation;
Claim 19(b)	the SDV autonomously maintains a buffer of space from other vehicles around the SDV and the SDV autonomously controls the steering of the SDV while the SDV autonomously controls the driver controls, without requiring the human driver to operate the driver controls; and
Claim 19(c)	when the fault exceeds the threshold for danger, the SDV takes the corrective action.
Claim 20(Pre)	The computer program product of claim 19, further comprising:
Claim 20(a)	determining a competence level of a human driver, comprising using the weighted voting system, the weighted voting system further comprising:
Claim 20(a)(i)	a second plurality of inputs and a second plurality of weights, wherein the second plurality of inputs comprise sensor readings from a second camera sensor; and

Claim Designation	Claim Language
Claim 20(b)	multiplying at least one of the second plurality of inputs by a weight from among the second plurality of weights;
Claim 20(c)	wherein the second plurality of weights are based on active learning data that includes information about a cohort of human drivers of other SDVs.

I, Christopher Wilson, declare as follows:

I. INTRODUCTION

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

A. Educational Background and Professional Experience

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

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

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

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

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

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

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

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

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

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

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

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

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

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

II. METHODOLOGY; MATERIALS CONSIDERED

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

14. For this work, I have been asked to review U.S. Patent No. 11,738,765 (“the ’765 *Patent*”) (Ex. 1001) including the specification and claims, and the ’765 Patent’s prosecution history (“’765 *File History*”) (Ex. 1002). In developing my

opinions relating to the '765 Patent, I have considered the materials cited or discussed herein, including those itemized in the Exhibit Table below.

<u>Exhibit</u>	<u>Description</u>
Exhibit 1001	U.S. Patent No. 11,738,765 (“’765 Patent”)
Exhibit 1002	Prosecution History for the ’765 Patent (“’765 File History”)
Exhibit 1004	U.S. Patent No. 9,406,177 (“Attard”)
Exhibit 1005	U.S. Patent No. 9,494,926 (“Frazer”)
Exhibit 1006	U.S. Patent No. 10,377,303 (“McNew”)
Exhibit 1007	U.S. Patent Application Publication No. 2016/0267335 (“Hampiholi”)
Exhibit 1008	U.S. Patent No. 9,063,543 (“An”)
Exhibit 1009	U.S. Patent No. 9,688,145 (“Kang”)
Exhibit 1010	U.S. Patent No. 9,451,030 (“Schunder”)
Exhibit 1011	U.S. Patent No. 9,714,037 (“DeRuyck”)
Exhibit 1012	U.S. Patent Application Publication No. 2007/0268158 (“Gunderson”)
Exhibit 1013	U.S. Patent Application Publication No. 2007/0219720 (“Trepagnier”)
Exhibit 1014	Gereon Meyer and Sven Beiker. <i>Road Vehicle Automation</i> . Springer. 2014. (“Meyer”)
Exhibit 1015	Jeff Wit et al. “Autonomous Ground Vehicle Path Tracking.” <i>Journal of Robotic Systems</i> 21(8), 439-449 (2004). (“Wit”)
Exhibit 1016	Keshav Bimbraw. “Autonomous Cars: Past, Present and Future.” <i>Proceedings of the 12th International Conference on Informatics in Control, Automation and Robotics (ICINCO-2015)</i> , pages 191-198, July 21-23, 2015. (“Bimbraw”)
Exhibit 1017	Xavier Mosquet et al. <i>Revolution in the Driver’s Seat</i> . The Boston Consulting Group. April 2015. (“Mosquet”)
Exhibit 1018	Steven E. Muldoon et al. “10.3: Vehicle Fault Diagnostics Using a Sensor Fusion Approach.” <i>IEEE</i> 2002. (“Muldoon”)
Exhibit 1019	U.S. Patent No. 8,825,258 (“Cullinane”)
Exhibit 1020	U.S. Patent No. 9,798,323 (“Tsimhoni-323”)
Exhibit 1021	U.S. Patent No. 9,884,631 (“James”)
Exhibit 1022	U.S. Patent No. 11,040,725 (“Scofield”)
Exhibit 1023	U.S. Patent No. 9,483,059 (“Caveney”)
Exhibit 1024	U.S. Patent No. 9,365,213 (“Stenneth”)

Exhibit 1025	International Publication No. WO 2006/047297 (“ <i>Allard</i> ”)
Exhibit 1026	Rajesh Rajamani et al. “A Complete Fault Diagnostic System for Automated Vehicles Operating in a Platoon.” IEEE Transactions on Control Systems Technology, Vol 9, No. 4, July 2001. (“ <i>Rajamani</i> ”)
Exhibit 1027	U.S. Patent Application Publication No. 2013/0063336 (“ <i>Sugimoto</i> ”)
Exhibit 1028	Matthew McNaughton et al. “Motion Planning for Autonomous Driving with a Conformal Spatiotemporal Lattice.” 2011 IEEE International Conference on Robotics and Automation. May 9-13, 2011, Shanghai, China. (“ <i>McNaughton</i> ”)
Exhibit 1029	A. de la Escalera. “Traffic sign recognition and analysis for intelligent vehicles.” Image and Vision Computing 21 (2003) 247-258. (“ <i>Escalera</i> ”)
Exhibit 1030	“Surface Vehicle Information Report J3016.” SAE International. January 2014. (“ <i>J3016</i> ”)
Exhibit 1031	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> ”).

15. I have considered these materials from the viewpoint of a POSITA as of the priority date of the '765 Patent. For the purposes of this declaration, I have been asked to assume that the priority date of the '765 Patent is September 25, 2015. I note that my opinions provided in this Declaration are made from the perspective of a POSITA as of this priority date of the '765 Patent, unless expressly stated

otherwise. To the extent that I use any verb tense in this Declaration that is present tense (e.g., “a POSITA would understand” instead of “a POSITA would have understood”), such verb tense should be understood to be my opinion as of the ’765 Patent’s priority date (again, unless expressly stated otherwise). I merely use the present verb tense for ease of reading.

III. OVERVIEW AND LEGAL STANDARDS

16. In formulating my opinions, I have been instructed to apply certain legal standards. I am not a lawyer. I do not expect to offer any testimony regarding what the law is. Instead, the following sections summarize the law as I have been instructed to apply it in formulating and rendering my opinions found later in this declaration. I understand that, in an inter partes review proceeding, patent claims may be deemed unpatentable if it is shown that they were anticipated or rendered obvious in view of the prior art. I understand that prior art in an inter partes review is limited to patents or printed publications that predate the priority date of the patent at issue. I understand that questions of claim clarity (definiteness) and enablement cannot be considered as a ground for considering the patentability of a claim in these proceedings.

A. Person of Ordinary Skill in the Art

17. I understand that the ’765 Patent, the record of proceedings at the Patent Office (which I understand is called the “File History” or “Prosecution History”),

and the teachings of the prior art are evaluated from the perspective of a person of ordinary skill in the art (“POSITA”). I understand that the factors considered in determining the ordinary level of skill in the art include: (i) the levels of education and experience of persons working in the field; (ii) the types of problems encountered in the field; and (iii) the sophistication of the technology. I may also consider, if available, the education level of the inventor, prior art solutions to the problems encountered in the art, the rapidity with which innovations are made in the relevant art.

18. I understand that a person of ordinary skill in the art is not a specific real individual, but rather a hypothetical individual having the qualities reflected by the factors above. This hypothetical person has knowledge of all prior art in the relevant field as if it were arranged on a workshop wall and takes from each reference what it would teach to a person having the skills of a POSITA.

B. Obviousness

19. I understand that a claim may be invalid under § 103(a) if the subject matter described by the claim as a whole would have been “obvious” to a hypothetical POSITA in view of a single prior art reference or in view of a combination of references at the time the claimed invention was made. Therefore, I understand that obviousness is determined from the perspective of a hypothetical POSITA. I further understand that a hypothetical POSITA is assumed to know and

to have all relevant prior art in the field of endeavor covered by the patent in suit and all analogous prior art. I understand that obviousness in an inter partes review proceeding is evaluated using a preponderance of the evidence standard, which means that the claims must be more likely obvious than nonobvious.

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

- A combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results;
- When a device or technology is available in one field of endeavor, design incentives and other market forces can prompt variations of it,

either in the same field or in a different one, so that if a POSITA can implement a predictable variation, the variation is likely obvious;

- If a technique has been used to improve one device, and a POSITA would have recognized that it would improve similar devices in the same way, using the technique is obvious unless its actual application is beyond his or her skill;
- An explicit or implicit teaching, suggestion, or motivation to combine two prior art references to form the claimed combination may demonstrate obviousness, but proof of obviousness does not depend on or require showing a teaching, suggestion, or motivation to combine;
- Market demand, rather than scientific literature, can drive design trends and may show obviousness;
- In determining whether the subject matter of a patent claim would have been obvious, neither the particular motivation nor the avowed purpose of the named inventor controls;
- One of the ways in which a patent's subject can be proved obvious is by noting that there existed at the time of invention a known problem for which there was an obvious solution encompassed by the patent's claims;

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

21. I also understand that an obviousness determination includes the consideration of various factors such as: (1) the scope and content of the prior art, (2) the differences between the prior art and the asserted claims, (3) the level of

ordinary skill in the pertinent art, and (4) the existence of secondary considerations such as commercial success, long-felt but unresolved needs, failure of others, and so forth.

22. I am informed that it is improper to combine references where the references teach away from their combination. I am informed that a reference may be said to teach away when a person of ordinary skill in the relevant art, upon reading the reference, would be discouraged from following the path set out in the reference, or would be led in a direction divergent from the path that was taken by the patent applicant. In general, a reference will teach away if it suggests that the line of development flowing from the reference's disclosure is unlikely to be productive of the result sought by the patentee. I am informed that a reference teaches away, for example, if (1) the combination would produce a seemingly inoperative device, or (2) the references leave the impression that the product would not have the property sought by the patentee. I also am informed, however, that a reference does not teach away if it merely expresses a general preference for an alternative invention but does not criticize, discredit, or otherwise discourage investigation into the invention claimed.

23. I am informed that even if a *prima facie* case of obviousness is established, the final determination of obviousness must also consider "secondary considerations" if presented. In most instances, the patentee raises these secondary

considerations of non-obviousness. In that context, the patentee argues an invention would not have been obvious in view of these considerations, which include: (a) commercial success of a product due to the merits of the claimed invention; (b) a long-felt, but unsatisfied need for the invention; (c) failure of others to find the solution provided by the claimed invention; (d) deliberate copying of the invention by others; (e) unexpected results achieved by the invention; (f) praise of the invention by others skilled in the art; (g) lack of independent simultaneous invention within a comparatively short space of time; (h) teaching away from the invention in the prior art.

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

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

C. Analogous Art

26. I have been informed that for a prior art reference to be proper for use in an obviousness analysis, the reference must be “analogous art” to the claimed invention. I have been informed that a reference is analogous art to the claimed invention if: (1) the reference is from the same field of endeavor as the claimed invention (even if it addresses a different problem); or (2) the reference is reasonably pertinent to the problem faced by the inventor (even if it is not in the same field of endeavor as the claimed invention). In order for a reference to be “reasonably pertinent” to the problem, it must logically have commended itself to an inventor’s attention in considering his problem. In determining whether a reference is reasonably pertinent, one should consider the problem faced by the inventor, as reflected either explicitly or implicitly, in the specification. I believe that all of the references that my opinions in this IPR are based upon are well within the range of references a person having ordinary skill in the art would consult to address the type of problems described in the Challenged Claims.

D. Claim Construction

27. I understand that the claim terms in this IPR will be construed according to their ordinary and customary meaning as understood in light of the claim language, the patent’s description, and the prosecution history viewed from the perspective of a POSITA. I further understand that where a patent defines claim

language, the definition in the patent controls, even if there are other definitions that might be understood by those working in the art.

IV. LEVEL OF A PERSON OF ORDINARY SKILL

28. Based on my review and analysis of the '765 Patent, the prior art cited herein, and the ordinary skill factors described in this section, a POSITA in the field of the '765 Patent at the time of the earliest possible priority date (September 25, 2015) would have been knowledgeable regarding the field of vehicle telematics and safety systems. In my experience working in this field, most workers of ordinary skill in the art as of the earliest possible priority date of September 25, 2015, would have had a bachelor's degree in computer engineering, computer science, electrical engineering, mechanical engineering, physics, or a related field, with at least four years of experience in the field of vehicle telematics and safety systems, or a master's degree in the same fields with at least three years of experience in the field of vehicle telematics and safety systems. Additional education or experience might substitute for the above requirements. *See, e.g.*, the '765 Patent (Ex. 1001), 1:19-20 (describing the "Field of the Invention"). When I refer to the understanding of a POSITA, I am referring to the understanding of such a person as of September 25, 2015.

29. As of September 25, 2015, I had more than ordinary skill in the art. I am, however, familiar with the skills and knowledge possessed by those I would have considered to be of ordinary skill in the art as of that date. For example, I knew

people working in the field while I worked at the companies I discussed in my Background (§§2-12).

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

V. BACKGROUND OF THE TECHNOLOGY

A. History of Autonomous Vehicles

31. In a non-autonomous vehicle, “the driver remains a critical component of the vehicle's control system” and they are responsible for “steering, obstacle and hazard recognition, and avoidance thereof.” *Trepagnier* (Ex. 1013), [0004]. Autonomous or self-driving vehicles (SDVs) are attractive, for example, to improve driver safety. *Id.*, [0007] (describing the attractiveness of autonomous vehicles for “addressing human deficiencies in the control of a vehicle or whether in environmentally hazardous conditions where human control is not preferred...”); *see also, Meyer* (Ex. 1014), p. 72 (describing “[e]missions reduction,” “[c]ongestion avoidance,” and “supporting unconfident drivers” as additional benefits of SDVs). “An autonomous vehicle is one that is capable of automatic navigation. It is self-acting and self-regulating, therefore it is able to operate in and react to its environment without outside control.” *Wit* (Ex. 1015), p. 439. In general, an SDV may be capable of performing various functions, including “(1) perceiving and modeling the environment, (2) localizing the vehicle within the environment, (3)

planning and deciding the vehicle's desired motion and (4) executing the vehicle's desired motion[]." *Wit*, p. 439-440.

32. Autonomous vehicles were well-known and in development before the '765 Patent (September 25, 2015) as "[t]he timeline of autonomous cars begins in 1926 with world's first radio controlled car 'Linriccan Wonder'." *Bimbraw* (Ex. 1016), p. 191. "In the subsequent decades, we see fairly autonomous electric cars powered by embedded circuits in the roads" and the "1980s saw vision guided autonomous vehicles, which was a major milestone in [SDV] technology...." *Id.* For example, "the vision guided Mercedes-Benz robotic Van in 1980" (which employed "LIDAR, radar, GPS and computer vision") laid the foundation for "autonomous technologies present in modern cars like adaptive cruise control, lane parking, steer assist etc." *Id.*

33. As shown below, various autonomous features were available in cars prior to the '765 Patent:

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

Mosquet (Ex. 1017), p. 6 (excerpt). In fact, some of these features were available earlier than indicated by *Mosquet*; regardless, all were well-known prior to the '765 Patent. For example, automatic lane keeping was present in Nissan's 2014 Infiniti Q50, which was released in 2013. *Bimbraw*, 195.

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

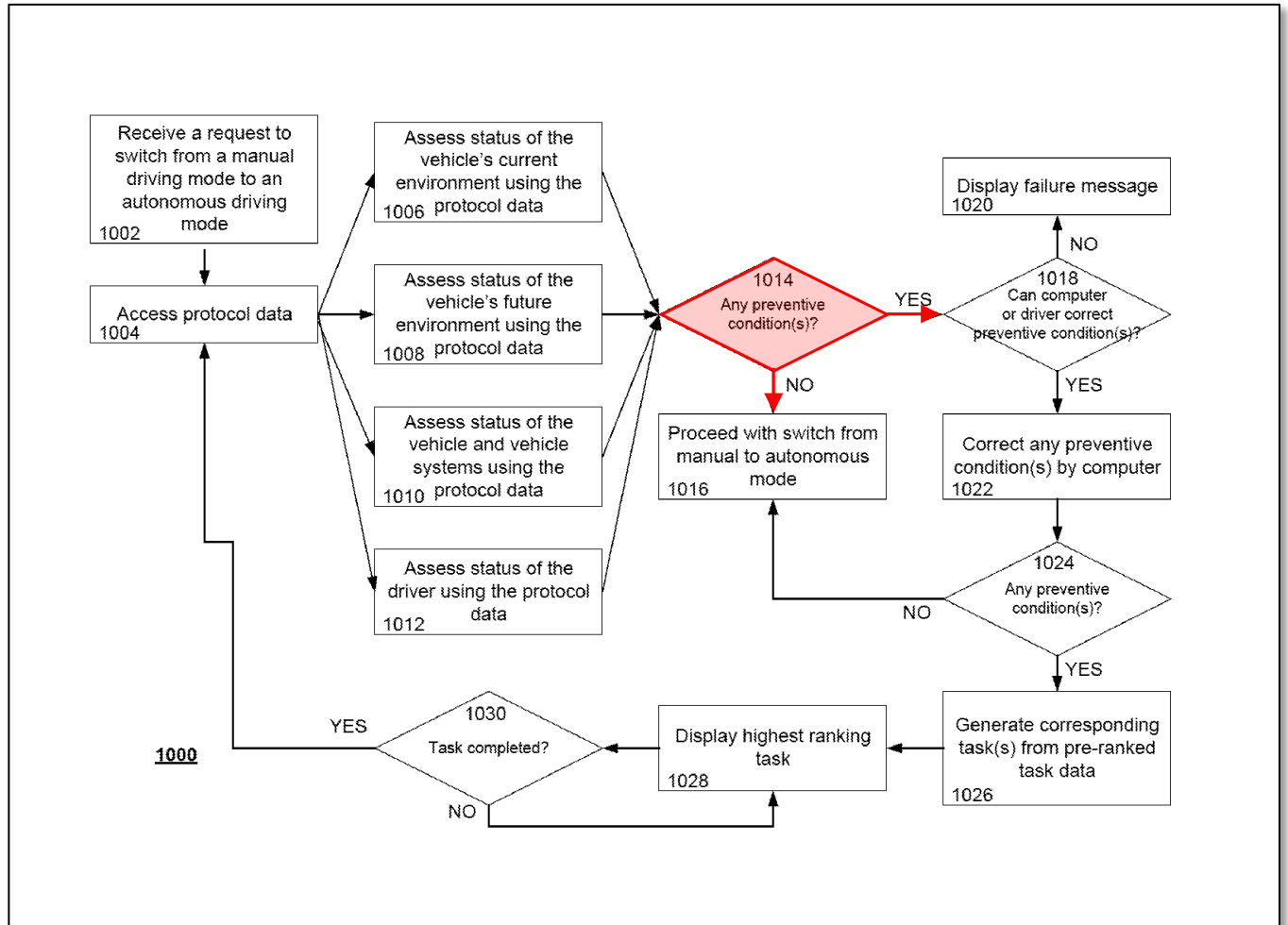
B. Faults

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

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

36. Prior to the ’765 Patent, SDVs were capable of “switching between autonomous and manual driving modes. In order to do so, the vehicle's computer may conduct a series of environmental, system, and driver checks to identify certain conditions.” *Cullinane* (Ex. 1019), Abstract, FIG. 10. Upon detecting “some emergency or some preventative condition such as a loss of communication with some component of the autonomous driving system, the computer 110 may immediately inform the driver of the need to switch to the manual driving mode.” *Cullinane*, 16:38-43; *see also, Tsimhoni-323* (Ex. 1020), Abstract (describing “[a]n automated vehicle [that] includes a control system configured to selectively transfer the automated vehicle from an automated control mode to a manual control mode based on a transfer-of-control criterion.” This “criterion is based on a current context of the automated vehicle and a dataset of previous transfer-of-control events and previous contexts” of other SDVs. Thus, SDVs were known to switch driving modes

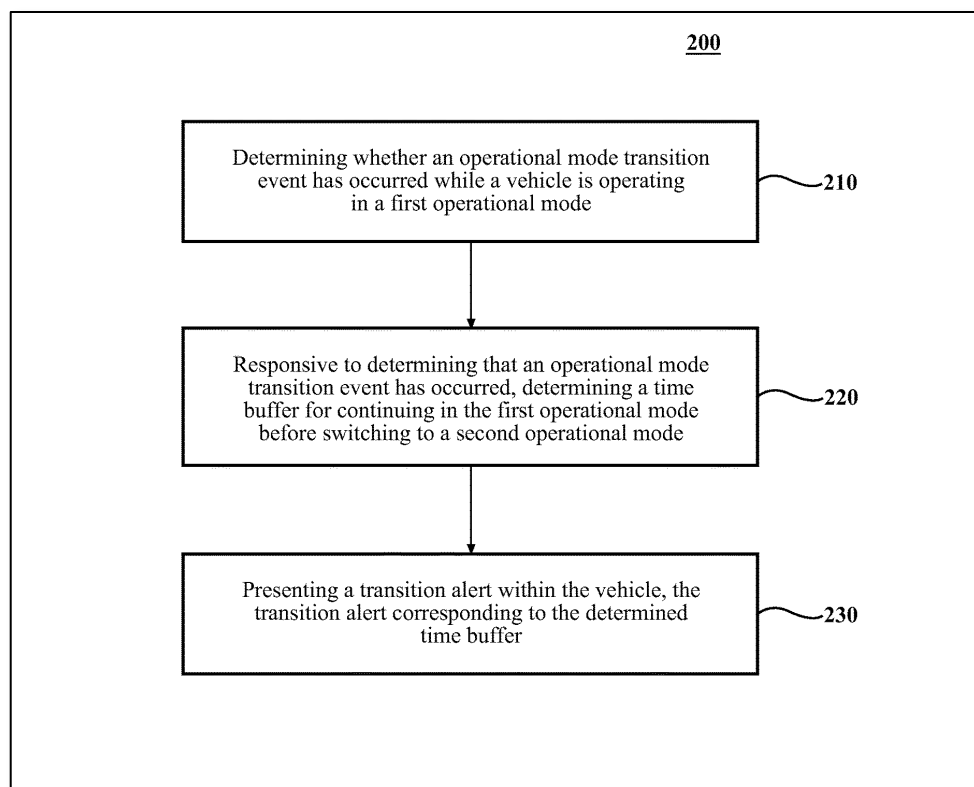
in response to detecting a fault (such as a “faulty braking system,” per the ’765 Patent). ’765 Patent, 5:53-6:2.



Cullinane, FIG. 10. FIG. 10 is annotated to demonstrate an SDV system “assessing the status of the vehicle’s environment (current and likely future), the status of the vehicle and the vehicle systems, as well as the status of the driver to identify any preventive conditions” (e.g., faults) which would inhibit a safe change in driving mode from manual to autonomous. *Cullinane*, 10:37-40; *see also*, *Id.*, 15:29-32.

37. *James* further teaches “transitioning a vehicle between a first operational mode and a second operational mode” dependent on if “an operational mode transition event has occurred” (e.g., a fault). *James* (Ex. 1021), 1:30-43, 2:1-5, 2:14-29, FIG. 2. “Such an event may be indicative of a **problem** which is to be communicated to the driver to prepare to take a greater degree of involvement in the vehicle control.” *James*, 10:52-55 (emphasis added), 19:19 (describing adjusting the autonomous driving mode depending on if the “driver is asleep, distracted, etc.”).

FIG. 2 below describes the process for transitioning driving modes:



James, FIG. 2.

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

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

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

39. As another example, *Tsimhoni-323* teaches “an automated vehicle control system that utilizes crowdsourced data...to determine whether transfer-of-control from automated to manual (or vice versa) is likely and/or desirable.” *Tsimhoni-323*, 2:16-22. *Tsimhoni-323* teaches transferring modes in an SDV in response to differing environmental conditions (“e.g., ‘night time+rain’”). *Tsimhoni-323*, 2:16-22, 4:43-48. For example,

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

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

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

40. It was well-known to alert the driver when the SDV was transitioning driving modes. *See, e.g., James*, FIGs. 3-4, 15:39-42 (describing how the “transition alert can have any suitable form. For instance, the transition alert can be a visual transition alert, an audial transition alert, a haptic transition alert, and/or combinations thereof.”); *Cullinane*, 13:8-10 (describing how “computer 110 may generate and display a notification explaining that the autonomous driving mode is currently unavailable due to the weather conditions.”); *Tsimhoni-323*, 4:43-46 (“In some embodiments, the alert includes a visual representation (e.g., shown via display 25) of a reason for transferring from the automated control mode to the manual control mode.”).

C. Driving Modes

41. *James* teaches various levels of automation in the vehicle, including levels defined by National Highway Traffic Safety Authority (NHTSA) 2013 policy. *James* (Ex. 1021), 3:1-4:43. For example, a vehicle may have level 0 automation (*James*, 3:47-53), which indicates manual control is required. *James*, 3:47-53 (“The vehicle 100 can have a manual operation mode. ‘Manual operational mode’ means that a substantial majority or all of the navigation and/or maneuvering of the vehicle

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

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

D. Assessing Competence Levels

1. Driver Competence

43. One of the primary features of SDVs is ensuring driver safety. *See* ¶ 31. Therefore, it was known prior to the '765 Patent to assess the capability of the driver to safely drive the vehicle in manual mode and further determine if instead engaging the autonomous driving mode is safer if driver competence is deemed low. Thus, SDVs were known to monitor driving habits. *See e.g., Scofield* (Ex. 1022), 6:31-51 (“Before generating a driver alert to assume manual vehicle control of the

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

44. One of the problems limiting the ability to deploy autonomous vehicles, and in fact making many doubt that “level 3” autonomy (*see J3016* (Ex. 1030), 2, 4) is even possible, is the handoff from automated control to a driver. In level 3 autonomy it is assumed that the driver is always prepared to take over control on “short notice,” however, there is no established method for ensuring this is the case, or what “short notice” means in terms of a threshold time. Note that this has nothing to do with the skill of the driver, rather it is a measure of the driver’s cognitive focus and ability to orient and control the vehicle. Many tests have determined that this time is usually on the order of a few seconds, but can extend to excess of 15 seconds. *See, e.g., McNew* (Ex. 1006) 4:47-61 (1.5 seconds for driver response time). The possibility that a driver is incapacitated and cannot take over must also be considered. *See, e.g., Meyer*, 50 (describing driver out of the loop), 56 (describing

driver handover), 204 (describing the need to surveil the driver for handover); *Scofield*, 6:31-51.

2. SDV Competence

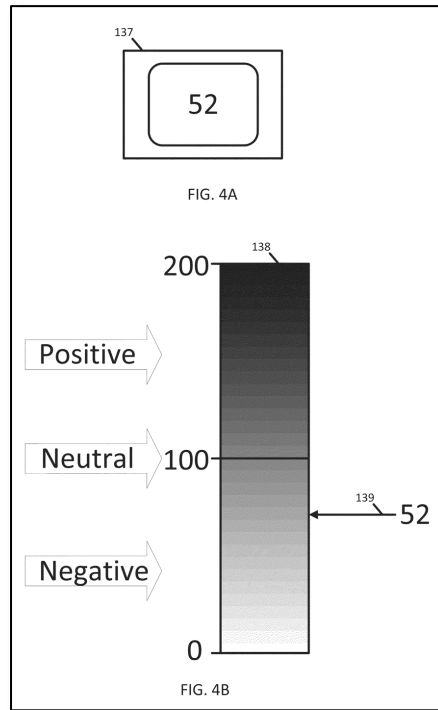
45. It was well-known prior to the '765 Patent to demonstrate to the driver how capable their SDV is of driving autonomously.

46. For example, *Stenneth* teaches either a “numeric” (FIG. 4a, below) or “gradient” (FIG. 4b, below) “confidence score display” showing the “vehicle confidence level” that determines when an SDV transitions between autonomous and manual driving modes. *Stenneth* (Ex. 1024), 1:49-51 (“[T]he driving mode command transitions the autonomous vehicle to the autonomous mode, if applicable, when the vehicle confidence score exceeds the confidence threshold.”), 9:65-10:4.

Stenneth further teaches that

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

Stenneth, 2:43-49.



Stenneth, FIGs 4a, 4b.

E. SDV Infrastructure

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

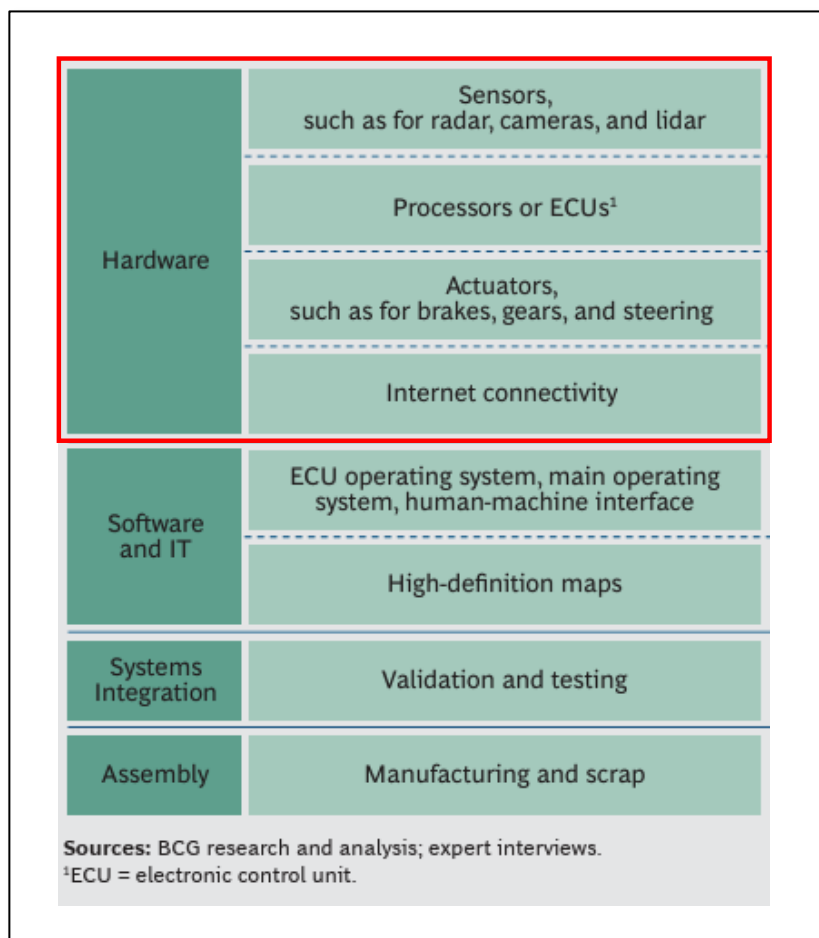
[s]hort-range communications technology—such as vehicle-to-vehicle and vehicle-to-infrastructure communication, collectively referred to as V2X—can be effectively applied to complex driving environments to enhance the safety of AVs [autonomous vehicles]. V2X technology can supplement on-board sensors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

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

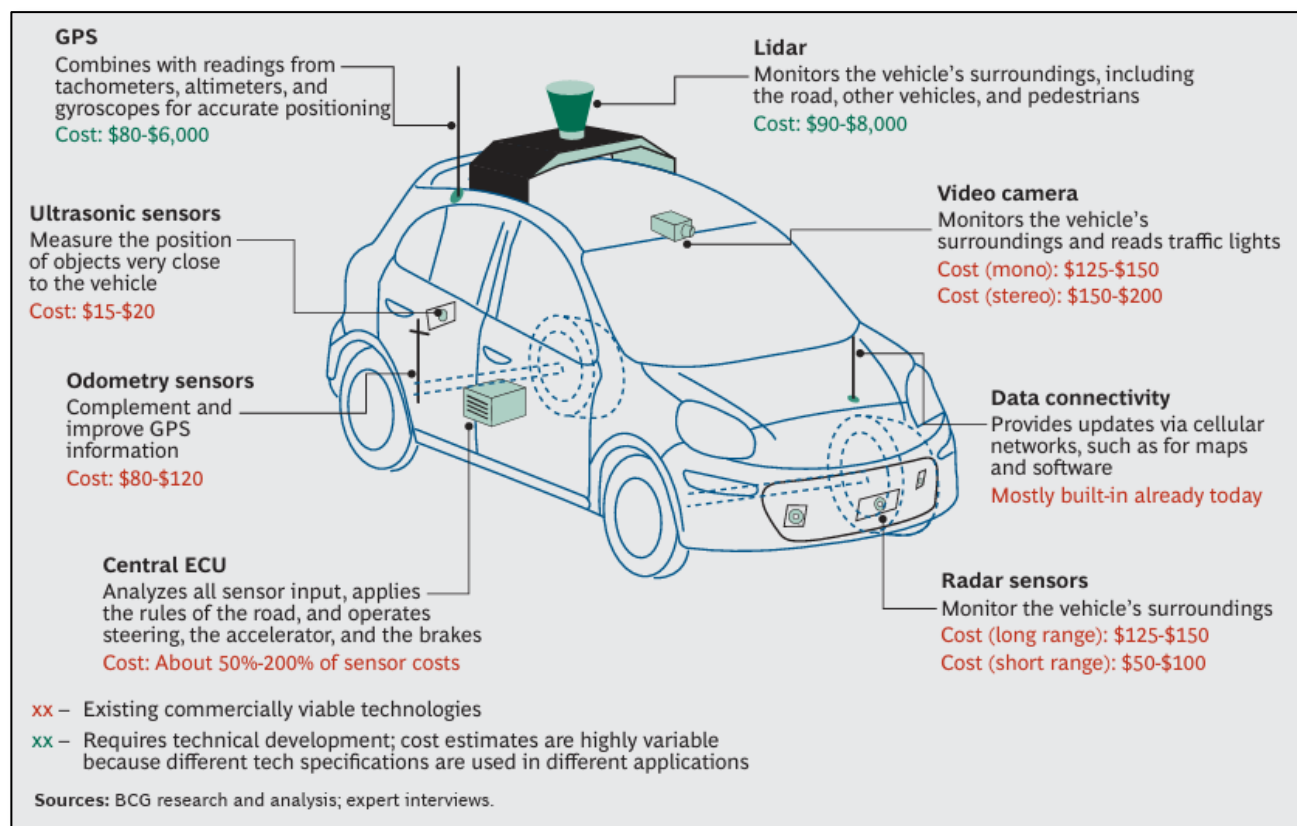
Mosquet, p. 14.

1. *SDV Hardware*

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



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



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

a) Sensors

49. SDVs included sensors for monitoring and navigating the environment. Additionally, sensors were used to monitor both the vehicle and the driver to ensure competence for safe autonomous driving. See e.g., *Stenneth*, 4:8-11 (describing how “external vehicle sensor 115 may determine road status such as the shape or turns of the road, the existence of speed bumps, the existence of pot holes, the wetness of the road, or the existence of ice, snow, or slush.”), 4:52 (“One or more of the vehicle sensors 113 may detect a driver.”); *Allard* (Ex. 1025), [0023] (“While operating

unmanned, the vehicle uses its onboard local area sensors and its perceptual context software to detect the presence of unsafe conditions.”); *Meyer*, p. 55 (“Surround sensing will require a combination of multiple sensors including radar and video sensors to generate a reliable and comprehensive 360° environment model of the vehicle environment.”). Examples of such sensors are provided below:

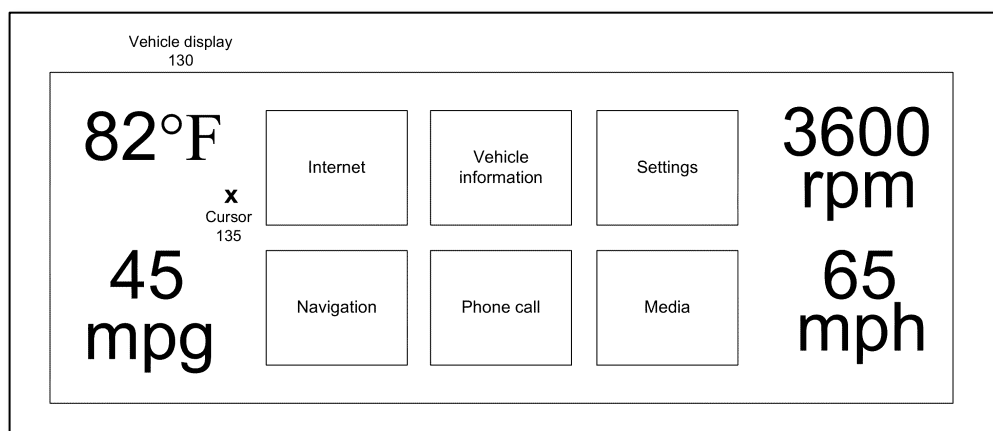
TABLE I COMPLETE SET OF SENSORS	
SENSOR FAULT	INFORMATION LOST
STEERING ANGLE SENSOR	Steering angle
YAW-RATE SENSOR	Yaw rate
MAGNETOMETER	Lateral displacement of car with respect to magnetic markers on the road
LATERAL ACCELEROMETER	Lateral acceleration of car
RADIO	Lead and previous vehicle's velocity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

Rajamani (Ex. 1026), Table 1, pp. 555-556 (Listing the required sensors for “longitudinal and lateral control systems” of autonomous vehicles operating in

platoons.) “The information lost due to a fault in any of these sensors is also indicated in the table.” *Id.*

b) Displays

50. SDVs included displays for communicating with the driver. *See e.g., Cullinane*, FIG. 2; *James*, FIG. 1. These displays present relevant information to the driver, including vehicle speed, notifications, warnings, temperature, and navigational tools. *See e.g., Sugimoto* (Ex. 1027), FIG. 1b, [0023] (“The display 130 in the embodiment of FIG. 1b displays internal and external vehicle information. For example, the display 130 displays the temperature outside the vehicle (82° F)...and the speed of the vehicle (65 miles per hour).”); *Cullinane*, 3:6-9 (describing how “in response to an indication by the user that the user wants to return to manual mode, a warning may be displayed to the driver when switching to manual driving mode is not recommended.”).



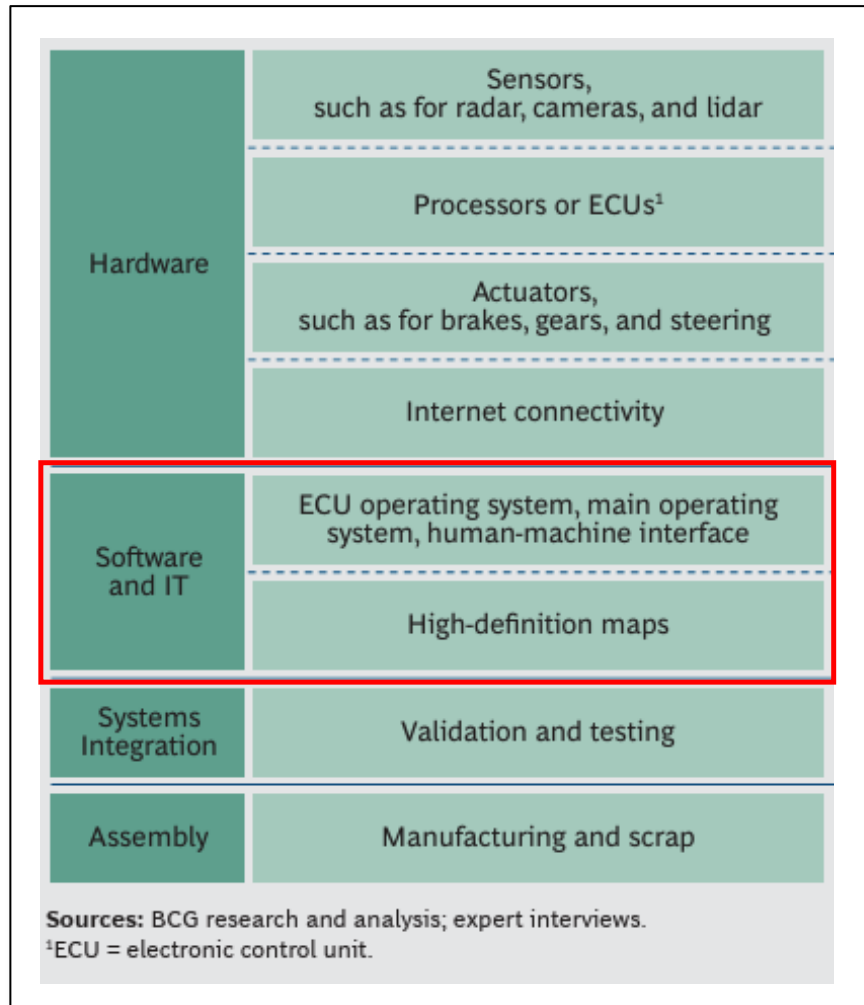
Sugimoto, FIG. 1b.

c) Braking and Steering

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

2. SDV Software

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



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

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

[s]oftware methods [] need to be further developed include methods for the highly dynamic modeling and simulation of the vehicle

environment like e.g. electronic horizon, methods for sensor data fusion and for the communication and processing of big amounts of traffic and operation data, as well as for their fusion with sensor data. Furthermore, dynamic online maps, methods for prediction and decision finding will increasingly play a role as enabling technologies.

Meyer, p. 78.

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

55. It is also necessary for SDVs to identify and interpret objects in their environment, such as road signs. *Escalera* (Ex. 1029) teaches “an algorithm for the detection and recognition of traffic sign[s]” accounting for “difficulties that exist for object recognition in outdoor environments” such as “lighting changes.” *Escalera*, pp. 256-257; *see also* 254 (“The process is executed in two steps. First, the extraction

of the information contained in the sign and second, its recognition by the NN [Neural Network].”).

VI. OVERVIEW OF THE PRIOR ART

A. Attard

56. USPN 9,406,177 to *Attard* (Ex. 1004) was cited but not substantively discussed during prosecution of the '765 Patent. *Attard* was filed February 20, 2014, qualifying as prior art under § 102(a)(2). *Attard* teaches determining actions to take when faults are detected in an autonomous vehicle. *Attard*, 1:15-24, 2:28-54.

57. *Attard* is analogous to the claimed invention of the '765 Patent because *Attard* is from a same field of endeavor: vehicles, and specifically self-driving vehicles. *Cf. Attard*, 1:15-24, 9:63-67 with '765 Patent, 1:19-23.

58. *Attard* is also reasonably pertinent to particular problems addressed by the '765 Patent: evaluating a computer's ability to autonomously operate a vehicle and determining actions to take when faults are detected. *Cf. Attard*, 1:15-24, 2:28-54, with '765 Patent, 1:19-52, 8:7-12.

B. Frazer

59. USPN 9,494,926 to *Frazer* (Ex. 1005) was neither cited nor considered during prosecution of the '765 Patent. *Frazer* was filed October 5, 2012, qualifying as prior art under § 102(a)(2). *Frazer* is narrowly utilized in the Petition to teach using an event table to perform an action when one or more conditions are fulfilled, as determined via a set of sensors. *Frazer*, 21:20-22:22, FIG. 6.

60. *Frazer* is analogous to the claimed invention of the '765 Patent because *Frazer* is from a same field of endeavor: vehicles, including those using programmable logic controllers. *Cf. Frazer*, 1:19-23 (expressly envisioning use in an autonomous vehicle), 21:20-22:22 *with '765 Patent*, 1:18-52, 3:10-17 (expressly envisioning use of a PLC), 8:23-40.

61. *Frazer* is also reasonably pertinent to a particular problem with which the inventor of the '765 Patent was involved: autonomously controlling a device's operational mode. *Cf. Frazer*, 19:23-25, 21:20-22:22, FIG. 6 *with '765 Patent*, 1:19-52, 8:23-40.

C. McNew

62. USPN 10,377,303 to *McNew* (Ex. 1006) was neither cited nor considered during prosecution of the '765 Patent. *McNew* was filed September 4 2014, qualifying as prior art under § 102(a)(2). *McNew* teaches managing vehicle control states of a semi-autonomous vehicle while simultaneously managing a driving state of a driver. *McNew*, 1:17-21.

63. *McNew* is analogous to the claimed invention of the '765 Patent because *McNew* is from a same field of endeavor: vehicles, including managing the level of automation of a vehicle. *Cf. McNew*, 1:17-30, 3:5-52, FIG. 1, *with '765 Patent*, 1:19-52, 6:27-53, 9:51-10:10, FIG. 5. *McNew* is utilized in the Petition to teach at least immediate transfer of control to a human driver (1(i)).

64. *McNew* is also reasonably pertinent to a particular problem addressed by the '765 Patent: selecting appropriate corrective actions for a given driving situation. *Cf. McNew*, 20:7-31, 4:3-5, 8:41-44, with '765 Patent, 7:53-8:12, 9:7-31, 10:27-57.

D. Hampiholi

65. US Application No. 2016/0267335 to Hampiholi (Ex. 1007) was neither cited nor considered during prosecution of the '765 Patent. *Hampiholi* was filed March 13, 2015, qualifying as prior art under § 102(a)(2). *Hampiholi* teaches a vehicle determining appropriate responses to detected driver distraction. *Hampiholi*, [0002]-[0004].

66. *Hampiholi* is analogous to the claimed invention of the '765 Patent because *Hampiholi* is from a same field of endeavor: vehicles, including evaluating a human's ability to safely operate a vehicle. *Cf. Hampiholi*, [0050]- [0051], [0057]-[0058], with '765 Patent, 1:19-52, 8:46-53.

67. *Hampiholi* is also reasonably pertinent to a particular problem addressed by the '765 Patent: adjusting an operation of a vehicle based on driver competence (e.g., level of distraction). *Cf. Hampiholi*, [0001]-[0004], [0057], with '765 Patent, 8:41-53.

E. Kang

68. USPN to Kang (Ex. 1009) was neither cited nor considered during prosecution of the '765 Patent. *Kang* was filed June 28, 2015 and claims priority to Korean Application 10-2014-0175770 filed December 9, 2014, qualifying as prior art under § 102(a)(2). *Kang* teaches a vehicle sensing weather conditions and applying weights to various conditions to improve driver safety. *Kang*, 2:7-29, 9:32-49, 10:55-11:6, 13:3-18, 18:2-7, Fig. 7C.

69. *Kang* is analogous to the claimed invention of the '765 Patent because *Kang* is from a same field of endeavor: vehicles. *Cf. Kang*, 2:7-29, 9:32-49, Fig. 7C, with '765 Patent, 1:19, 5:50-52.

70. *Kang* is also reasonably pertinent to a particular problem addressed by the '765 Patent: adapting to weather conditions to increase vehicle safety. *Cf. Kang*, 2:7-29, 9:32-49, 10:55-11:6, 13:3-18, Fig. 7C, with '765 Patent, 7:38-52, 13:58-14:15, 15:29-46.

F. Schunder

71. USPN 9,451,030 to Schunder (Ex. 1010) was neither cited nor considered during prosecution of the '765 Patent. *Schunder* was filed February 18, 2011, qualifying as prior art under § 102(a)(2). *Schunder* teaches crowdsourced weather collection and provision for vehicles. *Schunder*, Abstract.

72. *Schunder* is analogous to the claimed invention of the '765 Patent because *Schunder* is from a same field of endeavor: vehicles. *Cf. Schunder*, Abstract, 1:63-2:7 with '765 Patent, 1:19-20.

73. *Schunder* is also reasonably pertinent to a particular problem addressed by the '765 Patent: adapting to weather conditions to increase vehicle safety. *Cf. Schunder*, 1:63-2:7, 9:25-10:11, FIG. 4 with '765 Patent, 7:38-52, 13:58-14:15, 15:29-46.

G. DeRuyck

74. USPN 9,714,037 to DeRuyck (Ex. 1011) was neither cited nor considered during prosecution of the '765 Patent. *DeRuyck* was filed August 18, 2015, qualifying as prior art under § 102(a)(2). *DeRuyck* teaches detective driver behaviors in a vehicle. *DeRuyck*, 1:16-34, 3:50-63.

75. *DeRuyck* is analogous to the claimed invention of the '765 Patent because *DeRuyck* is from a same field of endeavor: vehicles. *Cf. DeRuyck*, 1:16-34, with '765 Patent, 1:19-20, 1:34-52, 8:46-53.

76. *DeRuyck* is also reasonably pertinent to a particular problem addressed by the '765 Patent: adjusting an operation of a vehicle based on driver competence level (e.g., level of distraction). *Cf. DeRuyck*, 1:16-34, 3:50-63, with '765 Patent, 8:41-53.

H. Gunderson

77. US Application No. 2007/0268158 to Gunderson (Ex. 1012) was neither cited nor considered during prosecution of the '765 Patent. *Gunderson* was filed May 9, 2006 and published November 22, 2007, qualifying as prior art under §§ 102(a)(1) and 102(a)(2). *Gunderson* teaches event-based analysis to reduce risky driver behavior. *Gunderson*, [0002].

78. *Gunderson* is analogous to the claimed invention of the '765 Patent because *Gunderson* is from a same field of endeavor: vehicles, and specifically evaluating a human's ability to safely operate a vehicle based on a sensed level of distraction. *Cf. Gunderson*, [0002], [0004], [0025], with '765 Patent, 1:19-20, 1:34-52, 8:46-53.

79. *Gunderson* is also reasonably pertinent to a particular problem addressed by the '765 Patent: evaluating driver behavior using weights and improving vehicle safety. *Cf. Gunderson*, [0062] with '765 Patent, 8:54-67.

I. An

80. U.S. Patent No. 9,063,543 to *An* (Ex. 1008) was neither cited nor considered during prosecution of the '765 Patent. *An* was filed September 11, 2013 and claims priority to Korean Application 10-2013-0021258 filed February 27, 2013, qualifying as prior art under § 102(a)(2). *An* teaches cooperative autonomous driving between a vehicle and its driver. *An*, 1:15-23, 1:52-63, 4:34-45.

81. *An* is analogous to the claimed invention of the '765 Patent because *Kang* is from a same field of endeavor: vehicles and, more specifically self-driving vehicles. *Cf. An*, 1:15-23, 1:52-63, 4:34-45, with '765 Patent, 1:19, 5:42-52.

82. *An* is also reasonably pertinent to particular problems addressed by the '765 Patent: evaluating a computer's ability to autonomously operate a vehicle and determining actions to take when faults are detected. *Cf. Attard, An*, 1:15-23, 1:52-63, 4:34-45, 4:46-6:24, 15:1-60, with '765 Patent, 1:19-52, 8:7-12.

VII. GROUNDS OF UNPATENTABILITY

Proposed Grounds of Unpatentability of the '765 Patent
<u>Ground 1:</u> Claims 1-2, 17 are obvious under §103(a) over <i>Attard, Frazer</i> , and <i>McNew</i> .
<u>Ground 2:</u> Claim 7 is obvious under §103(a) over <i>Hampiholi</i> and <i>Attard</i>
<u>Ground 3:</u> Claims 3-4, 18-19 are obvious under §103(a) over <i>Attard, Frazer, McNew, An, Kang</i> , and <i>Schunder</i> .
<u>Ground 4:</u> Claims 5, 20 are obvious under §103(a) over <i>Attard, Frazer, McNew, An, Kang, Schunder, DeRuyck</i> , and <i>Gunderson</i>
<u>Ground 5:</u> Claim 6 is obvious under §103(a) over <i>Attard, Frazer</i> , and <i>Hampiholi</i>
<u>Ground 6:</u> Claim 8 is obvious under §103(a) over <i>Hampiholi, Attard, Frazer, DeRuyck</i> , and <i>Schunder</i>
<u>Ground 7:</u> Claims 10-11 are obvious under §103(a) over <i>Hampiholi, Attard, DeRuyck</i> , and <i>Gunderson</i>
<u>Ground 8:</u> Claim 12 is obvious under §103(a) over <i>Hampiholi, Attard, DeRuyck, Gunderson</i> , and <i>McNew</i>
<u>Ground 9:</u> Claim 13 is obvious under §103(a) over <i>Hampiholi, Attard, McNew, An, Kang</i> , and <i>Schunder</i>

Ground 10: Claims 14-15 are obvious under §103(a) over *Hampiholi, Attard, McNew, DeRuyck, Gunderson, An, Kang, and Schunder*

Ground 11: Claim 16 is obvious under §103(a) over *Hampiholi, Attard, McNew, DeRuyck, Gunderson, An, Kang, Schunder, and Frazer*

VIII. GROUND 1: CLAIMS 1, 2, AND 17 ARE OBVIOUS OVER ATTARD, FRAZER AND MCNEW

A. Claim 1

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

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

a) *Attard Teaches Controlling a Driving Mode*

84. *Attard*’s vehicle 101 is capable of driving autonomously. *Attard*, 1:15-52, 2:28-32, 9:63-67. A POSITA would have understood that a vehicle capable of driving autonomously is a self-driving vehicle (SDV). Many such self-driving/autonomous vehicles were known. For example, as I discussed above, *J3016*

(Ex. 1030) is a document from SAE International that teaches various levels of automation for vehicles, including levels where a vehicle is capable of driving autonomously by using sensors to sense the environment and by autonomously steering, braking, and controlling engine throttle. *Attard's* vehicle 101 includes three driving modes: (1) an autonomous driving mode (in which autonomous driving module 106 of computer 105 controls vehicle 101's functions such as steering, braking, and speed), (2) a semi-autonomous mode (in which the driver/operator controls one or more of vehicle 101's functions and computer 105 controls one or more of vehicle 101's functions), and (3) a manual mode in which a human driver is in "complete" control of vehicle 101. *Attard*, 1:15-52 (autonomous, semi-autonomous), 1:62-2:9, 2:55-3:4 (semi-autonomous, manual; "an alert may inform the vehicle 101 occupant of a need to resume partial or complete manual control of the vehicle 101."), 3:22-27 (autonomous, semi-autonomous), 3:56-67 (autonomous; "module 106 may control various vehicle 101 components and/or operations without a driver to operate the vehicle 101. For example, the module 106 may be used to regulate vehicle 101 speed, acceleration, deceleration, steering, braking, etc."), 7:39-46 (semi-autonomous, manual; "manual braking, to take complete control of the vehicle"), 9:60-67-10:12 ("all vehicle 101 operations, e.g., steering, braking, speed, etc., could be controlled by the module 106 in the computer 105."), 10:36-41. Thus, a POSITA would have understood or found obvious that *Attard* teaches or renders

obvious (1) an autonomous driving mode, (2) a semi-autonomous mode in which both driver and computer each control one or more vehicle functions, and (3) a manual mode in which a driver has “complete” manual control over vehicle functions including steering, braking, and speed. A POSITA would have understood from *Attard*’s teachings that vehicle 101 would have included all three of these modes, including because it was known for self-driving vehicles to have multiple possible levels of automation even within a single vehicle. *See* ¶¶44, 84 (discussing *J3016* (Ex. 1030) and *James* (Ex. 1021)).

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

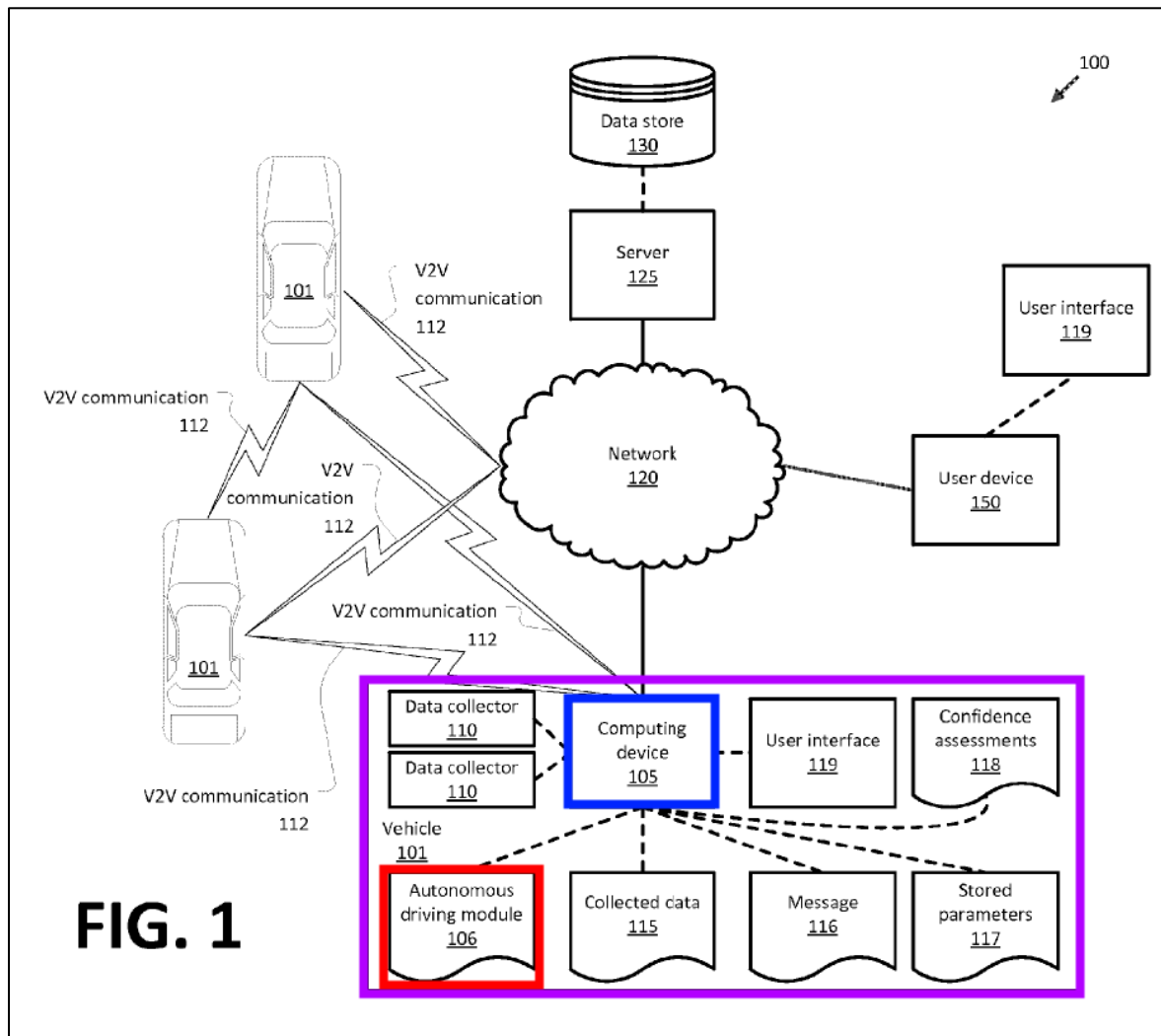
autonomous operations” as an action to take in response to a detected fault. *Attard*, 3:5-13.

86. A POSITA would have recognized that *Attard*’s computer 105 (including autonomous driving module 106) controlling vehicle 101 to transition from autonomous mode to either of semi-autonomous or manual modes would have been *controlling a driving mode*. As I discussed above, it was known for a vehicle to have multiple levels of automation, including for a single vehicle to have multiple modes for driving autonomously, semi-autonomously, or completely manually. *See* V.C. A POSITA would have understood that when disabling vehicle 101’s autonomous functions such as braking, steering, and acceleration, a human driver would have taken over managing such functions, as is done in a typical non-self-driving vehicle (e.g., standard non-SDV car). That is, a vehicle in “manual” (i.e., non-autonomous) mode requires a human driver to manage functions such as engine throttle, braking, and steering just like in a typical non-SDV automobile that does not have self-driving capabilities. *See* V.C. While *Attard* does not expressly use the phrase “manual *mode*,” a POSITA would have understood or found obvious that *Attard*’s driving mode in which the driver takes “complete control” of the vehicle teaches a “manual mode.” Manual mode here means a human driver manages functions such as engine throttle, braking, and steering. I refer to this as “manual mode” to describe the state of the vehicle in which the human driver is required to

actively drive the vehicle. As I discuss above, vehicle 101 includes an autonomous mode, a semi-autonomous mode, and a manual mode, where in the manual mode the human driver manages the engine throttle, braking, and steering.

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

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



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

88. *Attard* teaches the autonomous operations of vehicle 101 may be stored as a set of instructions in vehicle 101's memory and executable by a processor of computer 105. *Attard*, 2:27-32 ("Autonomous operations of the vehicle 101, including generation and evaluation of confidence assessments 118, may be performed in an autonomous driving module 106, e.g., as a set of instructions stored in a memory of, and executable by a processor of, a computing device 105 in the vehicle 101."), 3:15-22 ("In any case, the vehicle 101 generally includes a vehicle computer 105 that includes a processor and a memory, the memory including one or more forms of computer-readable media, and storing instructions executable by the processor for performing various operations, including as disclosed herein."), 15:11-46 (teaching computer-executable instructions, processor, and computer-readable medium including non-volatile media). Thus, a POSITA would have understood or found obvious that *Attard* teaches a computer program product for vehicle 101 including for controlling a driving mode and that the computer program product comprises non-volatile memory and a processor for executing programming instructions. I note that it was commonplace and well known for SDVs like *Attard's* vehicle 101 to include a processor, memory, and programming instructions to control various features of the vehicle including for controlling a driving mode. *See* V.E.

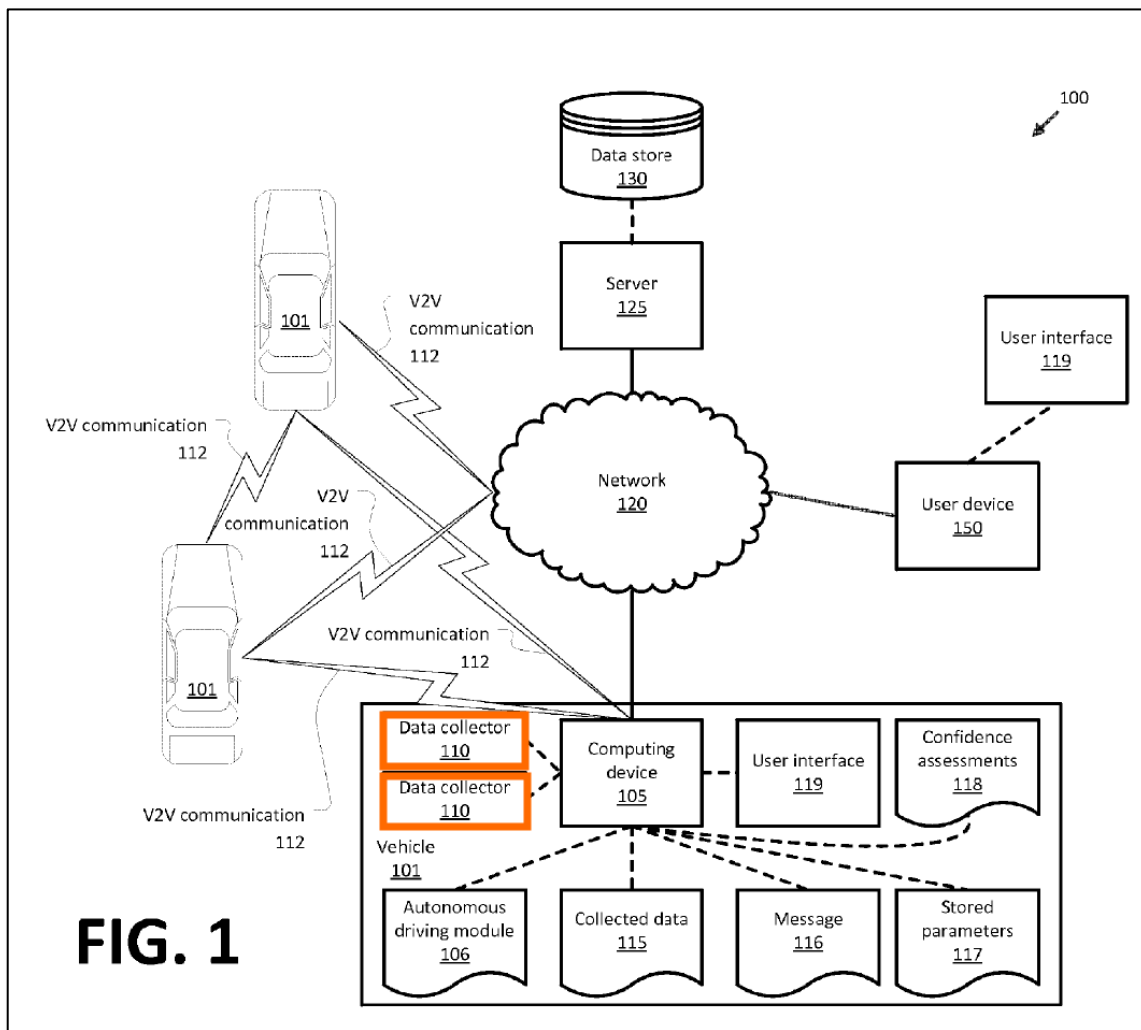
2. Claim 1(a): “receiving sensor readings from a system of sensors, wherein the sensor readings describe a current operational state of a SDV;”

a) Attard’s System of Sensors and Sensor Readings

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

90. Collected data 115 may include “a variety of data collected in a vehicle 101 from data collectors 110.” Attard, 4:32-45. Attard teaches numerous examples of data collectors 110 collecting collected data 115. A POSITA would have understood that a camera data collector would have collected image or video data, and similarly a GPS sensor would collect data related to GPS. I also note it was commonplace for self-driving vehicles such as Attard’s vehicle 101 to include a plurality of sensors. See V.E. Additionally, Attard teaches collected data 115

includes not only data gathered by one or more collection devices 115, but also includes data *derived from* the sensor readings. Specifically, *Attard* teaches collected data 115 includes “any data that may be gathered by a collection device 110 and/or derived from such data.” *Attard*, 4:32-45. *Attard*’s sensors 110 (annotated orange) are depicted below:



Attard, Fig. 1 (annotated). I note that *Attard* teaches a plurality of data collectors 110, including depicting at least two in Fig. 1. Further, *Attard* refers to data collectors

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

91. A POSITA would have understood or found obvious that *Attard*’s sensors 110 are a *system of sensors* because *Attard* teaches a plurality of such sensors and the sensors work together with vehicle 101 including computer 105 and autonomous driving module 106 to collect data 115. *Attard*, 4:1-17, 1:61-2:6. To the extent PO argues *Attard* does not expressly teach *sensor readings*, a POSITA would have understood or found it obvious that *Attard*’s cameras capture collected data 115, which are *sensor readings*. Compare *Attard* with ’765 Patent’s descriptions of sensors 153. For example, the ’765 Patent describes sensors 153 “are sensors that detect an operational state of an SDV, including anomalous states such as, but not limited to, a presence of snow tires mounted on the SDV during a first road condition of the roadway, an absence of snow tires ... tire pressure ... tire tread ...an inoperable headlamp ... a faulty braking system.” ’765 Patent, 5:53-6:2. In my opinion, *Attard*’s sensors are a system of sensors that detect operational states of the SDV, as I discuss in more detail below.

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

92. The '765 Patent describes that an “operational state” of a vehicle including states (e.g., presence/absence of snow tires), conditions (e.g., road conditions), and measured parameters (e.g., tire pressure, fluid volume) detected via its system of sensors. '765 Patent, 5:53-6:2. A POSITA would have understood that faults described in the '765 Patent are thus a subset of all the operational states, where a fault indicates an anomalous operational state. Operational states may, in some cases, indicate “anomalous” or “faulty” states, including failure of a particular system (e.g., an “all wheel traction system”) or a fault (e.g., a “faulty braking system.”). *Id.* Thus, a fault is a subset or species of the broader genus of operational states.

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

94. Because *Attard's* collected data 115 (“*sensor readings*”) detect conditions external to the vehicle (e.g., weather conditions, road attributes) and data internal to the vehicle (e.g., acceleration, speed) used to perform autonomous driving, *Attard's sensor readings describe a current operational state of a SDV*, as claimed. Compare *Attard*, 1:61-2:6, 4:1-17, 6:4-13, 10:13-27 with '765 Patent, 5:53-6:2. Indeed, as I discussed above, the '765 Patent describes sensors indicating operational states such as presence or absence of snow tires and weather or road conditions. *Attard's* sensors 110 are similarly capable of indicating conditions on the roadway, weather, and also operational states related to the vehicle itself.

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

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

a) '765 Patent's Fault Description

96. As discussed above regarding limitation 1(a), the “operational state” of a vehicle, as described by the '765 Patent, may indicate that a fault has occurred, such as a “faulty braking system.” '765 Patent, 5:53-6:2. Though a fault is sensed, in some instances the fault may be tolerable, so long as a threshold for danger has

not yet been exceeded (as further described below regarding limitation 1(c)). '765 *Patent*, 7:67-8:1 (“A threshold for seriousness of the fault may be applied to vehicle measures in order to determine if the switch (from manual mode to autonomous mode or vice versa) is required.”), 8:7-12 (“Based on the detected fault exceeding a threshold for danger, the SDV either switches from autonomous mode to manual mode or from manual mode to autonomous mode.”), 9:7-12.

b) Attard's Fault Teachings

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

98. *Attard* uses collected sensor data 115 to produce confidence assessments 118 indicating whether the vehicle “can and/or should be operated autonomously.” *Attard*, 5:54-6:3, 5:21-53, 6:14-35. *Attard's* confidence assessments 118 are generated in two coexisting forms. Specifically, *Attard* uses element number 118 to refer to all the confidence assessments, both for Φ and ϕ . I note that both Φ and ϕ are utilized in *Attard's* system. Φ refers to an overall scalar value whereas each ϕ refers to a single sensor or system of sensors, for example, as I discuss below.

99. In one form, *Attard* produces an overall confidence assessment Φ , which may be “a **scalar** value, e.g., as a number [] in the range of 0 to 1. *Attard*, 5:54-6:3.

100. Overall confidence assessment Φ is mapped as the claimed “control processor competence level” in limitation 1(h) below.

101. Additionally, *Attard's* confidence assessments 118 are provided in a **vector** form, represented as φ_n^{PL} (for confidence assessments related to external/perceptual data) or φ_m^{AL} (for confidence assessments related to internal/actuator data). *Attard*, 6:4-13, 5:21-6:3, 6:36-44. As I discussed above, both Φ and φ are generated and present in all embodiments of *Attard*. That is, Φ and φ are *not* alternatives to one another; rather, Φ and φ are both generated and both are necessary in *Attard*.

102. Vector confidence assessments φ^{PL} and φ^{AL} will be referred to as φ below, for simplicity.

103. As discussed below, each vector confidence assessment¹ (φ) comprises a plurality of sub-assessments φ_i , where each φ_i is related to a single sensor (e.g.,

¹ *Attard* uses element 118 to refer to both overall confidence assessment Φ and vector confidence assessments φ . *Attard*, 2:10-48, 5:54-6:44, 6:61-7:23, 7:39-46, 7:62-

camera) or a group of sensors. *Attard* names φ_i “confidence attribute sub-assessments 118.”² *Attard*, 7:39-46. I also note that in *Attard* the vector confidence assessment φ can be determined for a group of sub-assessments φ_i , such as for φ^{PL} and φ^{AL} . Thus, φ_i is referred to as a sub-assessment of a vector confidence assessment φ . Each of *Attard*’s vector components φ_i indicate a potential fault within one sensor or a group of related sensors. In particular, *Attard*’s sub-assessments φ_i may indicate a fault related to a single attribute of the vehicle 101 or a single condition related to the environment or operation of the vehicle (e.g., a weather condition, a road condition, vehicle speed, braking performance, acceleration, steering, navigation, traffic, etc.). *Attard* 6:4-13, 7:39-46 (teaching specific content of an alert message is based on the condition/attribute of φ_i), 7:65-8:13. In particular, *Attard* teaches generating an alert message with semantic content S_i based on φ_i . *Attard*, 7:65-8:45. As depicted below, the equation at *Attard*, 8:8 includes φ_i to indicate a single attribute, such as optical lane-tracking.

8:45. Element “118” is omitted below, and each confidence assessment is referred to as its specific type (i.e., overall, vector, sub-assessment) for clarity.

² *Attard* refers to φ_i as “confidence attribute sub-assessments,” “vector component,” and other related phrasing. *Attard*, 7:65-8:4, 11:10-15. For clarity, in the Petition and in this Declaration, φ_i is referred to as “sub-assessment” throughout.

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

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

104. Though *Attard* does not provide detailed mathematical description regarding Φ , a POSITA would have known various approaches for its calculation. As I discuss below, there were numerous known mathematical methods for converting one or more vectors into a scalar quantity, and it would have been obvious to a POSITA to utilize such a calculation to generate Φ from a plurality of sub-assessments ϕ_i . For example, a POSITA would have understood or found obvious techniques for converting *Attard's* **vector** confidence assessments ϕ directly to a **scalar** via a well-known mathematical method (e.g., computing magnitudes of ϕ^{PL} and ϕ^{AL} and summing or averaging their values, or computing the dot product of ϕ^{PL} and ϕ^{AL}) to yield overall confidence assessment Φ (a scalar value). I note that *Attard* does not expressly teach a specific method for performing such conversion, but a POSITA would have understood or found obvious using any number of mathematical approaches for such a calculation. I note claim 1 does not require any particular mathematical relationship between Φ (the mapped CPCL of limitation 1(h)) and ϕ . Therefore, in my opinion, any mathematical approach for calculating

Attard's Φ would have satisfied claim 1, including approaches in which Φ is not directly calculated using ϕ whatsoever. For instance, but each of Φ and ϕ may, in some embodiments, have been independently calculated from sensor data. *Attard* is not specific on how each are calculated, and the difference does not matter to the claims of the '765 Patent. A POSITA would have understood any number of approaches for calculating each of the values, potentially using simple vector mathematics. A POSITA would have understood that an approach using ϕ to calculate Φ would have made sense within *Attard*.

c) *Vector Components ϕ_i*

105. *Attard's* collection of sensor data is categorized into a perceptual layer (PL) comprising data sensed external to the vehicle, and an actuation layer (AL) comprising data sensed internal to the vehicle. *Attard*, 6:36-44. For each of *Attard's* collected data 115, whether categorized as PL or AL, a confidence assessment ϕ is generated and stored, which *Attard* labels as ϕ^{PL} having components $(\phi_1^{\text{PL}}, \phi_2^{\text{PL}}, \dots, \phi_n^{\text{PL}})$ and ϕ^{AL} having components $(\phi_1^{\text{AL}}, \phi_2^{\text{AL}}, \dots, \phi_m^{\text{AL}})$. *Attard*, 6:36-44. I note that each component of ϕ^{PL} and ϕ^{AL} is a sub-assessment ϕ_i , which I discussed above, related to either the PL or AL. *Attard* teaches “various ways of estimating confidences and/or assigning values to confidence intervals are known and may be used to generate the confidence assessments 118” using known techniques such as “Input Reconstruction Reliability Estimate (IRRE) for a neural network,

reconstruction error of displacement vectors in an optical flow field, global contrast estimates from an imaging system, return signal to noise ratio estimates in a radar system, internal consistency checks, etc.” *Attard*, 6:14-51. A POSITA would have understood from *Attard*’s teachings of using any of the various techniques to estimate confidences and/or assign values to confidence intervals that a variety of methods would have been suitable.

106. Regardless of into which vector (φ) each sub-assessment φ_i falls or how the sub-assessments φ_i are mathematically determined, each sub-assessment φ_i is compared with threshold(s) specified by *Attard*’s parameter 117 corresponding to that particular sub-assessment φ_i . *Attard*, 5:21-65. *Attard*’s thresholds are used to indicate when a fault has occurred. That is, for each sub-assessment φ_i , an associated parameter 117 is stored comprising thresholds ($\varphi_{\min}$) for comparison with sub-assessment φ_i to determine when associated collected data 115 indicates a particular driving condition/attribute has become problematic. *Attard*, 5:21-29, 6:4-13. Thus, when a sub-assessment φ_i is less than a threshold $\varphi_{\min}$, that indicates that a fault has occurred for that particular sensor (and thus for the operational state that the sensor monitors, such as road conditions or weather conditions). Thus, each sub-assessment φ_i represents a potential fault. Indeed, as I discussed above, *Attard* teaches generating an alert message with semantic content S_i based on φ_i . *Attard*, 7:65-8:45. As depicted

below, the equation at *Attard*, 8:8 includes ϕ_i to indicate a single attribute, such as optical lane-tracking.

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

Attard, 8:8.

107. In one example, *Attard* describes a sub-assessment ϕ_1 representing optical lane-tracking confidence. *Attard*, 8:10-39. Though *Attard* is not express on this point, a POSITA would have understood this particular sub-assessment ϕ_1 would have been based on collected data 115 received from a component such as an external camera or infrared sensor used for lane tracking. As an example, collected data 115 includes data obtained from sensors 110 such as camera images, radar, lidar, data from infrared sensors, etc. *Attard*, 4:67-5:3. In any case, *Attard* explains sub-assessment ϕ_1 is compared to a threshold ϕ_{min} (from an associated parameter 117), and if $\phi_1 < \phi_{min}$, a message may be generated regarding the fault, where the urgency/severity of the fault may be indicated in the message. *Attard*, 8:10-39. As an example, *Attard* teaches various levels of severity, including “Deadly,” “Danger,” “Warning,” “Caution,” and “Notice,” where “Deadly” indicates the highest level of severity and “Notice” indicates the lowest level of severity. *Attard*, 8:10-39. Regardless of the level of severity, a POSITA would have understood that a fault

occurs when $\phi_1 < \phi_{\min}$. Thus, sub-assessment ϕ_i falling below threshold $\phi_{\min}$ determines a “fault” has occurred, as claimed. *Id.*

108. As will be further discussed below regarding limitation 1(c), this “fault” may, in some cases, be tolerable to *Attard’s* SDV, much like the method described by the ’765 Patent. For example, when a sub-assessment ϕ_i falls below a particular threshold, a low-urgency fault message may be presented such as “Notice,” “Caution,” or “Warning.” *Attard*, 8:10-25. Here, the fault may not yet have exceeded the threshold for “Danger,” which would warrant a message indicating higher urgency. *Id.* As I discussed above, *Attard* teaches various levels of high severity such as “Deadly” and “Danger” and lower levels of severity including “Caution” and “Notice.” *Attard*, 8:10-39. Indeed, if a more severe problem has occurred, a POSITA would have understood that sending a more urgent message would have made sense. For example, if a sensor that is critical to autonomous driving (e.g., LIDAR or a camera, for example) has experienced a fault, a more urgent response would be needed than if a redundant sensor has failed or experienced a fault. In another example, a fault may indicate that one of multiple cameras has failed, but, due to redundancy, the vehicle may continue operating autonomously. *Attard*, 14:64-15:1. In such a case, a POSITA would have understood that a less urgent message would have been warranted to inform the driver that a problem has occurred but that the problem is not critical. Indeed, some faults may not exceed the threshold for danger

because they are not severe enough to significantly impact the autonomous driving mode, for example light fog that may be an indication of future problems but is insufficient to degrade performance as is. In such a case, there may be a fault that causes a lower urgency message to be sent to the driver, such as “Notice” or “Caution,” where the fault does not rise to the level of severity to send a message indicating “Deadly” or “Danger.” Thus, some faults may be “tolerable.”

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

109. As discussed regarding limitation 1(b), *Attard* teaches determining a fault when a sub-assessment ϕ_i falls below a threshold $\phi_{\min}$, triggering message generation such as “Notice,” “Caution,” or “Warning.” *See*, Claim 1(b) *citing Attard*, 8:10-39. As further explained above, *Attard* teaches computer 105 and at least one processor performing its steps. *See*, Claim 1(Pre)-1(a).

110. *Attard* continues, explaining that if the sub-assessment ϕ_i continues to fall below another threshold, a message for “Danger” is generated. *Attard*, 8:10-39, 11:36-62. That is, a second determination is made to determine *whether the fault exceeds the threshold for danger*. This is evidenced at least by *Attard* teaching that “[f]or each vector component that falls below the threshold, the computer 105 may formulate a message” such that the message formulation (e.g., the second determination) occurs after the first determination that there is a fault ($\phi < \phi_{\min}$). *Attard*, 8:1-4, *see also*, 11:36-62. As I discussed above for Claim 1(b), *Attard* teaches

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

111. Though *Attard*’s disclosure describes sub-assessment φ_i falling *below* a threshold for danger, a POSITA would have understood that *Attard* teaches surpassing, and thus “*exceeding*” the threshold for danger, as claimed. *Attard*, 8:10-25. *Attard*, 7:18-23 (“When an overall confidence assessment 118 for a specified value or range of values, e.g., a confidence interval, meets or exceeds a predetermined threshold within a predetermined margin of error, e.g., 95 percent plus or minus three percent, then the computer 105 may include instructions for providing a message 116, e.g., an alert, via the affective interface 119.”), 11:15-25

(teaching generating an alert based on a second assessment 118 meeting or exceeding a threshold even if a first assessment did not meet or exceed a threshold). Particularly, *Attard* expressly uses the word “exceed” to describe surpassing a threshold in the negative direction, i.e. the quantity “exceeds” a threshold by dropping below the threshold, though the value of the parameter is becoming smaller. A POSITA would have understood that “exceeding” may occur in either a positive or negative direction depending on the values of the scale, and that this is merely a design implementation detail that is essentially arbitrary. Additionally or alternatively, a POSITA would have had the skill and would have understood how to invert *Attard*’s scale such that surpassing/exceeding would be in the positive direction. For example, multiplying values by -1 would have inverted the threshold to be exceeded in the positive direction. Such a modification would have required only basic and straightforward changes to programming instructions, well within the skillset of a POSITA.

a) Overall Confidence Assessment Φ

112. As will be further discussed below regarding limitation 1(h), the above process of determining if a sub-assessment ϕ_i exceeds a threshold for danger only occurs if *Attard*’s overall confidence assessment Φ (the scalar between 0-1) falls below a threshold $\Phi_{\min}$. These two sub-steps of *Attard*’s process, wherein Φ falls

below $\Phi_{\min}$ AND φ_i falls *below* a threshold for danger, are collectively mapped as limitation 1(c).

113. Thus, *Attard's* overall confidence assessment Φ (mapped below as the claimed *control processor competence level*) is used as part of the step of “determining, by the one or more processors, whether the fault exceeds a threshold for danger.”

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

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

114. *Attard* teaches a fault. See Claim 1(b). Further, *Attard* teaches taking one or more corrective actions based on the fault that occurs. *Attard*, 14:63-15:4 (“the nature of a fault may indicate an action directed by the computer 105.”). For example, when Φ falls below $\Phi_{\min}$, computer 105 may perform a corrective action, such as sending a message (e.g. “Caution” or “Danger”) or performing an action (e.g., slowing the vehicle to a stop) based on the fault. Compare *Attard*, 2:28-3:4, 3:9-13, 7:18-57, 8:10-39, 14:27-33 with '765 Patent, 8:17-22, 11:64-12:3. In one example, content of message 116 to be displayed “may be determined according to an identity of the component that has dropped below” (i.e., “exceeded”) the threshold. *Attard*, 8:1-13. Here, *Attard* teaches the “component” refers to sub-assessment φ_i , and thus the message is related to the specific fault that has occurred.

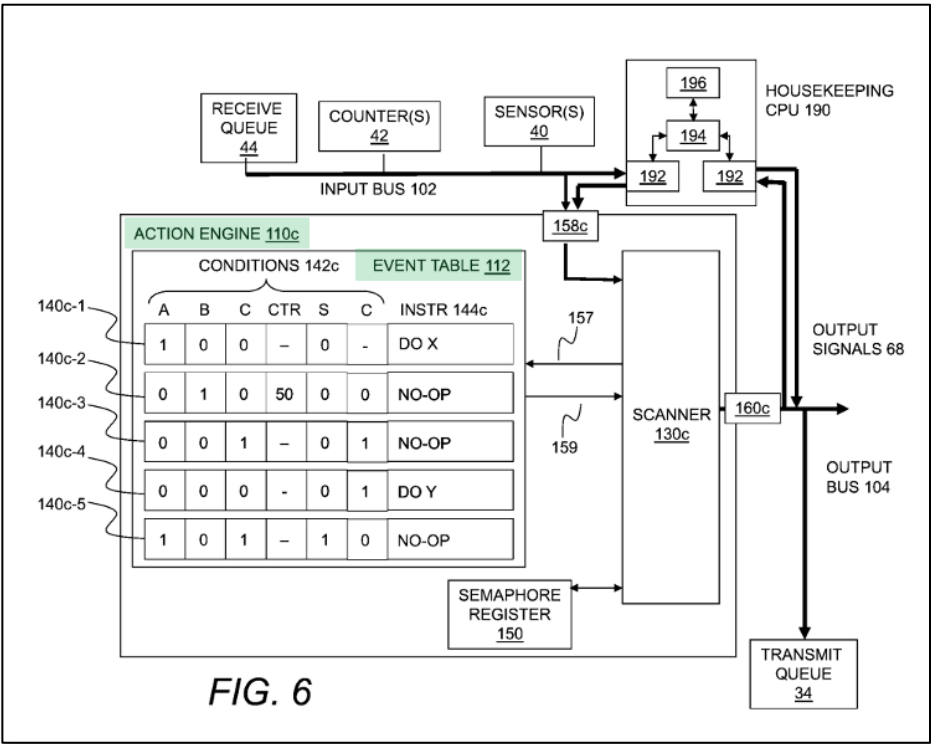
As discussed above, each sub-assessment ϕ_i relates to one or more sensors, such that a fault with a particular ϕ_i may be a fault in a particular sensor. Additionally, a requested action (“RA”) may be included in the message, where the RA is a function of the vehicle “subsystem i” and sub-assessment ϕ_i . *Attard*, 8:36-38 (“A requested action (RA); in the example above, $RA=f(i, \phi_i)$ is the phrase “Driver intervention.”). Here, the RA is a function of a specific sensor related to ϕ_i , which a POSITA would have understood means a requested action may be based on a fault of a single sensor. Thus, a POSITA would have recognized *Attard* teaches determining performing particular actions in response to particular determined faults.

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

b) Frazer Teaches a Fault-Remediation Table

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

142c stored in event table register 140c, corresponding action(s) 144c stored in event table register 140c are executed. *Frazer*, 22:6-22. *Frazer's* event table 112 is depicted below:



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

117. A POSITA would have recognized *Frazer's* event table 112 mirrors the description of a fault-remediation table in the '765 Patent. *See '765 Patent*, 8:23-40 (“fault-remediation table, where each row refers to a fault condition, a first column refers to a condition that gets manifested by that fault, and a second column that refers to the mode in which the vehicle should be driven when that condition is manifested.”) *compared with Frazer*, 21:19-43, FIG. 6. In particular, *Frazer's* rows 140c (annotated red) represent fault conditions, a first column 142c (annotated

green) refers to a condition manifested by that fault, and a second column 144c (annotated purple) refers to the action to be taken when the conditions are manifested (“DO X”). I note that *Frazer’s* event table 112 includes five exemplary rows 140c and similarly five instructions 144c (with each row having a corresponding corrective action/instruction), and six exemplary columns 142c. A POSITA would have understood that *Frazer’s* table is merely illustrative and that many more rows and/or columns would have been included as necessary to capture all the various scenarios for faults and corresponding corrective actions.

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

Frazer, FIG. 6 (excerpt, annotated). I note that here a condition column is annotated green, a fault is a row annotated red, and the column for corrective actions for each fault is annotated purple. In an *Attard-Frazer* table, rows 140c would indicate particular faults, conditions 142 would indicate conditions related to the faults (for

example, a sub-assessment ϕ_i being in a particular range of values), and one or more corresponding corrective actions to be taken as a result of the fault occurring.

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

c) Motivation to Combine Attard-Frazer

119. A POSITA would have found it obvious and been motivated to modify *Attard's* fault handling (including determining a corrective action, such as a “Danger” message) with *Frazer's* teachings of organizing faults, conditions, and action(s) to take for each fault in an event table (i.e., *fault-remediation table*), which would have resulted in *determining a corrective action associated with the fault using a fault-remediation table*. Indeed, one advantage of utilizing an event table (“fault remediation table”), such as per *Frazer's* teachings, is to have pre-programmed scenarios ready to go to address any desired scenario that may occur along with the proper action to take. A POSITA would have found it obvious and been motivated to determine which corrective action to take using *Frazer's* event table to enable easy access and quick determination of actions to take in response to

detected faults. Utilizing a well-known table for this operation means the vehicle does not need to come up with a corrective action on-the-fly; rather, the SDV determines there is a fault and looks up what correction action(s) should be taken. A POSITA would have recognized formatting data into a table was a well-known and widely-used method of efficiently organizing data for retrieval, reference, and potential modification. I note that tables are a widely utilized format for organizing data both electronically in computer systems and even on paper (such as in textbooks and academic journal articles).

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

121. A POSITA would have understood *Frazer* provides an express motivation for the combination, stating its action engine “exhibits a significantly low latency with respect to processing information relating to respective states of the

dynamic environment and taking actions in response to same.” *Frazer*, 23:64-67. A POSITA would have been motivated to utilize a solution such as *Frazer*’s event table to achieve such low latency for processing related to determining a corrective action to take. Indeed, when a driver is driving an SDV at high speed down a highway, for example, there may be little time before a particular corrective action needs to be taken (such as slowing the vehicle, switching to manual mode, alerting the driver, etc.). Thus, utilizing a fault-remediation table when driving in an SDV such as *Attard*’s would have been advantageous for the driver, including by increasing safety.

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

for example. A POSITA would have understood that such difficult ethical decisions are better decided ahead of time where more time is available to arrive at a desired corrective action instead of having to make a decision in mere seconds, for example. In this way, using a fault-remediation table such as *Frazer's* would have been advantageous in *Attard's* SDV.

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

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

6, and particularly the action engine 110c, may be employed include, ... autonomous or semi-autonomous vehicle.”), 21:33-51 (“The action engine 110c includes an event table 112”), *generally* 21:52-22:22.

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

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

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

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

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

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

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

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

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

129. For example, *Attard* teaches that when Φ falls below $\Phi_{\min}$, computer 105 may perform (*implement*) a corrective action, such as sending a message or

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

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

would have been well within the skillset of a POSITA. Thus, when a condition of the event table is met (e.g., fault, such as a threshold exceeded), a corresponding corrective action is implemented in response to the particular fault. A motivation to modify *Attard* per *Frazer*'s teachings is provided above. *See*, Claim 1(d).

7. *Claim 1(f): “wherein, the sensor readings comprise a reading from a GPS sensor;”*

131. As discussed above, *Attard* teaches vehicle 101 includes sensors 110 that perform sensor readings. *See* Claim 1(a). In particular, *Attard* teaches sensors 110 include a GPS sensor that sends GPS (global positioning system) sensor readings to computer 105. *Attard*, 4:4-11 (teaching vehicle 101 includes data collectors 110 such as global positioning system (GPS) equipment), 4:32-45, 6:4-13 (teaching navigation, which a POSITA would have understood would have utilized vehicle 101's GPS in at least some cases), 7:14-17, 10:42-52, 13:22-24 (teaching a first vehicle losing its ability to determine a vehicle 101 location, e.g., GPS coordinates), 13:56-58 (teaching using GPS data to generate a virtual map for vehicle 101), 14:41-48 (teaching vehicle 101 using stored map data and GPS data for navigation). *See* Claim 1(a). In the Petition, Petitioner notes claim 1 requires nothing more than mere presence of GPS sensor readings. In my opinion, *Attard* teaches GPS sensor readings.

8. *Claim 1(g): “the fault comprises a current weather condition of the roadway on which the SDV is currently traveling;”*

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

133. Further, *Attard* teaches or renders obvious a *fault comprises a current weather condition of the roadway on which vehicle 101 (“the SDV”) is currently traveling*. In particular, *Attard* teaches various weather conditions (e.g., ice, snow, rain) may cause a fault. *Attard*, 2:10-21, 2:61-3:4, 4:1-17, 4:32-56 (“collected data 115 could include data 115 concerning ... detection of road attributes such as those mentioned above, weather conditions, etc.”), 6:4-13 (“weather conditions, road conditions”), 6:61-7:5, 7:51-57, 10:42-52. I note that *Attard* teaches its sensors detect environmental conditions, for example around vehicle 101. Thus, *Attard’s* sensors (e.g., cameras) gather data regarding weather conditions for the roadway on which the SDV is currently traveling. When a fault that is related to a current weather condition occurs, the fault is thus related to the current weather condition of the roadway on which the SDV is currently traveling.

134. I note that the weather conditions themselves may cause a fault. That is, snow or sleet, for example, may be determined to be a fault even if hardware of vehicle 101 is still functional and will work as normal after the weather conditions have passed. In one example, *Attard* teaches weather conditions may cause a fault

by lowering a confidence assessment below a threshold even if there is no problem with a sensor 110 (that is, the fault is not due to hardware malfunction). That is, the fault comprises a current weather condition itself. *Attard*, 7:14-17 (“Note that lower confidence assessments 118 may or may not reflect a hardware fault; for example, environmental conditions (e.g., wet or icy roads) may lower a related confidence assessment 118 even though no hardware failure is implied.”). On the other hand, in some cases, a POSITA would have understood that perhaps strong winds, hail, or other factors would damage vehicle sensors, rendering the sensors inoperable. This is another example of *Attard*’s faults. That is, *Attard* teaches a weather condition may cause a fault by damaging hardware. Thus, *Attard* teaches a particular sub-assessment ϕ_i corresponding to a weather condition on the roadway on which the SDV is traveling, such as driving on currently wet or icy roads, that may result in a fault, and particularly a fault that may “exceeds a threshold for danger.” Thus, *Attard* teaches a particular sub-assessment ϕ_i corresponding to a weather condition on the roadway on which the SDV is traveling, such as driving on currently wet or icy roads, that may result in a fault, and particularly a fault that may “exceed a threshold for danger.”

9. ***Claim 1(h): “determining whether the fault exceeds a threshold for danger comprises determining a control processor competence level;”***

135. As discussed above, Attard teaches or renders obvious determining ... whether a fault has occurred and determining whether the fault exceeds a threshold for danger. See Claim 1(b)-1(c). Further, Attard teaches determining a control processor competence level (CPCL), Φ .

a) '765 Patent's CPCL

136. The '765 Patent characterizes a CPCL as “a competence level of the SDV control processor in controlling the SDV while the SDV experiences the current operational anomaly.” *'765 Patent*, 1:34-41, 10:3-9 (“Various approaches may be used to determine this control processor competence level.”), 10:27-47.

b) Attard's CPCL – Φ^3

137. As discussed above, *Attard's* confidence assessments 118 are generated in two coexisting forms: Φ , which may be “a **scalar** value, e.g., as a number...in the range of 0 to 1,” and ϕ , a **vector**, “where each value in the vector relates to an attribute [] of the vehicle 101 and/or a surrounding environment...such as such as vehicle speed, braking performance, acceleration,...weather conditions, road

³ For simplicity, I use the acronym CPCL to refer to the competence level of the control processor, which is claimed using various phraseology, e.g., *a control processor competence level* (Claims 1, 17); *a competence level of the processor* (Claims 6, 7); *competence level of a control processor* (Claim 18).

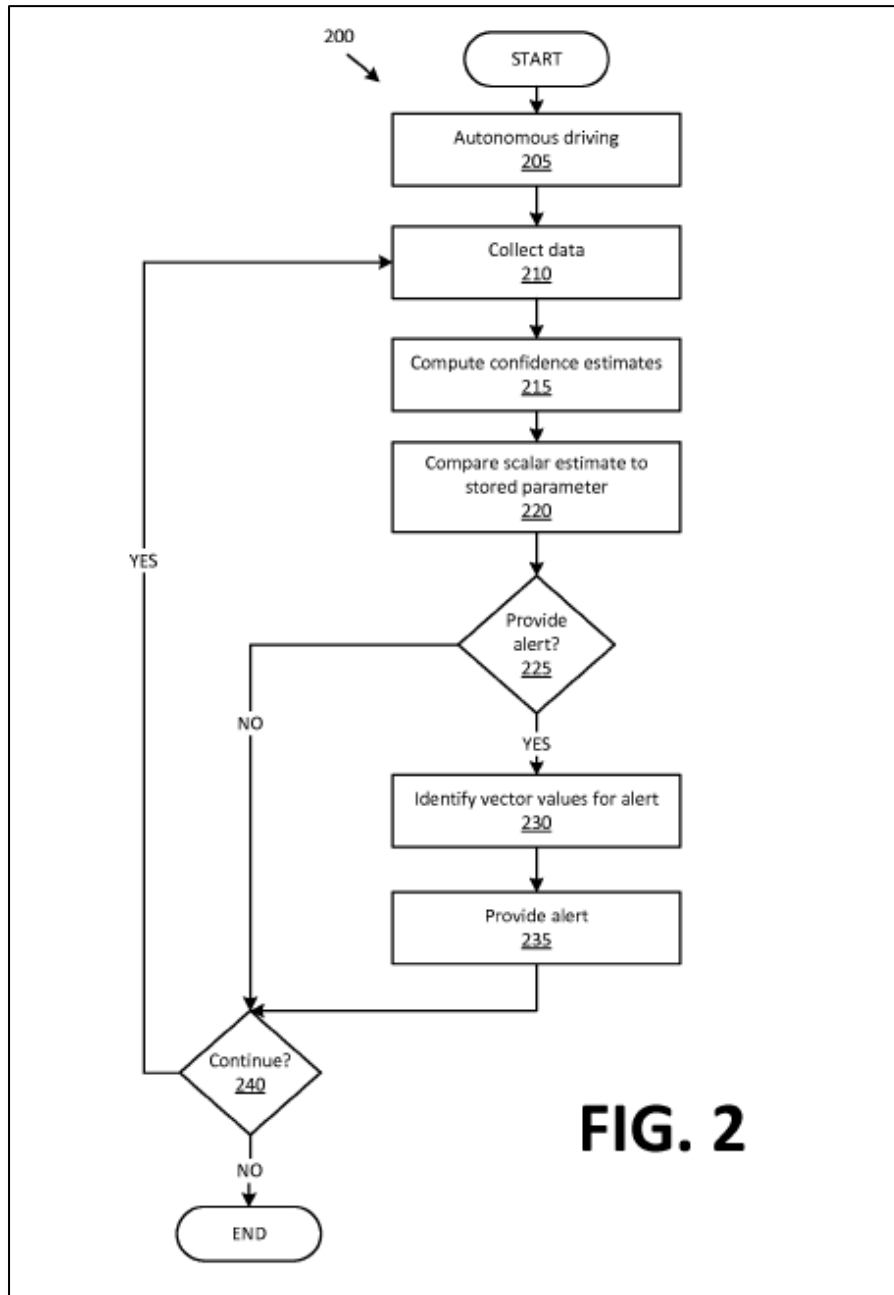
conditions, etc.” *Attard*, 5:54-6:13. *Attard* teaches determining a fault has occurred due to a particular sub-assessment ϕ_i falling below an associated threshold $\phi_{\min}$, triggering message generation specific to the particular sub-assessment ϕ_i . *See*, 1(b). *Attard*’s Φ is a CPCL because it “indicates an overall value that the vehicle 101 can and/or should be operated autonomously.” *Attard*, 5:54-6:3, 1:44-50 (“The computer 105 may include instructions for determining that an autonomous driving module 106, e.g., included in the vehicle computer 105, may not be able to operate the vehicle 101 autonomously or semi-autonomously with acceptable confidence, e.g., confidence expressed numerically that is lower than a predetermined threshold.”) Thus, *Attard*’s Φ is a CPCL because it indicates whether the autonomous module 106 and, therefore, vehicle 101 can operate autonomously.

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

139. Additionally, *Attard* explains that the functionality of comparing sub-assessment ϕ_i to $\phi_{\min}$ thresholds is “triggered when the overall confidence

assessment 118 (Φ) drops below a specified predetermined threshold $\Phi_{\min}$.” *Attard*, 7:18-28, 10:18-52, 11:26-42, Fig. 2. A POSITA would have understood that in *Attard*’s comparison process, Φ would fall below $\Phi_{\min}$ in at least some cases where φ_i falls below $\varphi_{\min}$, depending on how severe the fault represented by φ_i is. That is, though is possible that φ_i falling below $\varphi_{\min}$ does not result in the overall confidence assessment Φ dropping below $\Phi_{\min}$, at least in the case where φ_i falling below $\varphi_{\min}$ **does** result in Φ dropping below $\Phi_{\min}$ *Attard* teaches this limitation. Thus, the process of determining if a sub-assessment φ_i exceeds a threshold for danger only occurs if *Attard*’s overall confidence assessment Φ falls below a threshold $\Phi_{\min}$. Because these two sub-steps of *Attard*’s process (Φ falling below $\Phi_{\min}$ AND φ_i falling below a threshold for danger) are collectively mapped as “determining, by the one or more processors, whether the fault exceeds a threshold for danger,” *Attard* teaches “determining whether the fault exceeds a threshold for danger comprises determining a control processor competence level,” as claimed.

140. *Attard* provides a detailed description of one embodiment of its envisioned method as FIG. 2, which is reproduced below.



Attard, FIG 2, 9:60-12:31. Though this figure and accompanying description is not limiting, it provides a thorough explanation of the similarities between *Attard's* method and the claims of the '765 Patent. *Attard*, 15:47-16:8 (explaining that steps of figures may be performed in any order, have additional or omitted steps, or steps

may be performed simultaneously). At step 210, the *Attard* vehicle acquires collected data from a plurality of sensors, as in limitation 1(a). *Attard*, 10:13-17. At step 215, confidence thresholds Φ and ϕ_i (of which there are a plurality of ϕ_i s) are computed. *Attard*, 10:18-52. As explained above, Φ and ϕ_i are used in concert to determine that a fault has occurred. If the detected fault exceeds the threshold for danger, a corrective action is determined corresponding to a “danger” message notification at steps 220-230. *Attard*, 10:53-11:35. At step 235, the corrective action is taken, when the danger message is provided to the driver. *Attard*, 11:63-66.

10. *Claim 1(i): “the corrective action comprises transferring driver controls to manual control and alerting a human driver to take over immediately.”*

141. As discussed above, *Attard* teaches implementing corrective action(s) and *Attard-Frazer* teaches using a fault-remediation table to determine and implement a corrective action associated with the fault. *See* Claim 1(d)-1(e).

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

142. *Attard* teaches corrective actions including providing a message to a human driver including audio and/or visual alerts. *See* Claim 1(e). *Attard* also teaches the alerts can include an “urgency” component, for example, indicating a need for the driver to take over manual control immediately. For example, *Attard* teaches messages 116 (“e.g., an alert”) can “convey a level of urgency or importance to a vehicle 101 operator, e.g., by using prosody techniques to include emotional

content in a voice alert, a visual avatar having an appearance tailored to a level of urgency, etc.” *Attard*, 2:28-46. In particular, *Attard* teaches alerting the driver with a high level of urgency to take over manual control immediately. *Attard*, 2:55-61 (“an alert may inform the vehicle 101 occupant of a need to resume partial or complete manual control of the vehicle 101.”), 2:62-3:4 (“to indicate a level of urgency, e.g., immediate manual control is recommended.”), 7:39-61 (“a warning for a vehicle 101 occupant to take over steering, to institute manual braking, to take complete control of the vehicle 101.”).

143. As I discussed above for Claim 1(b), *Attard* teaches several exemplary levels of severity, including “Deadly,” “Danger,” “Warning,” “Caution,” and “Notice,” where “Deadly” indicates the highest level of severity and “Notice” indicates the lowest level of severity. Thus, if sub-assessment φ_i falls below $\varphi_{\min}$, the severity of the fault is determined, which in some cases means the fault has *exceeded a threshold for danger*. For example, severity levels of “Danger” and “Deadly” *exceed a threshold for danger*. A POSITA would have understood that the value of φ_i when compared to one or more thresholds $\varphi_{\min}$ thus determines the severity level, and an appropriate corrective action is taken. *See Attard*, 7:18-9:10. In at least some cases, an appropriate corrective action is warning the driver to “take over steering,” “take complete control of the vehicle,” “immediate manual control is recommended, manual control may be recommended within the next minute,” and other suitable

time frames. *Attard*, 2:55-3:4, 7:39-61. In one example, *Attard* teaches corrective actions include “the first vehicle 101 disabling and/or ceasing one or more autonomous operations, e.g., steering control, speed control, adaptive cruise control, lane maintenance, etc.” *Attard*, 3:9-13. A POSITA would have understood that such operations are for driving autonomously and that disabling and/or ceasing the one or more autonomous operations would have been transferring driver controls to manual mode.

144. To the extent it is argued that *Attard* merely warns the driver but does not actually transfer driver controls to manual control, *McNew* teaches it. For example, *McNew* teaches transferring driver controls to manual control by disengaging one or more autonomous vehicle operations.

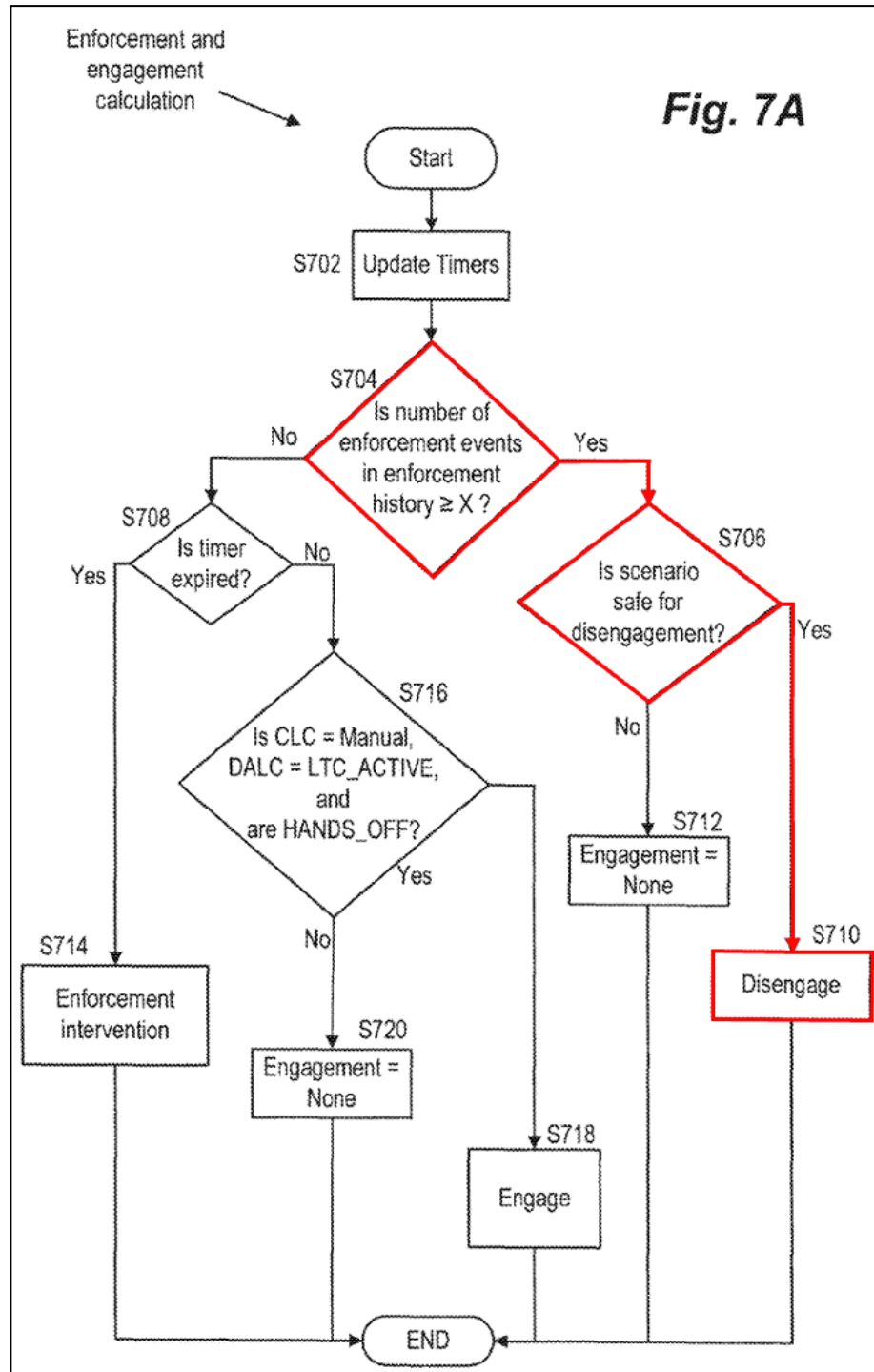
b) McNew Teaches Transferring Driver Controls to Manual Control

145. *McNew* teaches managing vehicle control states of a semi-autonomous vehicle (e.g., semi-autonomous, manual) while also managing a driver state (e.g., whether the driver is paying attention to the road). *McNew*, 1:17-21. *McNew*'s vehicle has a semi-autonomous mode manager (SAMM) to manage the control states, including control states of a lane trace control (LTC) system. *McNew*, 3:15-21. The LTC system includes several states, including MANUAL (where the LTC system is on and sensing, but the driver is in control) and OFF (where the LTC system is off). *McNew*, 3:59-4:5. To enhance safety of the semi-autonomous driving

system, *McNew* teaches monitoring driver states such as driver attention and taking actions such as warning the driver or reducing vehicle speed if the driver is not paying sufficient attention. *McNew*, 1:17-30, 1:59-65, 6:15-28.

146. In one example, if a driver continues ignoring warnings, *McNew* teaches disengaging the semi-autonomous⁴ driving system as long as the current driving scenario is “safe enough.” *McNew*, 20:7-31, 4:3-5, 8:41-44. Specifically, *McNew*’s system determines if the semi-autonomous mode should be disengaged due to a factor such as driver inattention (Step S704), determines if it is safe enough to disengage the semi-autonomous mode (Step S706), and disengages the semi-automatic driving system by “shutting down the semi-automatic driving system...[where] the LTC system transitions through the CO-STEER and **MANUAL** settings before being turned off.” (Step S710). *Id.* Fig. 7A below depicts Steps 704, 706, and 710 where the end result is disengaging the vehicle’s semi-autonomous system and transferring the driver controls to manual control:

⁴ *McNew* refers to its system as both “semi-autonomous” and “semi-automatic.” *McNew*, 1:7-13, 1:59-65, 6:15-28 (referring to both “semi-autonomous” and “semi-automatic” driving system), 20:7-31. A POSITA would have recognized *McNew* uses these terms synonymously because *McNew* does not provide a distinction between the two terms. I note that “semi-autonomous” is used herein for simplicity.



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

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

c) Motivation to Combine Attard-Frazer-McNew

147. As discussed above, a POSITA would have been motivated and found it obvious to modify *Attard* per *Frazer's* teachings of using an event table (“*fault-remediation table*”) to advantageously decrease latency when determining a corrective action associated with a fault. *See* Claim 1(d)-1(e).

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

autonomously), and the vehicle transitions from autonomous mode to manual mode as a corrective action.

149. Indeed, a POSITA would have been motivated at least because *Attard* includes a specific suggestion to do so, i.e., via *Attard's* repeated disclosures of recommending transferring driver controls to manual. *See, e.g., Attard*, 2:55-3:4. Modifying *Attard-Frazer* in this way would have simply been use of a known technique of taking a particular corrective action (e.g., transition from autonomous/semi-autonomous mode to manual control) in response to a fault and would have improved *Attard-Frazer's* similar autonomous/semi-autonomous vehicle in the same way as *McNew's*. I note that *Attard*, *Frazer*, and *McNew* all teach SDVs, such that modifying *Attard-Frazer's* similar SDV would have been straightforward, such as by making straightforward modifications to programming instructions. Thus, the *Attard-Frazer* SDV would have benefited from *McNew's* advantages in the same way as *McNew's* SDV.

150. Further, modifying *Attard-Frazer* per *McNew's* teachings would thus have allowed *Attard-Frazer's* vehicle to advantageously both (1) alert a driver of a need to transition from autonomous/semi-autonomous mode to manual mode and (2) actually perform the transition to manual mode. A POSITA would have understood that in at least some scenarios where it is unsafe to continue autonomous operations, it would have been advantageous to both warn the driver and actually

perform the transition to manual mode. Indeed, if only a warning is issued but the vehicle does not actually transition out of autonomous mode into manual mode, such would have been unsafe for the driver.

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

152. A POSITA would have understood that modifying *Attard-Frazer* to include a corrective action such as transferring driver controls to manual control would have had a reasonable expectation of success. *Attard-Frazer* and *McNew* teach similar SDVs, and *Attard-Frazer-McNew* teaches SDV hardware (processor, memory) and programming instructions. Modifying *Attard-Frazer* per *McNew*'s teachings would have required only straightforward changes to programming instructions. In particular, a POSITA would have understood that the necessary hardware was already present in the *Attard-Frazer* SDV. Thus, the only necessary modification is altering the *Attard-Frazer* programming instructions per *McNew*'s teachings. Indeed, *McNew* teaches implementing its system in computer program instructions, making the modification to *Attard-Frazer* straightforward. Modifying programming instructions would have been well-within the skillset of a POSITA. For example, the straightforward changes would have included modifying *Attard-Frazer*'s event table to include transferring driver controls to manual control as a corrective action.

153. Tables are well-known structures for organizing data, and modifying a table would have been a straightforward modification. Additionally, *Attard* expressly contemplates transition to manual control and teaches vehicle 101 is manually drivable, such that a POSITA would not have had to modify vehicle 101 to be able to drive using manual control. *Attard*, 2:55-3:4. In particular, I note the

SDV already is capable of driving manually, such that modifying *Attard-Frazer* per *McNew* would not have required installing driver control mechanisms such as a steering wheel or brake pedal that are needed for a driver to drive in manual mode.

B. Claim 2

1. Claim 2(Pre)

154. *See*, 1(Pre).

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

155. *See*, 1(f).

3. Claim 2(b): “...the fault comprises a road condition, wherein the road condition comprises an absence of lane markings;”

156. *Attard* teaches this limitation. *Attard* expressly envisions a fault due to its lane tracking system being “unable to see the lane-markings.” *Attard*, 8:10-13, 10:42-52; *see also*, 1(a). More specifically, *Attard* teaches sending a message 116: “Caution: the lane-tracking system is unable to see the lane-markings. Driver intervention is recommended” in response to a φ_i for a lane tracking system being below its $\varphi_{\min}$. *Attard*, 8:10-13. As I discussed with respect to Claim 1(b), a *fault* occurs when φ_i is below $\varphi_{\min}$. *See* VIII.A.3. Therefore, because *Attard* teaches an example in which a φ_i for a lane tracking system is below its $\varphi_{\min}$ and, resultantly, sends a message indicating that the lane tracking system cannot see the lane

markings, *Attard* teaches that *the fault comprises a road condition, wherein the road condition comprises an absence of lane markings.*

4. ***Claim 2(c): “determining whether the fault exceeds a threshold for danger comprises determining a control processor competence level;”***

157. *See*, 1(h).

5. ***Claim 2(d): “the corrective action comprises transferring driver controls to manual control and alerting a human driver to take over immediately.”***

158. *See*, 1(i).

C. Claim 17

1. ***Claim 17(Pre)***

159. *See*, 1(Pre).

2. ***Claim 17(a): “receiving sensor readings...”***

160. *See*, 1(a).

3. ***Claim 17(b): “determining ... whether a fault has occurred;”***

161. *See*, 1(b).

4. ***Claim 17(c): “determining... whether the fault exceeds a threshold for danger;”***

162. *See*, 1(c).

5. ***Claim 17(d): “determining a corrective action associated with the fault using a fault-remediation table;”***

163. *See*, 1(d).

6. ***Claim 17(f): “...a GPS sensor;”***

164. *See*, 1(f).

7. ***Claim 17(g): “...a current weather condition of the roadway...;”***

165. *See*, 1(g).

8. ***Claim 17(h): “...determining a control processor competence level;”***

166. *See*, 1(h).

9. ***Claim 17(i): “... transferring driver controls to manual control and alerting a human driver to take over.”***

167. *See*, 1(i).

IX. GROUND 2: CLAIM 7 IS OBVIOUS OVER HAMPIHOLI AND ATTARD

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

168. Claim 7 is rendered obvious over a combined *Hampiholi-Attard* self-driving vehicle (SDV), operating according to *Hampiholi*'s disclosure and modified to incorporate *Attard*'s self-driving modes, functions, features, and CPCL, as well as any hardware and software necessary to provide an operable SDV practicing the techniques taught by both *Hampiholi* and *Attard*. The combined *Hampiholi-Attard* vehicle would have desirably been capable of self-driving and implementing corrective actions when appropriate, whether due to detected reduced human competence (per *Hampiholi*) or due to detected reduced processor competence (per *Attard*). A POSITA would have had the skill, found it obvious, and been motivated to configure the combined vehicle to intelligently blend the two systems, accounting

for situations in which the human driver competence and the computer processor competence levels are both imperfect, choosing appropriate corrective actions (or no corrective action) in response to detected sensed conditions as a particular situation dictates. A POSITA would have appreciated that the resulting vehicle would have thus furthered *Hampiholi*'s stated goal of increasing driver, passenger, and bystander safety by controlling a driving mode of an SDV to respond to faults such as hardware failures or weather conditions as well as decreased driver competence. *Hampiholi*, [0002], [0017]. A POSITA would have recognized *Hampiholi*'s safety goal would have been additionally furthered by enabling the vehicle to detect and respond to faults in hardware components or weather conditions, per *Attard* – components that were already present in the *Hampiholi* vehicle, such as outward-facing cameras and external weather sources. *Attard*, 7:14-17, 14:63-15:4; *Hampiholi*, [0005], [0037]. See Claim 7(c) for additional motivation to modify *Hampiholi* per *Attard* to include features for self-driving functionality.

169. A POSITA would have had a reasonable expectation of success for combining the vehicles of *Attard* and *Hampiholi* because each describe vehicles configured to automatically take measures to increase the safety of the vehicle in response to detected danger. *Attard*, 5:44-53, 8:1-61; *Hampiholi*, [0002], [0057], [0065]-[0069]. Whether the source of the danger was hardware failure, weather conditions, or human incompetence, a POSITA would have appreciated that the core

intent of each of *Attard* and *Hampiholi* was to identify and mitigate that danger to improve the safety of the driver and potentially nearby others.

B. Claim 7

1. ***Claim 7(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:”***

170. To the extent the preamble is limiting, *Hampiholi-Attard* teaches a computer program product that manages fault handling in a vehicle having automatic operation (an “*SDV*”) including controlling a driving mode by automatically engaging responses detected faults (“*controlling a driving mode of a self-driving vehicle*”). *Hampiholi* and *Attard* each teach computer readable storage containing program code executable by processors to perform methods of controlling the functionality of a vehicle. *Hampiholi*, [0029], [0032], FIG. 2; *Attard*, 2:28-37, 3:15-27, 5:21-29, FIG. 1. Further, *Hampiholi-Attard* teaches non-volatile memory and programming code readable and executable by a processor. A motivation to combine the overall vehicles, systems, and techniques described by *Hampiholi* and *Attard* is described above, and particular SDV features are described at Claim 7(c); both of these discussions are incorporated herein by reference.

a) Hampiholi-Attard Teaches Controlling a Driving Mode

171. *Hampiholi's* vehicle is capable of driving automatically. *Hampiholi*, [0057] (describing “**automatically** controlling the vehicle speed or braking” and “**automatically** bringing the vehicle to a complete stop”), [0073], [0076] (“**automatic** adjustment of engine operation”), Fig. 4. A POSITA would have understood that a vehicle capable of driving automatically is a self-driving vehicle (SDV) because it is controlling the three main components of driving: thrust, braking, and steering. Each of these would have been necessary for the vehicle to drive automatically, and are sufficient for automated driving, at least for short periods of time in simple private or public spaces, thus meeting the '765 Patent's description of “Self-Driving Vehicle”. *Id.* Similarly, as discussed above regarding claim 1, *Attard* also teaches an autonomous self-driving vehicle because it too is controlling the thrust braking, and steering of the vehicle. *See*, 1(Pre). As further discussed, *Attard* teaches *controlling a driving mode*, transitioning from autonomous mode to either semi-autonomous mode or manual mode responsive to detecting a fault. *Id. citing Attard*, 1:62-65, 2:55-3:4. Thus the combined *Hampiholi-Attard* vehicle is a SDV.

b) Hampiholi's Computer Program Product Comprises Non-Transitory Computer-Readable Memory and Processor

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

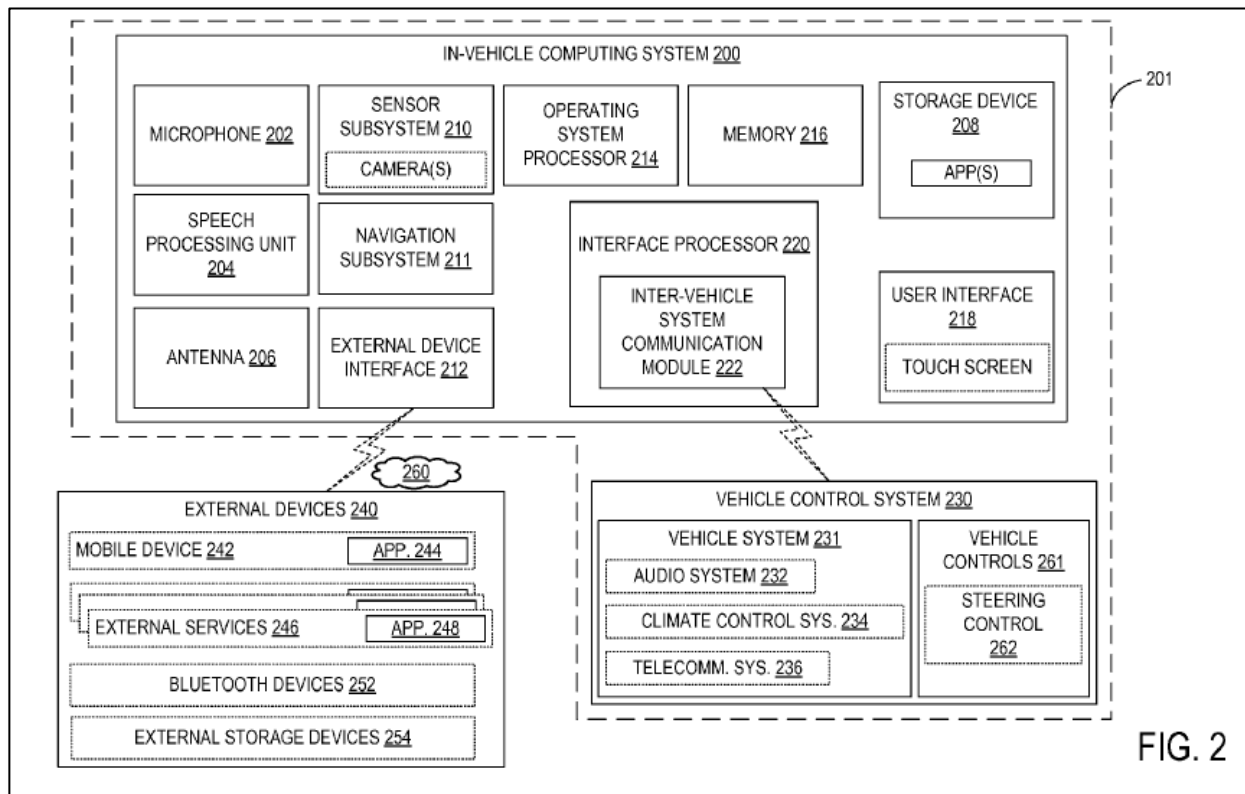


FIG. 2

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

173. *Hampiholi* teaches storage device 208 may store instructions and/or code that, when executed by a processor (e.g., operating system processor 214 and/or interface processor 220), controls the in-vehicle computing system 200 to perform one or more actions. *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. Particularly, a POSITA would have expected that the instructions described by *Attard* for controlling its vehicle systems in response to detecting a fault, including instructions for performing methods regarding Φ and φ (and φ_i), would have been stored in the same memory as the instructions described by *Hampiholi* for controlling its vehicle in response to detecting driver distraction to provide an operable vehicle that would not have needed separate, duplicated memory locations. In either case, whether automatically adjusting the operation of the vehicle pursuant to *Hampiholi*’s driver distraction or *Attard*’s faults, the combined vehicle would have been configured to use these instructions to control its driving mode, as claimed. Thus, a POSITA would have understood or found obvious that *Hampiholi-Attard* teaches a computer program product for a vehicle including for controlling a driving mode and that the computer program product comprises non-volatile memory and a processor for executing programming instructions.

2. *Claim 7(a): “determining a competence level of a human driver, wherein the competence level describes a competence level of the human driver in controlling the SDV;”*

174. *Hampiholi* teaches a system and method of determining a competence level of a human driver in controlling its vehicle, as measured by the severity level

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

175. For example, a low-level severity rank R may indicate a short-lived driver distraction while the vehicle is not in immediate danger of collision, while a medium-level severity rank R may include a more serious driver distraction, (e.g., droopy eyes indicating sleepiness) while the vehicle is in an otherwise safe environment (e.g., no objects within a trajectory/path of the vehicle, driving at a low speed), and a high-level severity rank R may include any driver distraction while an object in the vehicle's environment is on a colliding course with the vehicle. *Hampiholi*, [0057]. In these examples, the vehicle synthesizes data about the human driver's performance at piloting the vehicle (that is, the driver's competence level) and combines that data with context reflecting the current operational state of the vehicle itself, such as objects in the vehicle's path or the vehicle's speed. The method uses this information to determine the severity rank R of the driver's distraction. Exemplary severity ranks R are illustrated in Fig. 7 below, corresponding to detected human behaviors and road/vehicle conditions indicating the situation.

700

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

Less Distracted/
Higher
Competence

More Distracted/
Lower
Competence

FIG. 7

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

scale being used, at most requiring mathematical treatment using known computer programming techniques to account for an inversion of the numerical scale (thus higher values would be better, indicating higher competence). Whether to make the severity rank R number larger or smaller for a more-distracted driver compared to a less-distracted driver is a mere design choice that would have been obvious to try an inverted scale, if necessary. For example, a simple computer program that sets an HDCL “H” equal to $9-R$ would have yielded $H=1$ for severity rank $R=8$ and $H=8$ for severity rank $R=1$, effectively inverting the scale with at most a few lines of computer code. This is merely one example provided to show how simple it would have been to invert the scale, and is not intended as being required for the *Hampiholi* vehicle and method to teach the HDCL of claim 7.

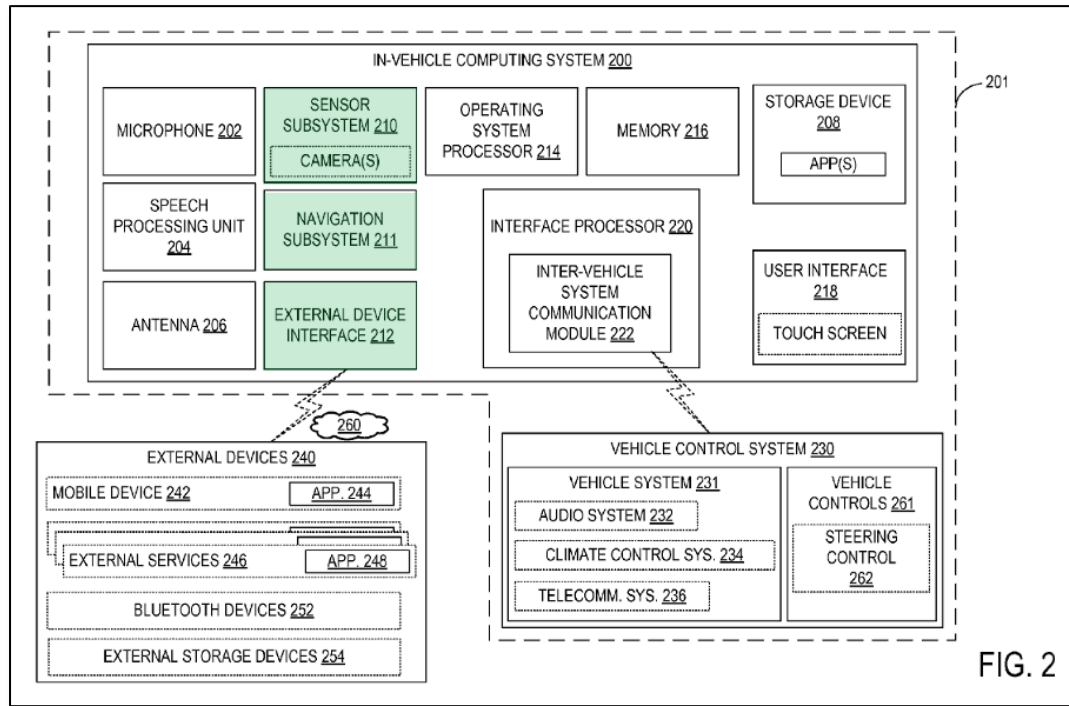
176. *Hampiholi*'s severity rank R teaches a competence level of the human driver in controlling the SDV. For example, a driver that is paying more attention is more competent at taking control of the vehicle if a transition to manual mode is required. For instance, if a deer were to run out in front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

for inclement weather. Also, a driver paying more attention would allow for more possible corrective actions (e.g., transition to manual, disable one or more autonomous driving features, automatically slow to a stop, override the autonomous system) because a driver paying more attention would allow for sufficient lead time to safely transition to manual mode or disable an autonomous driving feature. For example, it was known that SDV drivers required sufficient lead time to accept the transition to manual mode. *J3016*, 4; *see* Claim 1(i) including *McNew*'s teachings of transitioning when it is safe to do so. In the case where the driver is severely distracted, the sufficient lead time may be insufficient such that the transition to manual mode is not sufficiently timely to avoid an unsafe condition, forcing the vehicle to transition to a minimal risk condition. If a driver is asleep or otherwise not paying sufficient attention (lower competence level), transitioning to manual mode would be more dangerous, and corrective actions may be limited to automatically slowing/stopping the vehicle in the minimal risk condition.

3. *Claim 7(b): "receiving sensor readings from a system of sensors about the competence level of the human driver;"*

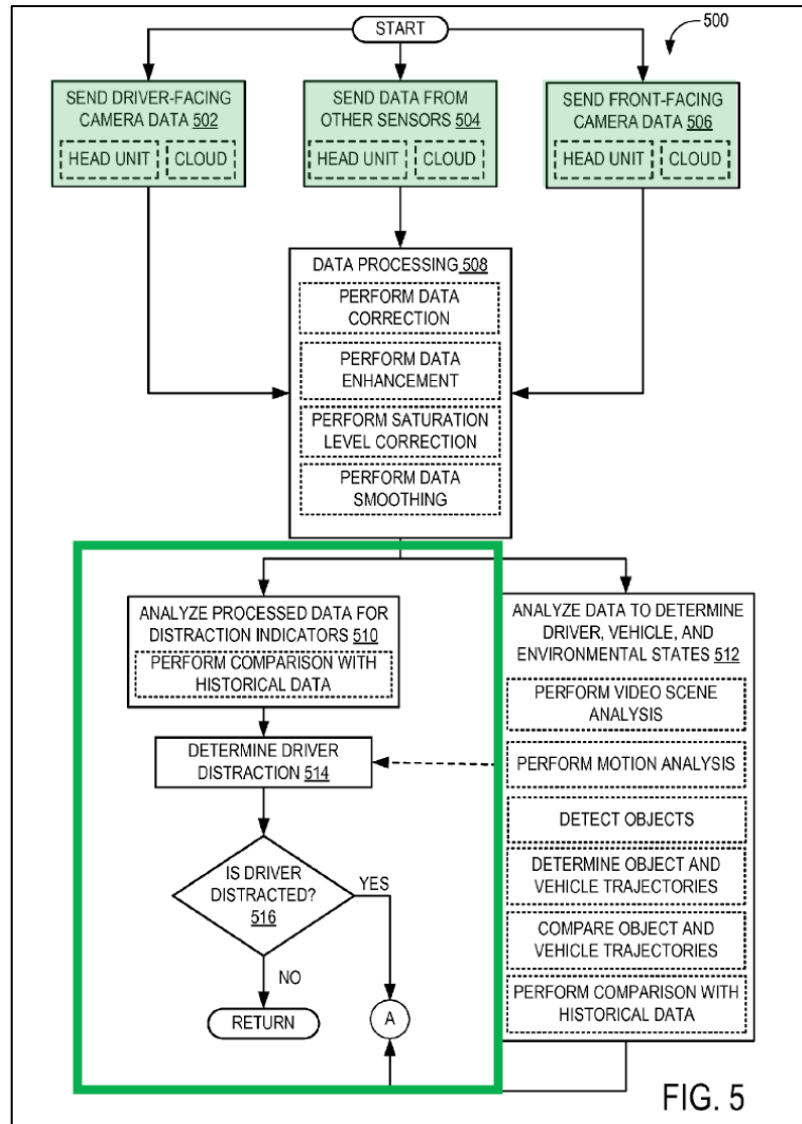
a) Hampiholi's System of Sensors

177. *Hampiholi* teaches receiving inputs from a plurality of sensors in sensor subsystem 210 and navigation subsystem 211 including signals regarding gas pedal and brake inputs, temperatures, vehicle and engine speed, and the vehicle's location.



Hampiholi, Fig. 2, [0031], [0034]. A plurality of readings from these sensors would have been collected from across the vehicle for processing and analysis at the vehicles computing processor in order to provide the vehicle with a constantly-updating analysis of the vehicle's operating condition. Specific sensors described by *Hampiholi* include interior and exterior cameras, thermometers, and a GPS sensor. *Id.* Each of these sensors were well known prior to the '765 Patent for inclusion in SDVs, enabling the vehicle to operate safely and effectively. These sensors are collectively mapped as the claimed "system of sensors."

178. As illustrated in Fig. 5 below, *Hampiholi* expressly describes 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*").



Hampiholi, FIG. 5. Examples of sensor readings used to determine *Hampiholi's* competence level of the driver (severity rank R) may include the driver's eyelid position as determined by the video from a driver facing-camera ([0062]) and the speed or location of the vehicle ([0057]). A POSITA would have recognized that a driver with drooping eyelids or closed eyes would have indicated that a driver is (or would be) less competent at operating the vehicle, particularly at high speeds or in

known congested or difficult areas, such as major highway interchanges or steep mountain roads.

179. As discussed below regarding limitation 7(d), a POSITA would have been motivated to also determine a competence level of a processor (Φ) as taught by *Attard* in the *Hampiholi-Attard* SDV. *Infra*, 7(d). A POSITA would have been motivated to include in the combined *Hampiholi-Attard* vehicle any sensors necessary to determine Φ , such as *Attard's* cameras, Global Positioning System (GPS) equipment, sensors relating to vehicle speed or acceleration, RADAR, LIDAR, and sonar. *See*, Claim 1(a). Specifically, though *Hampiholi* does not expressly discuss the use of LIDAR, LIDAR was well-known prior to the '765 Patent for providing a more-detailed analysis of the surrounding environment as expressly taught by *Attard*. *Attard*, 4:1-17, 13:50-63. This applies equally to each of *Attard's* other sensors necessary for computing *Attard's* Φ but not expressly described by *Hampiholi*. A POSITA would have been motivated to incorporate such sensors necessary to enable the system to compute Φ for the benefit of performing the steps described by *Attard* regarding determining the competence level of its processor detailed in limitation 7(d) below. A POSITA would have recognized such a combination constitutes use of well-known techniques combining known technologies resulting in a reasonable expectation of success without undue

experimentation. A full motivation to combine *Hampiholi* and *Attard* is provided below regarding 7(d) and incorporated herein by reference.

4. Claim 7(c): “wherein the SDV is operable to provide autonomous control of driver controls comprising: engine throttle, steering mechanism, braking system, and navigation;”

180. As discussed above, the *Hampiholi-Attard* vehicle is configured to automatically modify particular operations of the vehicle, including specifically autonomously controlling the vehicle speed and bringing the vehicle to a complete stop (per *Hampiholi*) and disabling one or more autonomous operations, such as in response to a fault (per *Attard*). See, Claim 7(Pre), Section IX.A.

181. *Attard* teaches its vehicle is operated partially or completely autonomously by autonomous driving module 106 in its computer 105, including specifically the operation of the vehicle’s “steering, braking, [and] speed,” as well as “navigation.” *Attard*, 9:63-10:12, 14:13-48. A POSITA would have recognized or at least found obvious that controlling the vehicle’s “steering” teaches controlling its “steering mechanism,” as claimed, because the steering mechanism would have naturally and/or intentionally adjusted to stay in sync with the movements of the vehicle to enable the driver to retake control of the vehicle when desired and/or necessary. Similarly, a POSITA would have recognized that *Attard*’s description of controlling its “speed” teaches controlling its “engine throttle,” as claimed, because the vehicle’s engine throttle would have been adjusted to increase the thrust of the

engine to result in an increase in the vehicle's speed. Additionally, *Attard's* description of controlling its "braking" would have been done via its braking system at least including the vehicle's brakes, and thus *Attard* teaches controlling its "braking system," as claimed.

182. A POSITA would have understood or found obvious that because *Attard* teaches a vehicle operable in manual and autonomous modes and *Attard* defines an autonomous vehicle as being "operated wholly ... without human intervention, i.e., ... autonomous" and its vehicle computer making "decisions concerning vehicle speed, course, etc.," that *Attard's* vehicle would have included autonomous control of vehicle controls performing these functions, including changing the vehicle's speed (engine throttle and braking) and direction (steering mechanism and navigation). *Attard* expressly envisions that its vehicle "may be operated wholly or partly without human intervention," relying on its central computer to "operate the vehicle, e.g. to make decisions regarding vehicle speed, course etc." *Attard*, 1:15-24. A POSITA would have recognized that a vehicle operably performing this function would have autonomously controlled the engine throttle, steering mechanism, braking system, and navigation driver controls. In specific examples, *Attard's* vehicle may take an autonomous actions such as a "slow to a stop," "pull over and stop," or "limp home" operation. *Attard*, 2:46-54. Stopping requires control of the engine throttle, and braking system and pulling over requires

control of the steering mechanism, while “limp[ing] home” would have additionally required controlling navigation. Thus, a POSITA would have recognized each of these autonomous operations would have required control of the engine throttle, steering mechanism, braking system, and navigation as recited in 7(c). In another example, *Attard* directly describes how the vehicle’s navigation is autonomously used for avoiding obstacles, pulling to a road shoulder, or slowing to a stop, stating that if a camera were to fail, the vehicle may “continue to a road shoulder based on stored map data, GPS data 115, and/or extrapolating from last known reliably determined lane boundaries.” *Attard*, 14:13-48. This example from *Attard* comprises control of all four claimed driver controls – the navigation system comprising GPS data is used to continue to a road shoulder (using the steering mechanism) and stop by decreasing the engine throttle and engaging the braking system. *Id.* Though *Attard* does not explicitly use the term “engine throttle,” a POSITA would have recognized *Attard*’s description of a vehicle autonomously controlling its speed to teach the claimed “engine throttle.”

a) Motivation to Combine

183. A POSITA would have incorporated *Attard*’s teachings regarding autonomous control of the driver controls listed in 7(c) 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. A POSITA would have recognized that a vehicle which is capable of taking over control and self-driving through dangerous situations would have been safer than a vehicle unable to do so, and would have resulted in a more-desirable vehicle to consumers. Such a modification is merely the combination of known prior art elements (*Attard's* sensors and controls) according to known methods to yield predictable results of a car operable to autonomously perform corrective actions such as “slow to a stop,” “pull over and stop,” and/or “limp home” operations. Further, these modifications would have been use of a known technique of applying various vehicle hardware and software to allow for additional self-driving functionality in the *Hampiholi-Attard* vehicle and would have improved *Hampiholi* and *Attard's* similar vehicles in the same way – by allowing the vehicle to autonomously drive in unsafe conditions, and to detect when such conditions occur. While this modification may add additional complexity to *Hampiholi's* vehicle, a POSITA would have been motivated to make such a tradeoff to achieve *Attard's* benefits. A POSITA would have appreciated that self-driving vehicles increase driver, passenger, and bystander safety, furthering *Hampiholi's* intended purpose. *Hampiholi*, [0002]. *Attard* expressly extols the benefits of incorporating its system utilizing a CPCL (Φ), explaining that “mechanisms are needed for evaluating a computer’s ability to autonomously operate the vehicle, and for determining an action or actions to take when one or more faults are detected”

such as “determin[ing] a safe stopping location,” leading a POSITA to a motivation to combine *Attard*’s methods and supporting systems into *Hampiholi*’s vehicle, to result in a self-driving vehicle. *Attard*, 1:21-24, 14:27-48. A POSITA would have been aware that SDVs provide desirable features to users, benefitting sales of the vehicles while improving safety. Autonomous driving functionalities allow users to be more relaxed while driving and reduce the likelihood of accidents borne of human error.

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

5. Claim 7(d): “determining a competence level of a processor;”

185. As mapped above, *Attard* teaches determining a competence level of a processor via its scalar form of its confidence assessment 118, Φ . See, 1(b), 1(e). I

note that claim 1 requires nothing more than mere presence of a competence level of a processor. Thus, *Hampiholi* modified to include *Attard's* Φ teaches limitation 7(d).

a) Motivation to Combine *Hampiholi-Attard*

186. A POSITA would have been motivated and found it obvious to modify *Hampiholi* to implement *Attard's* known technique of determining a competence level of an SDV using one or more sensor readings to assist *Hampiholi-Attard's* SDV in driving in an autonomous mode, which is reliant upon sensors such as cameras, GPS, LIDAR to perform the autonomous driving actions (e.g., to avoid obstacles, maintain a safe distance in traffic, switch lanes or turn without wrecking). A POSITA would have recognized that a vehicle capable of detecting and responding to inclement weather, such as icy or wet road conditions would have been safer than the unmodified *Hampiholi* vehicle, but would have furthered *Hampiholi's* goal of improving driver and bystander safety. *Attard*, 7:14-17; *Hampiholi*, [0002]. *Hampiholi's* safety goal would have been additionally furthered by enabling the vehicle to detect and respond to faults in hardware components, per *Attard* – components that were already present in the *Hampiholi* vehicle, such as outward-facing cameras. *Attard*, 14:63-15:4; *Hampiholi*, [0005]. Further, the standard message set for sending weather data between vehicles was standardized before the '765 Patent. *Harding* (Ex. 1037), 79, 77 (discussing ambient air

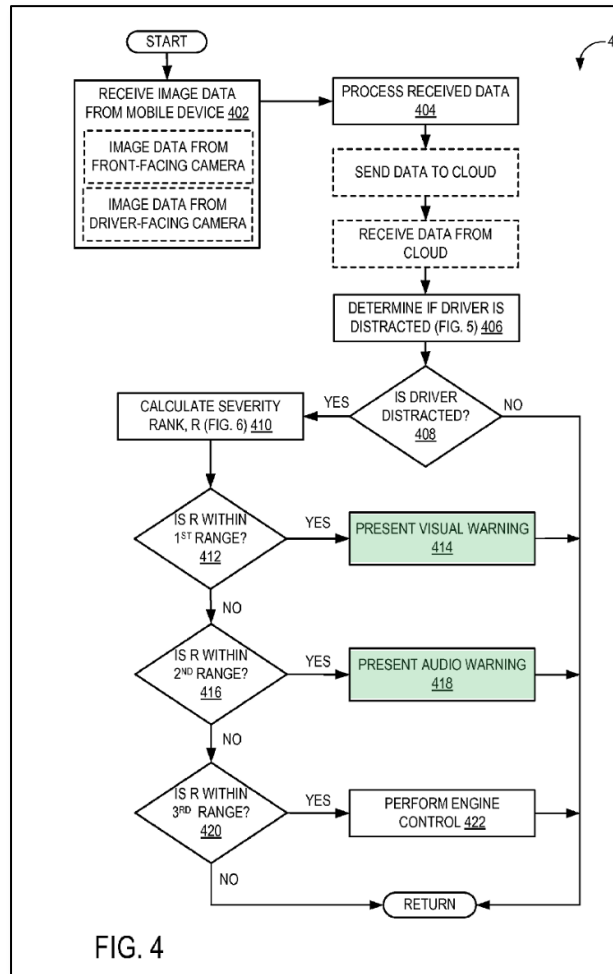
temperature, wiper status, and rain sensors). In an example, if a sensor such as a speed controller needed for SDV functionality is malfunctioning, *Attard's* known technique would have provided for a corrective action in *Hampiholi-Attard*. *Attard*, 15:1-4. *Hampiholi's* technique of monitoring user distraction would have coexisted with *Attard's* Φ technique, and a POSITA would have configured the combined SDV to operably mitigate any simultaneous automatic actions that the vehicle may have taken pursuant to the description of *Hampiholi's* responses to severity rank R and *Attard's* responses to Φ dropping below $\Phi_{\min}$. For example, if the driver had a low severity rank distraction but the vehicle was experiencing multiple or critical hardware faults, a POSITA would have configured the modified vehicle to continue operating in a manual mode, in spite of the moderate reduction in human driver competence level. Conversely, if the driver was dozing off but the Φ remained high, the vehicle might transition to an autonomous mode to maximize safety for the driver and bystanders, even if Φ was not maximum (1). These are merely non-limiting examples of how a POSITA would have been skilled and motivated to combine the systems of *Hampiholi* and *Attard*, using their normal skill and intellect to overcome any obstacles to the combination and result in an operable vehicle that is safer for the driver and bystanders than the unmodified *Hampiholi* vehicle.

187. Incorporating *Attard's* technique of determining the competence level of the processor would have resulted in a safer, and thus more desirable, SDV. *Id.*

Such a modification would have had a reasonable expectation of success because *Hampiholi* already teaches a vehicle and sensors, along with computer hardware and programming instructions. Fig. 2, [0029], [0032]. Similarly, *Attard* teaches an autonomous vehicle and computer hardware and programming instructions, such that modifying *Hampiholi* would have required only modifying programming instructions and providing hardware to perform autonomous driving. A POSITA would have had a reasonable expectation of success for the combination because *Hampiholi* already includes a processor and memory necessary for performing automatic functions, as well as a system of sensors, to which any sensors described by *Attard* necessary for determining the competence level of the processor may have been added, as discussed above regarding 7(b). POSITAs would have had sufficient skills in hardware (*e.g.*, sensors, processors, memory), vehicle systems (*e.g.*, braking, engine control, steering, and navigation) and software programming necessary to combine the disclosed vehicles and methods. Without requiring bodily incorporation, POSITAs (likely a large team of POSITAs) would have had the skills and knowledge necessary to produce an SDV incorporating the concepts taught by each of *Hampiholi* and *Attard* to result in a safer SDV, capable of accounting for hardware faults, weather faults, and driver incompetence.

6. Claim 7(e): “determining a corrective action; the SDV implementing the corrective action.”

188. *Hampiholi* teaches determining and implementing a corrective action, such as an audio warning, visual warning, or engine control. *Hampiholi*, [0051], [0057], [0073], FIG. 4. Because claim 7 does not expressly recite how the corrective action is determined or implemented, the mere presence of corrective actions satisfy claim 7. However, *Hampiholi* goes further and teaches that the corrective actions are determined based at least in part on the HDCL (severity rank R), and that the corrective actions are actions deemed appropriate for the driving situation and environment of the vehicle. *Hampiholi*, [0050], [0057], [0065]-[0069]. *Hampiholi* teaches the corrective actions may be determined by the vehicle's processor in response to a determined distraction severity rank R, as illustrated below in Fig. 4.



Hampiholi, FIG. 4. For example, *Hampiholi* envisions implementing a visual warning message in response to determining a low R distraction level, an audio warning response to determining a medium R distraction level, and controlling engine speed or braking response to determining a high R distraction level. *Hampiholi*, [0057]. These particular corrective actions are not limiting, and are merely examples of what appropriate responses a POSITA would have recognized *Hampiholi*'s disclosure teaches and/or renders obvious for implementing in the *Hampiholi-Attard* SDV. *Hampiholi*, [0003]-[0005], [0018], [0050], [0083]-[0087].

Any message, verbal or audible, engine control, or other corrective action such as reducing the volume of music may have been implemented in the *Attard-Hampiholi* vehicle. *Hampiholi*. [0057]. A very low distraction level, not within any of the three ranges illustrated in Fig. 4, may result in no corrective action at all.

X. GROUND 3: CLAIMS 3-4, 18-19 ARE OBVIOUS OVER ATTARD, FRAZER, MCNEW, AN, KANG, AND SCHUNDER

A. Claim 3

1. Claim 3(Pre)

189. *See*, 1(Pre).

2. Claim 3(a): “determining the control processor competence level comprises using a weighted voting system, the weighted voting system comprising:”

a) ’765 Patent’s Weighted Voting

190. The ’765 Patent describes weighted voting with inputs and where an “input’s weight (w) is the number of ‘votes’ associated with the input.” ’765 Patent, 8:54-64.⁵

b) Attard’s Weighted Voting System

191. *Attard* teaches determining a control processor competence level Φ . *See* Claim 1(h). Further, *Attard* teaches a weighted voting system. For example, *Attard*

⁵ While the ’765 Patent also describes a quota is sometimes utilized in a weighted voting system, “quota” is not recited in Claim 3. ’765 Patent, 8:54-64, Claim 3.

teaches weighting determinations of collected data 115 from sensors 110 based on factors including precipitation, road conditions, and environmental conditions to generate confidence assessments about the ability of vehicle 101 to operate autonomously. *Attard*, 6:28-35. A POSITA would have understood or found obvious that “when weighting various determinations,” *Attard*’s weights would have been multiplied by *inputs* (e.g., collected data 115) to yield weighted results for generating confidence assessments. As discussed above, *Attard*’s confidence assessment Φ is a CPCL. *See* Claim 1. Thus, a POSITA would have understood or found obvious that *Attard* teaches determining CPCL Φ using a weighted voting system. As I mentioned above, weighting sensor readings was well known in the art. Furthermore, weighting sensor values to determine whether a vehicle should be driven autonomously (e.g., to determine a control processor competence level) was well known. For example, *An* (Ex. 1008) teaches computing an “autonomous driving state risk index” that indicates “whether basic autonomous driving is possible,” and that weights sensor readings, including “GPS reception error, a lane recognition error, an obstacle recognition error...” *An*, 5:66-6:17, Eq. 7; *see also*, *Chandra* (Ex. 1034), 2:25-3:19 (describing a weighted voting system for vehicles). *An* is discussed further below.

c) *An*’s Teachings

192. *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. Here, 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 they are used (*input*) to the risk index equation to determine the index value. To state another way, each error is a parameter, i.e., an *input*, for the risk index equation. In the *Attard* combination, the *inputs* include *Attard*’s camera sensor readings as I discussed above and also detail below with respect to Claim 3(a)(i), which are thus weighted, per *An*. Thus, because *An* teaches multiplying the inputs by the weights, *An*’s autonomous driving state risk index equation teaches a *weighted voting system*.

193. As discussed below for Claim 3(a)(i)-3(b)(ii), *Attard-Frazer-McNew*’-*Ans* weighted voting system is modified per *Kang* regarding a plurality of weights based on weather conditions. *Kang* teaches that weather condition data may come from sources external to the vehicle (e.g., Internet) but does not expressly teach the weather data originates from other vehicles. *Kang*, 9:33-49. *Attard-Frazer-McNew-Kang* is further modified per *Schunder* for the SDV to receive weather condition

data from a cohort of other SDVs (*the active learning data includes weather condition data from a cohort of other SDVs*) via a server.

d) Motivation to Combine Attard-Frazer-McNew-An

194. A POSITA would have been motivated and found it 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 (e.g., sensor determinations). A POSITA would have recognized the similarities between the *Attard's* Φ computation and *An's* autonomous risk state index and, as such, would have been motivated to modify *Attard's* Φ , per *An*, to gain the benefits of weighting inputs (i.e., improved accuracy/flexibility) as taught by *An*. Compare *Attard*, 5:58-6:3 with *An*, 5:64-6:2. As mentioned, *Attard* provides an express teaching, suggestion, and motivation for combining with *An* by teaching “weighting various determinations” for computing Φ . *Attard*, 6:28-35. Using the known technique of weighted voting would have improved *Attard's* similar system in the same way as *An's*, e.g., by providing greater accuracy in computing Φ . That is, based on *Attard's* weighting disclosure, a POSITA would have been motivated to turn to references that detail how to weight a determination of whether to drive autonomously, e.g., *An*.

195. A POSITA would have had a reasonable expectation of success at least because (a) weighting inputs was well-known prior to the '765 Patent, and (b)

modifying *Attard* would have required only straightforward programming modifications to multiply *Attard*'s determinations by weights, per *An*'s teachings. Further, it was well known to a POSITA to weight different equation inputs such that the inputs have more or less importance. For example, and while not expressly taught by *An*, a POSITA would have recognized that if *An*'s control error was a less important factor than the recognition error in the ability to drive autonomously, the weight W3 applied to the control error would have been less than the weight W1 applied to the recognition error. For example, it would have been a straightforward modification and within the skillset of a POSITA to modify *Attard* to store weights, per *An*, in memory, such as in a lookup table.

3. *Claim 3(a)(i): “a first plurality of inputs and a first plurality of weights, wherein the first plurality of inputs comprise sensor readings from a first camera sensor; and”*

196. As discussed above, *Attard* teaches a system of sensors 110 including a plurality of cameras. *See* Claim 1(a). Also discussed above, *Attard* teaches weighting a plurality of determinations relating to environmental conditions based on collected data 115 from sensors 110. *See* Claim 3(a). *Attard*'s collected data 115 is thus used as a plurality of inputs to determine CPCL Φ . For example, *Attard* teaches the CPCL Φ “may arise from data 115 provided by data collectors 110 included in a perceptual layer (PL) of the autonomous vehicle 101, or from data collectors 110 in an actuation layer (AL).” *Attard*, 2:15-18. More specifically, *Attard*

provides an example in which a confidence assessment 118 is formed by a PL vector

$\phi^{PL} = (\phi_1^{PL}, \phi_2^{PL}, \dots, \phi_n^{PL})$, where “n is a number of perceptual sub-systems, e.g., groups of one or more sensor data collectors 110, in the PL.” *Attard*, 6:36-40. A POSITA would have found it obvious the PL of vehicle 101 to include camera data collectors 110. *See, e.g., Allard*, [0025] (perception system includes stereo vision system). Thus, because *Attard*’s PL includes sensor readings from a camera data collector 110, *Attard* teaches *wherein the first plurality of inputs comprise sensor readings from a first camera sensor*.

197. Further, *Attard* teaches weighting a plurality of determinations. For example, *Attard*, 6:28-35 teaches weighting various determinations.

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

Attard, 6:28-35. A POSITA would have understood or found obvious that a first plurality of weights would have been utilized when making said plurality of determinations related to different conditions. *Attard*, 6:28-35. Namely, a POSITA would have understood that a weight would be applied to each of the determinations/sensor readings. For example, a POSITA would have understood or

found it obvious to apply a first weight to sensor readings associated with road condition data and a second weight to sensor readings associated with precipitation data based on their impact in the ability of *Attard's* vehicle 101 to drive autonomously. For example, if the impact of bad road conditions was greater than the impact of precipitation in the vehicle's ability to drive autonomously, a POSITA would have found it obvious to weight the road conditions sensor data higher than the precipitation sensor data in order to increase the likelihood Φ falls below $\Phi_{\min}$ and a recommendation to manual driving is provided. As another example, a POSITA would have found it obvious that the *Attard's* disclosure to teach weighting sensor readings based on their accuracies, e.g., to apply a lower weight to less-accurate sensors to mitigate faulty sensor readings from impacting a determination.

198. Additionally or alternatively, as discussed below, *Attard-Frazer-McNew-An* as modified by *Kang* teaches a plurality of weights where the weights are based on different weather conditions. *See* Claim 3(b)(i). A motivation to modify *Attard-Frazer-McNew-An* per *Kang* is provided below. *See* Claim 3(b).

4. *Claim 3(b): "multiplying at least one of the first plurality of inputs by a weight from among the first plurality of weights;"*

199. *Attard* teaches weighting determinations, which a POSITA would have understood or found obvious to mean multiplying collected data 115 by weights as I discussed above. *See*, ¶ 197. To the extent it is argued that *Attard* does not teach such multiplying or a plurality of weights, a POSITA would have been motivated

and found it obvious to modify *Attard-Frazer-McNew* per *Kang's* teachings of multiplying inputs by weights. Namely, a POSITA would have been motivated and found it obvious to weight the weather conditions determined from *Attard's* sensor collectors 110 based on the specific weather type (e.g., snow vs rain), per *Kang*, to make a more accurate determination of Φ , as I detail further below.

5. *Claim 3(b)(i): "wherein the first plurality of weights are based on active learning data; and wherein the active learning data includes weather condition data"*

a) Kang's Weights

200. *Kang* teaches vehicle 1 includes a road and weather information collecting unit 135. *Kang*, 9:32-49. *Kang* teaches weather information collecting unit 135 obtains weather information from an external source (e.g., Internet) based on the vehicle's GPS information. *Kang*, 9:32-49 ("obtains rain or snowfall information from current location information transmitted from the GPS and weather information provided from the Internet."). Alternatively, *Kang* teaches vehicle 1 uses onboard sensors to obtain weather information. *Id.* ("obtains rain information based on detection information transmitted from the rain sensor.").

201. *Kang* teaches a plurality of weights based on various weather conditions. *Kang*, 5:26-29 ("FIG. 7C is an exemplary diagram showing weights for each road type and weights for each weather condition that represent external environment information."), 9:32-49, 10:42-11:6, 13:3-18, 13:30-33. Fig. 7C is

depicted below with environment information including clear weather weighted as 1, rain weighted as 2, and snow weighted as 3.

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. Kang teaches multiplying weather weights by inputs to yield weighted results. Kang, 15:40-59. Specifically, Kang teaches computing a “driving condition” to determine a “function restriction level” to place on a terminal, where the driving condition is based on driving information, environment information (e.g., weather), and user information. Kang, 10:42-50. Kang’s computation also includes applying a priority weight. Kang, 12:34-39. Thus, Kang includes both a weight for the weather, and a weight applied to the weather (the “priority weight”). Kang provides an example computation of the driving condition as follows:

A value for determining a driving condition=(weight of priority 1×(sum weights for each piece of subcategory information))+((weight of priority 2×(sum weights for each piece of

subcategory information)) + . . . + ((weight of priority $n \times$ (sum weights for each piece of subcategory information))), where priority n is the last among the priorities. It is assumed that a priority of driving information is 1, a priority of state information of a driver is 2, **a priority of environment information is 3**, a priority of passenger information is 4, a weight of priority 1 is 4, a weight of priority 2 is 3, **a weight of priority 3 is 2**, and a weight of priority 4 is 1. In this case, it is assumed that collected information includes a driving speed of 40, forward driving, a sightline direction of “forward,” a degree of concentration of “high,” no speaking, **clear weather**, and a local road. A value for determining a driving condition = $((4 \times 4) + (4 \times 1)) + ((3 \times 1) + (3 \times 1) + (3 \times 1)) + ((2 \times 1) + (2 \times 1))$.

Kang, 15:40-56. In this example, one of the (2×1) terms is a weighted result where the “2” is the priority weight, and the “1” is the weather weight, selected based on the collected information being “clear weather.” *Id.*

b) Motivation to Combine Attard-Frazer-McNew-An-Kang

202. A POSITA would have been motivated and found it obvious to modify *Attard-Frazer-McNew-An* per *Kang* to provide a plurality of weights based on weather conditions to be multiplied by inputs (e.g., collected data 115), where both weights and inputs are used in generating CPCL Φ . Modifying *Attard-Frazer-McNew* in this manner would have advantageously improved *Attard's* weighted voting system to account for various weather conditions based on their severity when generating CPCL Φ . As discussed above, *Attard* expressly contemplates weighting

various sensor determinations, including those related to weather conditions. *Attard*, 6:28-35 (discussing weighting absence/presence of precipitation); *see* ¶ 197. A POSITA, accordingly, would have been motivated to turn to references that disclose with more specificity applying weights to weather conditions, e.g., *Kang*.

203. Indeed, this modification would have given more weight to inputs that indicate faults that are more likely to impede autonomous driving functionality. A POSITA would have clearly recognized the benefits of modifying *Attard* to have weather-specific weighting in determining Φ as a POSITA would have understood that certain weather conditions may significantly impact autonomous driving functionality, while others would have little to no impact on such. For example, icy road conditions are more dangerous than clear weather, so weighting inputs per *Kang* would have improved *Attard's* weighting (which does not expressly teach using a plurality of weights for various weather conditions). This modification would have been use of a known technique of using weighted voting based on weather conditions and would have improved *Attard-Frazer-McNew's* similar computer program product and SDV in the same way as *Kang's* vehicle and computer program product. That is, the *Attard-Frazer-McNew-An* program and SDV would have seen the same improvement in computing Φ as seen in *Kang's* computation of the driving condition by using weather specific weights in determining whether to restrict the function of a device (*Kang's* terminal) based at least in part on the specific weather

condition being encountered by a vehicle. Combining these prior art elements (inputs and weighted voting values) according to known methods would have yielded the predictable result of a functional and advantageous weighted voting system. Such a weighted voting system would have provided the *Attard-Frazer-McNew* computer program product/SDV with a more accurate computation of Φ and, accordingly, a more accurate method by which to determine whether the SDV should be driven autonomously.

204. A POSITA would have had a reasonable expectation of success for modifying *Attard-Frazer-McNew* per *Kang* to utilize a plurality of weights based on weather conditions in a weighted voting system. Again, as I discussed above, giving certain inputs a higher or lower importance by applying weights to the inputs is a process that has been done for many years, including in the field of vehicles and self-driving vehicles. See ¶ 191. As discussed above, *Attard* already teaches weighting a plurality of determinations. *Attard*, 6:16-35. *Attard* teaches implementing its autonomous vehicle and methods using computer program instructions. *Attard*, 15:12-46. *Kang* similarly teaches implementing its methods and vehicle using program instructions. *Kang*, 6:10-21, 2:17-34. A POSITA would have recognized that modifying *Attard-Frazer-McNew* would have required merely straightforward changes to programming instructions, which would have been well-within the skillset of a POSITA. For example, the modification could easily have been

implemented by storing a table, such as the table shown in *Kang*'s FIG. 7, in *Attard*'s memory. Look up tables were extremely common prior to the '765 Patent such that a POSITA would have had a reasonable expectation of success in modifying the *Attard-Frazer-McNew* computer program product/SDV accordingly. See VIII.A.5.c) (further describing benefits of storing data using tables).

6. ***Claim 3(b)(ii): “[wherein the active learning data includes weather condition data] from a cohort of other SDVs, wherein the weather condition data shares one or more traits with the current weather condition of the roadway on which the SDV is currently traveling.”***

205. In my opinion, *Attard* alone teaches this limitation through his discussion of V2V data collection. *Attard* discloses that vehicles can “receive one or more vehicle-to-vehicle (v2v) communications 112... [which] may include a variety of data concerning operations of vehicle 101... [and] can include a wide variety of collected data 115 obtained from a vehicle 101 data collectors 110”. *Attard*, 4:46-5:13. This data can include weather data from the nearby vehicles, which share the trait of being near the same location as the ego vehicle, and many on the same roadway. A POSITA would have understood that weather conditions, such as wiper status, were communicated within V2V standards. To the extent it is argued *Attard* does not teach this limitation, *Schunder* does.

206. As discussed above, *Kang* teaches a plurality of weights based on weather data and that said weather data may be either obtained via the vehicle's

sensors or from an external source (e.g., Internet). *See* Claim 3(b). Additionally, *Attard* teaches vehicle-to-vehicle communications and receiving weather data from server 125. *Attard*, 2:41-60, 6:61-7:5, 9:11-39. However, neither *Attard* nor *Kang* expressly teaches receiving weather condition data based on data from other vehicles (“active learning data”). *Schunder* teaches a vehicle receives weather condition data from a server, where the weather condition data is based on weather condition data from other vehicles, including vehicles on the same roadway. Thus, the combination would have utilized weights based on weather conditions, such as *Kang*’s weights, and utilized active learning data (weather condition data) from other vehicles, such as taught by *Schunder*. As I detail further below, a POSITA would have been motivated to modify *Attard-Frazer-McNew-An-Kang* further with *Schunder*’s teachings of leveraging weather data from multiple vehicles at least because a POSITA would have recognized the benefits of leveraging data from multiple sources to improve the decision-making process, as well as obtaining weather data from the road to be travelled when there may be no fixed weather stations on said road. So modified, in the *Attard-Frazer-McNew-An-Kang-Schunder* system, active learning data, i.e., weather condition data received from other vehicles, per *Schunder*, would be weighted according to the type or weather, per *Kang*, for use in *Attard*’s Φ and/or φ computation.

207. Furthermore, with respect to weather specifically, a POSITA would have appreciated the benefits of receiving weather data from vehicles ahead of the vehicle to predict future conditions, which is expressly contemplated by *Attard*.

Further, the overall confidence assessment 118 may take into account a temporal aspect. For example, data 115 may indicate that an unexpected lane closure lies ahead, and may begin to affect traffic for the vehicle 101 in five minutes. Accordingly, an overall confidence assessment 118 at a given time may indicate that autonomous operations of the vehicle 101 may continue. However, the confidence assessment 118 at the given time plus three minutes may indicate that autonomous operations of the vehicle 101 should be ended.

Attard, 10:18-36.

a) *Schunder's Weather Condition Data*

208. *Schunder* teaches vehicles include sensors for gathering weather condition data. *Schunder*, 1:63-2:58. *Schunder* teaches weather-related conditions “include, but are not limited to, temperature, wind speed, wind chill, humidity (relative and absolute), barometric pressure, etc.” *Schunder*, 5:12-15, 8:62-9:3 (also teaching cloudiness, visibility, cloud ceiling, precipitation, rain droplet size, wind direction). *Schunder* teaches “crowd-sourcing” weather data from “millions of automobiles traveling along the nation’s highways” and the data is “cataloged based on GPS coordinates associated with the vehicle’s position where the data reading was taken.” *Schunder*, 5:31-38, 7:15-22.

209. *Schunder* teaches a server receives weather data from a plurality of vehicles including GPS coordinates of the vehicles, and either automatically or in response to a request, the server transmits weather data to vehicles including based on the vehicle's location along a route. *Schunder*, 1:63-2:58, 8:34-39, 9:4-15, 9:38-54. *Schunder* teaches utilizing this system to avoid certain weather conditions or also to inform a driver when certain weather conditions are unavoidable. *Schunder*, 10:17-22, 10:47-11:4. Thus, the weather report includes active learning data from other vehicles including vehicles in the same area or on the same roadway as the requesting vehicle. I note that *Schunder's* disclosures mirror those of the '765 Patent's in regards to *active learning data*. For example, the '765 Patent describes that "active learning is employed so that the system as a whole learns from the experiences of many SDVs and drivers, in different geographies and among cohorts." '765 Patent, 9:1-5, 7:43-52 (describing receiving weather data from multiple vehicles). Similarly, *Schunder's* teachings involve a vehicle "learning" the weather data captured by other vehicles in order to take measures, such as avoiding certain weather conditions. *Schunder*, 10:17-22, 10:47-11:4.

210. *Schunder* teaches a vehicle requests weather data from a server and receives weather data from the server regarding vehicles on the same route as the vehicle requesting the weather data as I discussed above. Indeed, *Schunder* teaches prioritizing/weighting weather data sent to the requesting vehicle based on the

location of the requesting vehicle, including the roadway on which the requesting vehicle is traveling. 10:3-16, 5:38-48, 11:35-63. For example, *Schunder* teaches that once the vehicle's location is known, "the server gathers a variety of data points surrounding the vehicle at different radii" and "may focus on points in a pattern," such as "more points in the heading of the vehicle." *Schunder*, 9:38-54, 10:3-16 (accounting for the change in vehicle's position while the server processes the request), 11:35-63 (describing a "blended area reporting" approach). *Schunder's* weather condition data "correspond[s] to weather data reported from other vehicles **at a time in close proximity to a present time**" such that it *shares one or more traits with the current weather condition*. *Schunder*, 2:14-21. Thus, because *Schunder* teaches providing weather data from data points collected proximate the vehicle's location and/or future location that is temporally proximate to the present time, *Schunder's* weather condition data *shares one or more traits with the current weather condition of the roadway on which the SDV is currently traveling*. Therefore, *Schunder* teaches Claim 3(b)(ii).

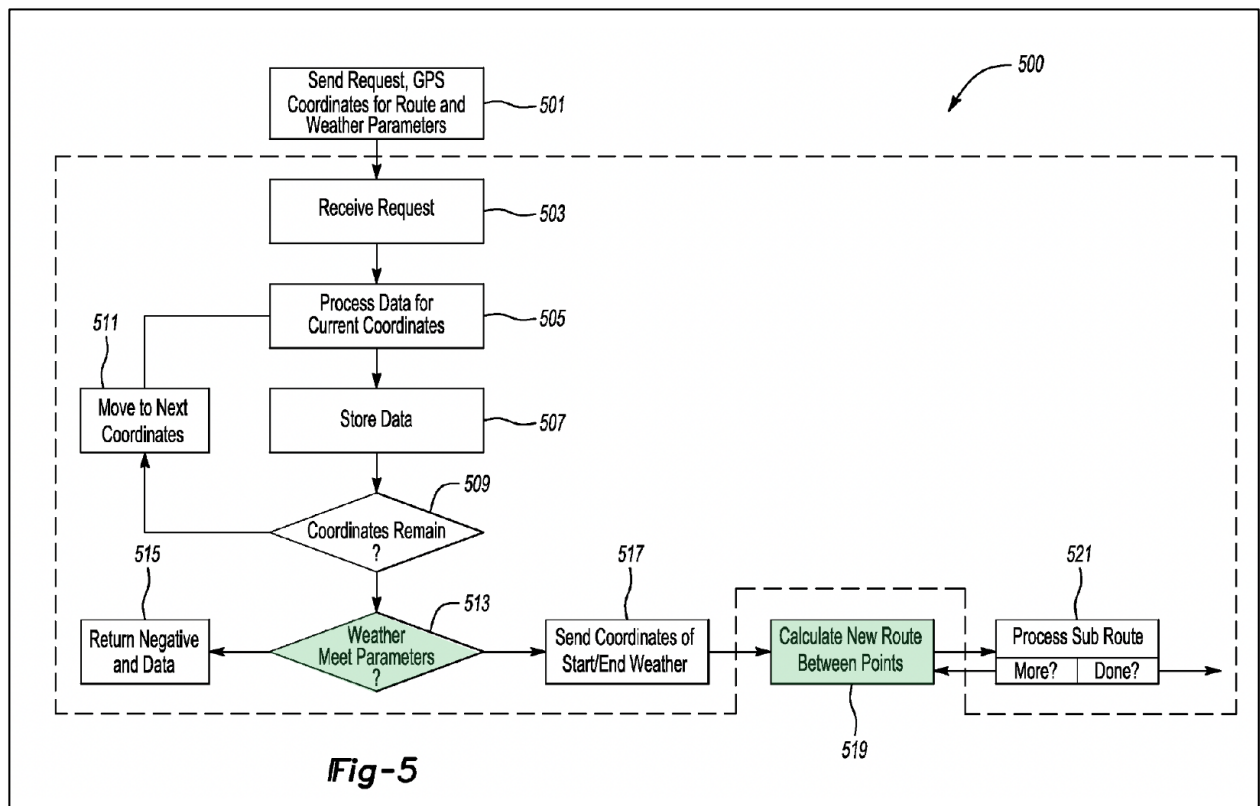
b) Motivation to Combine Attard-Frazer-McNew-An-Kang-Schunder

211. A POSITA would have been motivated and found it obvious to modify *Attard-Frazer-McNew-An-Kang* per *Schunder* to utilize weather active learning data from other vehicles to receive more accurate weather reports for a vehicle traveling down a roadway. As I mentioned above, a POSITA would have appreciated the

benefits of receiving weather data from other vehicles that are ahead of the *Attard-Frazer-McNew-An-Kang* computer program product/SDV in the same direction of travel, thereby enabling decision-making to be made based on future weather conditions that the SDV will encounter. 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. A similar scenario is expressly envisioned by *Attard* in which *Attard's* Φ accounts for an upcoming road closure. *Attard*, 10:28-31. Thus, a POSITA would have appreciated the benefits provided by *Schunder's* teachings, which also relate to improving decision making for a vehicle based on future events the vehicle will encounter. As such, a POSITA would have been motivated and found it obvious to modify the *Attard-Frazer-McNew-An-Kang* computer program product/SDV further with *Schunder's* teachings.

212. Furthermore, *Schunder* teaches several advantages including more accurate weather data for weather reports because the weather data is gathered by many vehicles and can inform other vehicles traveling on the same roadway of weather conditions they are going to encounter further up the road. Thus, the system “tailor[s]...the weather request by paying more attention to the data points closest to the vehicle and giving less weight to data points further from the vehicle,” which also “lends itself to more accurate weather condition.” *Schunder*, 5:44-51. *Schunder*

can also advantageously try to plot a route to avoid particular weather conditions or at least warn a driver when weather conditions are unavoidable. *Schunder*, 10:17-11:4. For example, *Schunder*'s FIG. 5, below, is a method "of a request process for requesting weather for a route, including adjusting the route based on weather." *Schunder*, 10:23-25.



Schunder, FIG. 5. As shown, *Schunder*'s method 500 involves, at 513, checking "to see if the projected weather data meets the 'avoid' parameters for any stretch of the route" and, if so, at 519, the system will "calculate 519 a new route avoiding the weather." *Schunder*, 10:43-51.

213. Modifying *Attard-Frazer-McNew-An-Kang* per *Schunder* to gather active learning data regarding weather conditions from other vehicles would have been use of *Schunder's* known technique and would have improved the *Attard-Frazer-McNew-An-Kang* system in the same way as *Schunder's* system. Namely, such a modification would have predictably improved *Attard's* Φ computation by accounting for more accurate weather data, including future weather events the SDV is likely to encounter. Indeed, modifying *Attard's* server 125 functionality, per *Schunder's* teachings, or simply substituting *Schunder's* server and its functionality for *Attard's* server 125, would have obtained predictable results of more accurate weather condition reporting. That is, such a modification or substitution would have predictably yielded in the *Attard* system being capable of sourcing weather information from other vehicles per *Schunder*. Because this modification enables “a comprehensive image of weather in the area where the vehicles travel” and for “a weather prediction [that] can be custom tailored for a specific vehicle’s location,” a POSITA would have understood such a modification to predictably improve the *Attard-Frazer-McNew-An-Kang* system. *Schunder*, 5:41-44, 6:18-22. As I opined above, weather data messages were standardized before the '765 Patent. *Harding*, 77-79.

214. A POSITA would have had a reasonable expectation of success when making this modification. Indeed, *Attard* teaches natively receiving weather

information from server 125 and *Attard's* vehicle 101 already has sensors 110 to capture weather-related data. *Attard*, 3:45-55, 9:11-59, 10:42-52, 2:10-27, 2:55-3:4, 4:32-45, 6:4-13, 6:61-7:5; *see* Claim 1(a). Thus, the modification would have merely required straightforward changes to programming instructions of the vehicle and potentially adding additional sensors to capture additional weather-related data. Such sensors were well known in vehicles. *See, e.g., Kang*, 9:44-49 (weather collecting unit 135 and rain sensor); *Hampiholi*, [0065]. Combining prior art sensors with a vehicle according to known methods would have yielded predictable results. Due to the well-known nature of these weather sensors in vehicles and their common inclusion in vehicles, such a modification would have yielded predictable results.

215. To the extent *Attard's* server 125 would also need to be modified, such would have been straightforward. That is, it would have been well within the skill of a POSITA to modify *Attard's* server 125 to also receive weather data from other vehicles. *Attard's* server 125 is already configured to receive weather data. *Attard*, 6:62-65 (“[T]he PL may be in real-time communication with a data service, e.g., via the server 125, that can report weather along a planned or projected vehicle 101 route.”). Additionally, this server 125 is configured for communication with vehicle 101. *Attard*, 1:53-56. Thus, it would have been a straightforward modification to server 125 to receive weather data from a vehicle 101. Or, alternatively, a simple substitution of using *Schunder's* server instead of *Attard's* server 125 would have

obtained the predictable results of *Schunder's* functionality. *Attard*, 6:61-7:5, 9:11-39. To elaborate, a POSITA would have found it obvious and been motivated to substitute *Attard's* server 125 with *Schunder's* server at least because *Schunder's* server system is configured for “hundreds, thousands or even millions of data points to be collected throughout a day, providing a comprehensive image of weather in the area where the vehicles travel.” *Schunder*, 7:15-21.

216. Further underscoring the reasonable expectation of success, *Schunder* teaches a vehicle based computing system 1 (VCS) for vehicle 31 including a processor and program instructions stored in memory. *Schunder*, 4:23-42. As discussed above, *Attard-Frazer-McNew-An-Kang* also teaches similar vehicle-based computing system with processor and program instructions stored in memory. See Claim 1(d). Thus, modifying *Attard-Frazer-McNew-An-Kang's* functionality per *Schunder* would have required only straightforward changes to programming instructions that would have been well-within the skillset of a POSITA. That is, the modification would have required a simple software change such that either (a) the *Attard-Frazer-McNew-An-Kang* SDV could receive weather data directly from other vehicles and/or (b) *Attard's* server 125 transmits and receives weather data to/from vehicles.

B. Claim 4

1. Claim 4(Pre)

217. *See*, 1(Pre).

2. ***Claim 4(a): “when the fault does not exceed the threshold for danger, the SDV autonomously controls the driver controls, wherein said driver controls comprise: engine throttle, steering mechanism, braking system, and navigation;”***

218. As discussed above, if there is no fault detected, the vehicle does not take any particular corrective action and stays in autonomous mode, controlling engine throttle, steering, braking, and navigation. *See* Claim 1.

3. ***Claim 4(b): “the SDV autonomously maintains a buffer of space from other vehicles around the SDV and the SDV autonomously controls the steering of the SDV while autonomously controlling the driver controls, without requiring the human driver to operate the driver controls; and”***

219. *Attard* teaches autonomously maintaining a buffer of space from other vehicles around the SDV. *Attard* provides two examples of such. First, *Attard* teaches sensors such as cameras, RADAR, and LIDAR for detecting the presence of other vehicles on the roadway to “detect and/or to maintain a distance from other vehicles.” *Attard*, 1:62-2:6, 4:1-17, 4:65-5:3. A POSITA would have understood maintaining a distance from other vehicles to be the same as *maintain[ing] a buffer of space*. Second *Attard* teaches generating a virtual map indicating the location of other vehicles relative to the first vehicle and using this virtual map “to avoid [a] second vehicle”. 13:50-14:26. Again, a POSITA would have understood avoiding a second vehicle to teach *maintain[ing] a buffer of space* from the second vehicle.

220. I note that SDVs autonomously maintaining a buffer of space from other vehicles is part of what makes an SDV an SDV as otherwise the SDV would require driver invention to avoid collisions with other vehicles. Even lower-level autonomous vehicles maintained space between other vehicles. Likewise, it was well known for SDVs to control throttle, steering, braking, and navigation. *See generally J3016; James* (about which I opined above at ¶¶ 37, 40-42).

221. *Attard* also teaches the SDV autonomously controls the steering of the SDV while autonomously controlling driver controls without requiring the human driver to operate the driver controls. *See* Claim 1; (discussing *Attard's* autonomous mode). Specifically, *Attard* teaches autonomous driving module 106 of computing device 105 for driving autonomously including autonomously controlling steering the SDV. Further, *Attard* teaches, that autonomous operations include “**steering control, speed control**, adaptive cruise control, lane maintenance, etc.,” along with “acceleration, deceleration..., **braking**,” and “**navigation**.” *Attard*, 3:9-13, 3:65-67, 6:4-13. Autonomous module 106 “control[s] various vehicle 101 components and/or operations **without a driver to operate the vehicle**.” *Attard*, 3:60-65.

4. *Claim 4(c): “when the fault exceeds the threshold for danger, the SDV takes the corrective action.”*

222. *See* Claim 1.

C. Claim 18

1. ***Claim 18(Pre): “The computer program product of claim 17, further comprising:”***

223. See, 17(Pre).

2. ***Claim 18(a): “determining the control processor competence level comprises using a weighted voting system, the weighted voting system comprising:”***

224. See, 3(a). Thus, *Attard-Frazer-McNew-An-Kang* teach 18(a).

3. ***Claim 18(a)(i): “: a first plurality of inputs and a first plurality of weights, wherein the first plurality of inputs comprise sensor readings from a first camera sensor; and”***

225. See, 3(a)(i). Thus, *Attard-Frazer-McNew-An-Kang* teach 18(a)(i).

4. ***Claim 18(b): “multiplying at least one of the first plurality of inputs by a weight from among the first plurality of weights;”***

226. See, 3(b). Thus, *Attard-Frazer-McNew-An-Kang* teach 18(b).

5. ***Claim 18(b)(i): “wherein the first plurality of weights are based on active learning data; and”***

227. See, 3(b)(i). Thus, *Attard-Frazer-McNew-An-Kang* teach 18(b)(i).

6. ***Claim 18(b)(ii): “wherein the active learning data includes weather condition data from a cohort of other SDVs, wherein the weather condition data shares one or more traits with the current weather condition of the roadway on which the SDV is currently traveling.”***

228. See, 3(b)(ii). Thus, *Attard-Frazer-McNew-An-Kang-Schunder* teach 18(b)(ii).

D. Claim 19

1. *Claim 19(Pre): “The computer program product of claim 18, further comprising:”*

229. *See, 17(Pre), 18.*

2. *Claim 19(a): “when the fault does not exceed the threshold for danger, the SDV autonomously controls the driver controls, wherein said driver controls comprise: engine throttle, steering mechanism, braking system, and navigation;”*

230. *See, 4(a). Thus, Attard-Frazer-McNew-An-Kang-Schunder teaches 19(a).*

3. *Claim 19(b): “the SDV autonomously maintains a buffer of space from other vehicles around the SDV and the SDV autonomously controls the steering of the SDV while autonomously controlling the driver controls, without requiring the human driver to operate the driver controls; and”*

231. *See, 4(b). Thus, Attard-Frazer-McNew-An-Kang-Schunder teaches 19(b).*

4. *Claim 19(c): “when the fault exceeds the threshold for danger, the SDV takes the corrective action.”*

232. *See, 4(a). Thus, Attard-Frazer-McNew-An-Kang-Schunder teaches 19(c).*

XI. GROUND 4: CLAIMS 5, 20 ARE OBVIOUS OVER ATTARD, FRAZER, MCNEW, AN, KANG, SCHUNDER, DERUYCK, AND GUNDERSON

A. Claim 5

1. *Claim 5(Pre)*

233. *See, 1(Pre).*

2. Claim 5(a): “determining a competence level of a human driver, comprising using the weighted voting system, the weighted voting system further comprising:”

234. *Attard-Frazer-McNew-An-Kang-Schunder* teaches a weighted voting system. See Claim 3. As discussed below, *Attard-Frazer-McNew-An-Kang-Schunder-DeRuyck-Gunderson* teaches determining a competence level of a human driver using a weighted voting system (e.g., weighted voting system of Claim 3).

235. *DeRuyck* teaches determining a competence level of a human driver by analyzing driver behavior including fatigue and distraction from playing games or texting. *DeRuyck*, 3:50-52. *DeRuyck* teaches using a weighted voting system to determine driver behavior. *DeRuyck*, 13:21-41, 12:2-8, 14:9-31, 17:50-18:21, 18:58-19:2. Specifically, *DeRuyck* teaches an array of weights W1-W6 1020 where each weight weighs the output of one of a plurality of disparate data sources, including driver movement data 1002, occurrence data 1004 (e.g., number of times driver movement 1002 occurs), in-cab data 1006, among others. *DeRuyck*, 13:21-41. Per *DeRuyck*, weights 1020 “can be set at a value W ranging between 0 and 1.0 (e.g., 0% and 100%)” and can be “refined over time based on experience.” *Id.* Thus, the data sources are weighted and summed at summer 1015 then passed to driver behavior detector 208, as depicted in Fig. 10:

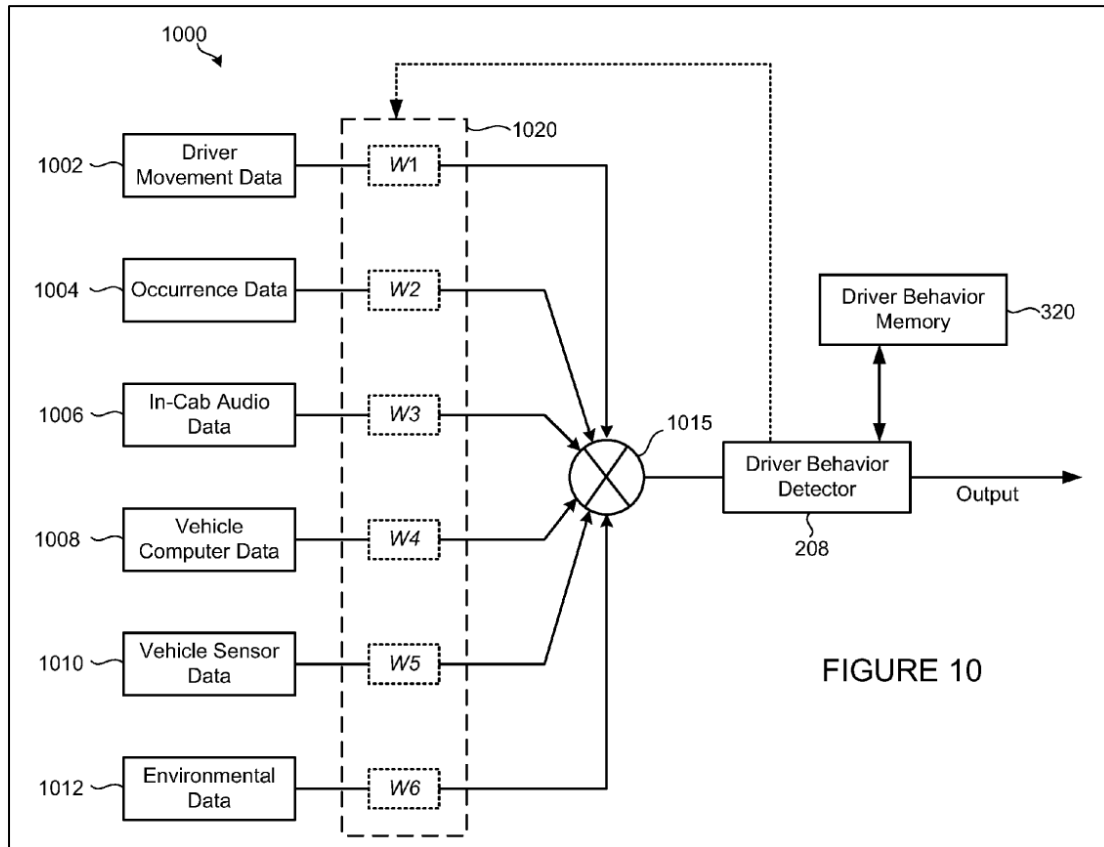


FIGURE 10

DeRuyck, Fig. 10.

236. The driver movement data 1002 can include “head movements, e.g., head rotation downward or toward an electronic device, facial movements, [and] gaze direction.” *DeRuyck*, 15:62-67, 17:54-18:2 (describing capturing and analyzing driver facial movements), 18:34-46 (describing capturing and recognizing driver head, arm, and hand movements).

237. The “driver behavior detector 208 generates an output indicating that a driver behavior of interest has been detected.” *DeRuyck*, 12:2-5, FIG. 8. If a “driver distraction event” is detected, “an alert is generated.” *DeRuyck*, 13:45-56, FIG. 11. Thus, *DeRuyck*’s teachings of detecting driver distraction events based on driver

movement data 1002, which is determined using camera sensors, is *a competence level of the human driver*. A motivation to combine *Attard-Frazer-McNew-An-Kang-Schunder-DeRuyck* is provided below. See Claim 5(a)(i).

3. Claim 5(a)(i): “a second plurality of inputs and a second plurality of weights, wherein the second plurality of inputs comprise sensor readings from a second camera sensor; and”

a) DeRuyck’s Plurality of Inputs and Weights

238. As discussed above, *Attard* teaches a first camera sensor (e.g., sensor 110) and first plurality of inputs from said sensor 110. See Claim 1. *Attard-Frazer-McNew-An-Kang-Schunder* teaches a first plurality of weights. See Claim 3. Further discussed above, *DeRuyck* teaches a second plurality of weights (e.g., W1-W6) and a second plurality of inputs (e.g., data 1002-1012). See Claim 5(a).

239. *DeRuyck* teaches its *plurality of inputs* comprises *sensor readings from a second camera sensor*. Specifically, *DeRuyck’s* driver movement data 1002 comprises sensor readings from a camera sensor. For example, cameras 222 and/or 222a are positioned to monitor driver behaviors. *DeRuyck*, 8:46-61, 20:7-34, 6:19-41, 6:57-67, 13:21-41, 15:2-7, 23:26-43, 24:21-56, 26:4-28, 3:20-22, Figs. 19, 21, 23. *DeRuyck* teaches “[o]ne or more second in-cab cameras 222a can be mounted...and directed toward the driver and/or passenger within the cab,” which can be used to detect “[e]vidence of a driver behavior event of interest” such as “driver movements that show an electronic device in view of, or being held by, the

driver.” *DeRuyck*, 24:42-49, 15:55-62. Such “driver facing cameras” were a standard vehicle feature generally known as “driver monitoring systems”. Thus, driver movement data 1002 captured by a camera (e.g., 222a) is weighted by a weight 1020, summed by summer 1015, and analyzed by driver behavior detector 208. *DeRuyck*, 20:7-34.

240. I note that, with respect to FIG. 4, *DeRuyck* describes an embodiment in which the camera data is kept internal to the vehicle and is not transmitted externally. *DeRuyck*, 7:50-8:11. However, in my opinion, this would not have dissuaded a POSITA from combining *DeRuyck* with *Attard-Frazer-McNew-An-Kang*. First, *DeRuyck* discloses a number of other embodiments in which the driver behavior data is shared external to the vehicle, including in the FIG. 4 discussion. *DeRuyck*, 7:57-60 (“In response to detecting the driver distraction event, and [sic] alert response, such as a message, is communicated 410, such as within the vehicle cab and/or **to a remote system.**”), *see also*, 8:58-61, 9:1-5, 13:55-57. A POSITA would have appreciated the benefits of sending the driver distraction event for use in reducing future driver distraction events, which is expressly envisioned by *DeRuyck*.

b) Motivation to Combine Attard-Frazer-McNew-An-Kang-Schunder-DeRuyck

241. A POSITA would have been motivated and found it obvious to modify *Attard-Frazer-McNew-An-Kang-Schunder* per *DeRuyck*’s teachings of determining

a competence level of a human driver using a weighted voting system including a plurality of weights and plurality of inputs where the plurality of inputs comprise sensor readings from a camera sensor. Such a modification would have predictably improved the combined system by yielding a more accurate determination of the driver's competence by leveraging weights that are based on data from other drivers. As I discussed with respect to weighting inputs for determining the CPCL, it was well known to weight inputs according to their importance. *See* Claim 3(a). The same holds true here, i.e., a POSITA would have appreciated that some inputs for determining driver competence are more important to the competence than others. In addition, the available signatures for driver competence vary between drivers (e.g. sunglasses may prohibit the camera perceiving eyelid position or accurately tracking gaze direction), and therefore the available signatures must be weighed accordingly. For at least these reasons a POSITA would have been motivated to modify the *Attard-Frazer-McNew-An-Kang-Schunder* with *DeRuyck's* teachings.

242. Modifying *Attard-Frazer-McNew-An-Kang-Schunder* per *DeRuyck's* teachings would have advantageously provided functionality for determining a competence level of a human driver beyond *Attard's* native teachings of looking at “static” qualities. For example, *Attard* teaches that Φ can be compared to $\Phi_{\min}$ to determine whether to send a message. *Attard*, 7:62-65. This $\Phi_{\min}$ threshold is “specified by a parameter 117,” which is “associated with a particular vehicle 101

operator..., e.g., according to operator age, level of driving experience, etc.” A POSITA would have found it obvious the $\Phi_{\min}$ to be changed based on parameters that indicate a level of driving competence, e.g., driver’s with less experience would have a lower $\Phi_{\min}$ making it less likely Φ falls below $\Phi_{\min}$ and a transfer to manual message 116 is sent.

243. Indeed, modifying the *Attard* combination in this way would have enhanced *Attard*’s native driver characteristic monitoring to further include driver behaviors such as driver movements, for example indicating a driver is drowsy or distracted. For example, modifying *Attard* in such a way would have allowed for the driver-related parameter 117 to incorporate driver distraction events, per *DeRuyck*’s teachings. Such a modification would have been use of a known technique of determining competence level of a human driver using weighted voting and sensor readings from camera sensors that would have improved *Attard-Frazer-McNew-An-Kang-Schunder*’s autonomous vehicle in the same way as *DeRuyck*’s vehicle, i.e., by basing a parameter 117 on a driver distraction event or otherwise based on the driver movement data, per *DeRuyck*. Indeed, this modification would have improved *Attard*’s vehicle by improving driver safety and awareness, as *DeRuyck* expressly teaches. *DeRuyck*, 3:50-63, 8:46-61. For example, a POSITA would have appreciated the benefits of selecting parameter 117 based on the driver distraction data to allow for a more accurate recommendation/corrective action to be taken in

the *Attard* system. For example, while the vehicle 101 operator's level of driving experience may have indicated a highly-skilled driver, this does not account for the current state of the driver. Thus, a scenario could exist where manual control is recommended while the driver is not paying attention, leading to an unsafe situation. Accordingly, a POSITA would have appreciated the safety benefits provided by the *DeRuyck* modification to incorporate the driver's behavior. Further, this modification would have combined prior art elements according to known methods per *DeRuyck* to yield predictable results in the modified *Attard* system and computer program product. Specifically, such a modification would have yielded the predictable result of the *Attard* system being modified to determine human driver competence using weighted inputs (*a weighted voting system*) per *DeRuyck's* teachings.

244. A POSITA would have had a reasonable expectation of success when modifying *Attard-Frazer-McNew-An-Kang-Schunder* per *DeRuyck's* teachings. *Attard* already teaches identifying various driver characteristics and using sensors 110 for this purpose. *Attard* also already teaches weighted voting and camera sensors, such that modifying the *Attard* combination would have required merely straightforward changes to programming instructions. For example, both *Attard* and *DeRuyck* teach implementing their teachings using computer program products. *Attard*, 15:12-46; *DeRuyck*, 27:3-28.

4. ***Claim 5(b): “multiplying at least one of the second plurality of inputs by a weight from among the second plurality of weights;”***

245. As discussed above, *DeRuyck* teaches *multiplying at least one of the second plurality of inputs* (e.g., driver movement 1002) by a weight (e.g., W1) *from among the second plurality of weights* (e.g., weights 1020). See Claim 5(a)(i); *DeRuyck*, 13:21-41. As I discussed with respect to 5(b), *DeRuyck*’s inputs/driver movement data 1002 includes *sensor readings from a second camera sensor* (e.g., cameras 222a), such that it is this camera data that would be weighted (potentially along with other driver movement data) by the *weight* W1.

5. ***Claim 5(c): “wherein the second plurality of weights are based on active learning data that includes information about a cohort of human drivers of other SDVs.”***

246. *DeRuyck* does not expressly teach how its weights 1020 are generated. Specifically, *DeRuyck* does not expressly teach its weights are based on active learning data that includes information about a cohort of human drivers of other SDVs. *Gunderson* teaches such.

a) ***Gunderson’s Active Learning Data***

247. *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 one or more event capture devices 20 “identifies an event and stores certain audio and video data along with related information about the event.” *Gunderson*, [0032]. *Gunderson* teaches data regarding

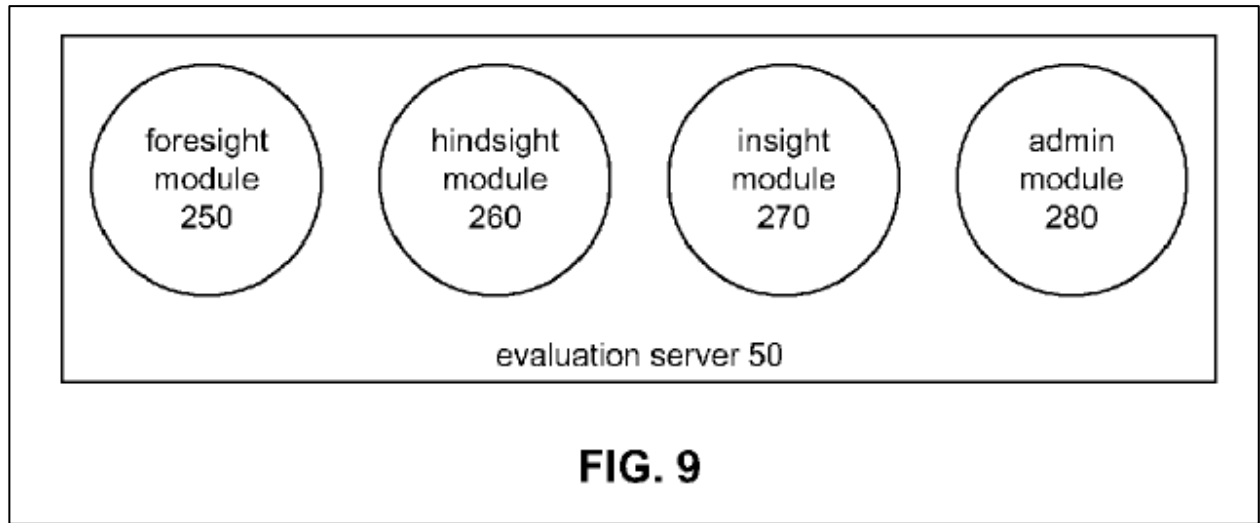
event 150 from event detector 30 is stored locally until being provided to evaluation server 50, for example, over network 70 (e.g., wireless network 72). *Gunderson*, [0040]-[0045]. In particular, evaluation server 50 may include insight module 270, which “aggregate[s] event data into a database of driving events and correlate[s] information in the database to identify trends in driving behavior that relate to risk factors.” *Gunderson*, [0056], [0059].

248. Insight module 270 compares correlations and driver safety trends with historical event information to provide a driver rating/score for an individual driver. *Id.* Insight module 270 also 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 various risk factors (e.g., changing lanes without signaling). *Gunderson*, [0061]. Group module 410 similarly analyzes event data for a group of individual drivers. *Gunderson*, [0062]. Specifically, group module 410 “may be configured to assign relative weights to the risk factors depending on their prevalence to the group as a whole.” *Id.* In one example, a tendency such as not utilizing a turn signal before changing lanes appears in only one driver out of ten, such that the risk factor is reduced by 90 percent when applied to the group as a whole. *Id.* These weights, which are based on the driver’s activity (e.g., lack of turn signaling) are, accordingly, *weights based on active learning data that includes information about a cohort of human drivers of other*

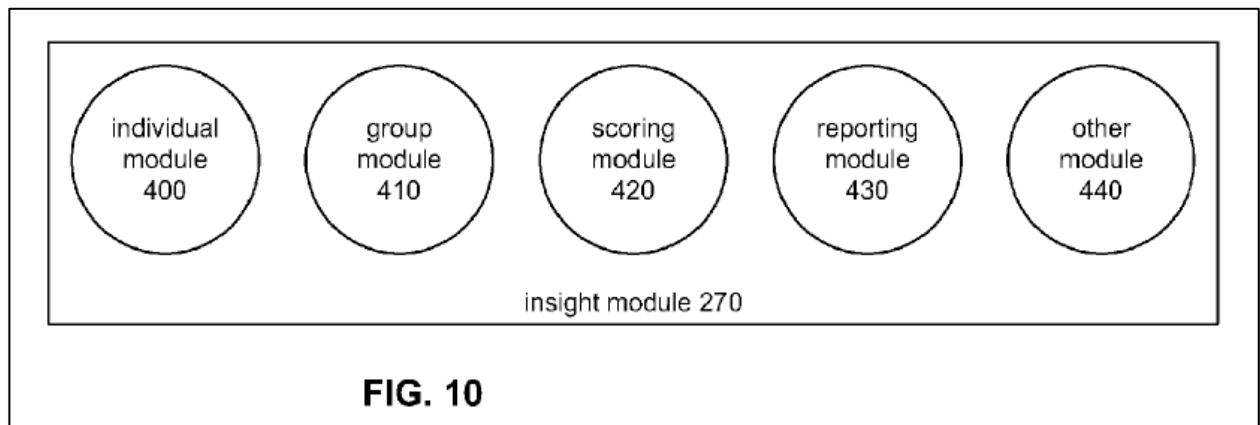
SDVs. In the combined *Attard* system, it would have been obvious for these drivers to be drivers of other SDVs because *Attard's* vehicle is itself an SDV. Thus, at least some of the drivers in the cohort of human drivers would have been human drivers of other SDVs.

249. Group module 410 provides its information to scoring module 420, similar to the process done with individual module 400. *Gunderson*, [0062]-[0064]. The scoring module 420 “analyzes the various driver tendencies and risk factors and correlates those tendencies and risk factors with aggregate information about driver tendencies and risk factors.” *Gunderson*, [0064]. Thus, scoring module 420 computes “an individual driver score or a collective driver score for a group of drivers based on individual driver tendencies and characteristics and other information about the drivers.”

250. Evaluation server 50's modules (including insight module 270) are depicted below:



Gunderson, Fig. 9. Similarly, components of insight module 270 are depicted in Fig. 10 below:



Gunderson, Fig. 10.

251. A POSITA would have understood or found obvious that weighting driver behaviors in this way (both individually and/or as a group) allows for “a more granular and accurate group driving score.” *Gunderson*, [0007], [0062], [0079], Abstract. That is, a POSITA would have found it obvious that taking into account the behavior of a group of drivers (i.e., *a cohort*) to determine appropriate weights

to apply to inputs would have provided a more accurate human driver competence level determination. Specifically, and as expressly envisioned by *Gunderson*, one driver may have a behavioral tendency not shared by other drivers in a group such that behavior is not as highly weighted because it has less importance to the driver cohort as a whole. *Gunderson*, [0062]. Thus, *Gunderson* teaches *weights based on active learning data that includes information about a cohort of human drivers of other SDVs*.

b) Motivation to Combine Attard-Frazer-McNew-An-Kang-Schunder-DeRuyck-Gunderson

252. A POSITA would have been motivated and found it obvious to modify *Attard-Frazer-McNew-An-Kang-Schunder-DeRuyck* per *Gunderson*'s teachings to base a second plurality of weights on active learning data that includes information about a cohort of human drivers of other SDVs. Again, as with using weights based on data from other SDVs, a POSITA would have found it obvious, been motivated, and recognized the benefits of using a weighted voting system where the weights are based on data from other drivers, per *Gunderson*, to increase the accuracy/flexibility of the human driver competence computation. This modification would have improved the *Attard* combination by modifying weights according to information about a cohort of human drivers of other SDVs to advantageously improve how the weights are determined and applied. Further, by using weights from other drivers, the competence level computation would change over time if the behavior of the

driver's changed over time, which would have been advantageous in ensuring the competence level is not determined based on dated information/driver trends. In addition, competency signals for a driver may change seasonally (lower speeds in snow) or geographically (e.g., people drive differently in Boston than Colorado). For example, *Gunderson* teaches certain negative tendencies may be relatively uncommon among drivers (e.g., one out of ten drivers changes lanes without signaling), and the driver cohort data may be weighted to account for such behaviors. In this way, trends in driver behaviors among an individual driver or group of drivers can be identified that relate to risk factors, and relationships between those risk factors and driver safety can be determined and then applied to an individual driver's behavior. Further, with historical event information for a particular driver, a driver's behavior may be analyzed for safety issues over time and weighted accordingly as previously described.

253. Specifically, with respect to *Gunderson's* teachings that improve driver safety, *Gunderson* teaches insight module 270 "identif[ies] trends in driving behavior that relate to risk factors" and is "configured to correlate cause and effect relationships between data points" to "determine the effect of those relationships upon driver safety." *Gunderson*, [0059]. The correlations are then used to "provide a driver rating or driver score for an individual driver." The risk factors can relate to, for example, a driver that "has a tendency to change lanes without employing a

turn signal first.” *Gunderson*, [0061]. As discussed in the above mapping, *Gunderson* can then use this data for a group of drivers to “assign relative weights to the risk factors depending on their prevalence to the group as a whole.” *Gunderson*, [0062]. Thus, by assigning weights to risk factors, which are indicators of dangerous driving behavior, based on the actions of a group, a “more accurate[]” assessment of the driver’s driving behavior can be obtained. *Id.* A POSITA would have understood that this increased accuracy would have predictably improved the combined *Attard* system to provide a more accurate HDCL computation.

254. Modifying *Attard-Frazer-McNew-An-Kang-Schunder-DeRuyck* per *Gunderson* would have had a reasonable expectation of success. *Attard* already teaches receiving information from a server and vehicle-to-vehicle communications. See ¶ 206. *Attard* also teaches weighting determinations and taking driver characteristics into consideration. See ¶ 244; *Attard*, 6:28-35, 4:18-31. Further, the *Attard* combination already includes hardware necessary to perform *Gunderson*’s steps, including *Attard*’s camera sensors 110, in-cab cameras (e.g., *DeRuyck*’s in-cab cameras 222a), processor, memory, server 125, and programming instructions. *Gunderson*, likewise, teaches implementing its functionality using a processor and programming instructions. Specifically, *Gunderson* teaches computer executable code stored in a main memory 756 that “when executed, enable[s] the computer system 750 to perform the various functions of the present invention.” *Gunderson*,

[0099], *see also*, [0088]-[0105] (detailing the computer system 750 including processors 752 and computer readable media), FIG. 14. Thus, modifying *Attard-Frazer-McNew-An-Kang-Schunder-DeRuyck* per *Gunderson* would have required only straightforward changes to programming instructions and would have been well-within the skillset of a POSITA. For example, *Attard*'s server would have been modified to perform *Gunderson*'s data processing, and *Attard*'s vehicle would have been modified to include one or more in-cab cameras (e.g., per *DeRuyck*) and utilize weights such as taught by *Gunderson*. As I discussed with respect to Claim 3, the software modification to multiple *Attard*'s sensor determinations (*inputs*) would have been a simple modification well within the skill of a POSITA because weights are merely basic coefficients. *See* ¶ 204.

B. Claim 20

1. *Claim 20(Pre): "The computer program product of claim 19, further comprising:"*

255. *See*, 17(Pre).

2. *Claim 20(a): "determining a competence level of a human driver, comprising using the weighted voting system, the weighted voting system further comprising:*

256. *See*, 5(a). Thus, *Attard-Frazer-McNew-An-Kang-Schunder-DeRuyck* teach 20(a).

3. *Claim 20(a)(i): "a second plurality of inputs and a second plurality of weights, wherein the second plurality of inputs comprise sensor readings from a second camera sensor"*

257. See, 5(a). Thus, *Attard-Frazer-McNew-An-Kang-Schunder-DeRuyck* teach 20(a)(i).

4. ***Claim 20(b): “multiplying at least one of the second plurality of inputs by a weight from among the second plurality of weights;”***

258. See, 5(b). Thus, *Attard-Frazer-McNew-An-Kang-Schunder-DeRuyck* teach 20(b).

5. ***Claim 20(c): “wherein the second plurality of weights are based on active learning data that includes information about a cohort of human drivers of other SDVs.”***

259. See, 5(c). Thus, *Attard-Frazer-McNew-An-Kang-Schunder-DeRuyck-Gunderson* teach 20(b).

XII. GROUND 5: CLAIM 6 IS OBVIOUS OVER ATTARD, FRAZER, AND HAMPIHOLI

A. Claim 6

1. ***Claim 6(Pre)***

260. See, 1(Pre).

2. ***Claim 6(a): “a sensor system comprising a plurality of sensors;”***

261. See Claim 1(Pre).

3. ***Claim 6(b): “vehicle controls comprising: engine throttle, steering mechanism, and braking system;”***

262. See Claim 7(c). *Attard* teaches its vehicle is operated partially or completely autonomously by autonomous driving module 106 in its computer 105, including specifically the operation of the vehicle’s “steering, braking, and speed,”

as well as “navigation.” *Attard*, 9:63–10:12, 14:13-48. A POSITA would have recognized or at least found obvious that controlling the vehicle’s “steering” teaches controlling its “steering mechanism, controlling its “braking” teaches controlling its “braking system,” and controlling its “speed” teaches controlling its “engine throttle.” It is established fact that the vehicle’s speed is controlled via the throttle, which controls the air flow into the engine, and in a typical non-self-driving vehicle, is controlled by the driver actuating the gas pedal. *See, e.g., Takada* (Ex. 1035), 1:13-25. As I discussed in the background section, SDVs typically include the same hardware components for driving as non-SDVs, with the difference between the two being the additional sensors and software added to recognize the environment in order to drive autonomously. *See* Section V.E. Thus, a POSITA would have found it obvious that *Attard*’s disclosures of autonomous controlling the steering, braking, and speed to teach the claimed *engine throttle, steering mechanism, and braking system*.

4. ***Claim 6(c): “a computer system comprising a processor coupled to a non-transitory computer readable storage medium containing program code, the program code readable and executable by a processor;”***

263. *See* Claim 1(Pre).

5. ***Claim 6(d): “the computer system is capable of receiving a sensor reading from the system of sensors;”***

264. *See* Claim 1(a).

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

265. See Claim 6(b).

7. ***Claim 6(f): “the computer system is capable of determining the operational state of the self-driving vehicle (SDV);”***

266. See Claim 1(a).

8. ***Claim 6(g): “the computer system is capable of determining a vehicle fault;”***

267. See Claim 1(b)-1(c).

9. ***Claim 6(h): “the computer system is capable of determining a competence level of the processor;”***

268. See Claim 1(c), 1(h).

10. ***Claim 6(i): “the computer system is capable of determining competence level of a human driver;”***

269. *Attard-Frazer-Hampiholi* teaches this limitation. See Claim 7(a).

11. ***Claim 6(j): “the computer system is capable of determining a corrective action using the competence level of the processor and the competence level of the human driver;”***

270. The *Attard* combination teaches *the computer system is capable of determining a corrective action using the competence level of the processor*. See Claim 1(h). The *Attard-Frazer* combination further modified by *Hampiholi* teaches *the computer system is capable of determining a corrective action using the competence level of the processor and the competence level of the human driver*. As further discussed regarding 7(a), *Hampiholi* teaches *determining a competence level*

of a human driver as measured by the severity level of distraction the driver is experiencing, such as not looking at the road for upcoming turns, being distracted by music, handling infotainment units, or being sleepy/tired. *See*, 7(a) citing *Hampiholi*, [0001]-[0004], [0050]. As also discussed with respect to Claim 1(h), *Attard* teaches sending a message 116 when Φ is below $\Phi_{\min}$. *See* Claim 1(h); *Attard*, 7:62-65. *Attard* teaches or renders obvious that $\Phi_{\min}$ is “a threshold provided by the parameter 117.” *Attard*, 5:62-65, 10:53-11:4. Specifically, *Attard* teaches the following. First, *Attard* teaches comparing the confidence assessments 118 (Φ) to a parameter 117.

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

Attard, 5:21-30. Second, *Attard* teaches parameter 117 is “associated with a particular vehicle 101 operator” and “may be determined in a variety of ways, e.g., according to operator age, level of driving experience, etc.” *Attard*, 5:33-37. Thus, *Attard* itself envisions parameter 117 accounts for the driver’s ability to operate the vehicle, e.g., for the *competence level of the human driver*. A POSITA would have

been motivated and found it obvious to modify *Attard's* computer system such that $\Phi_{\min}$ is substituted with *Hampiholi's* severity rank R or is based on severity rank R (HDCL). At least because *Hampiholi's* severity is, like *Attard's* parameter 117 “associated with a particular vehicle 101 operator, a POSITA would have found it obvious to modify *Attard* with *Hampiholi's* severity rank R. *Attard*, 5:33-37. Thus, in the *Attard-Frazer-Hampiholi* combination, *Attard's* Φ (CPCL) is either compared directly to *Hampiholi's* severity rank R (HDCL), i.e., the modification is a simple substitution, or *Attard's* parameter 117, which is used to determine $\Phi_{\min}$, is modified to be based on severity rank R, where the modification is use of a known technique. For example, in my opinion, it would have been obvious to modify *Attard* such that $\Phi_{\min}$ based on *Hampiholi's* severity rank R instead of (or in addition to) the age or level of driving experience disclosed by *Attard*. This would have predictably improved *Attard's* system by providing a safer transfer protocol that is based on real-time data, per *Hampiholi's* teachings. Alternatively, instead of basing parameter 117 on severity rank R, a POSITA would have found it obvious and been motivated to substitute $\Phi_{\min}$ with R. Severity rank R, like Φ and $\Phi_{\min}$, is a scalar value. *Attard*, 5:66-6:2. Thus, it would have been an easy modification to substitute one scalar (severity rank R) for another scalar ($\Phi_{\min}$).

271. Because *Attard* teaches determining to send message 116 when Φ is below $\Phi_{\min}$, and in the combination, $\Phi_{\min}$ is substituted or modified using

Hampiholi's severity rank R , the *Attard-Frazer-Hampiholi* combination teaches or renders obvious determining a corrective action using the competence level of the processor and the competence level of the human driver. As I have previously discussed, the corrective action is or results from Φ falling below $\Phi_{\min}$ such that modifying *Attard* to modify $\Phi_{\min}$ based on severity rank R or modifying *Attard* to substitute $\Phi_{\min}$ with severity rank R , renders obvious *determining a corrective action using the competence level of the processor (Φ) and the competence level of the human driver* (severity rank R).

272. While not required by Claim 6(j), a POSITA would have found it obvious to modify *Frazer's* event table 112 (fault-remediation table) to further store the appropriate $\Phi_{\min}$ at which corrective action(s) should be taken. In fact, *Frazer* teaches storing thresholds in event table 112. *Frazer*, 21:61-64. For example, as discussed above, *Attard-Frazer* teaches determining a corrective action using a fault-remediation table (*Frazer's* event table 112) including registers (rows 140c-1, 140c-2, etc.) containing particular sets of conditions 142c and an instruction/action 144c to be taken conditions are met. *See*, 1(d) *citing Frazer*, 21:20-22:22, Fig. 6. As explained, *Frazer's* rows 140c represent fault conditions, *Frazer's* columns 142c refer to conditions manifested by that fault, and *Frazer's* second column 144c refers to a corrective action to be taken when the conditions are manifested ("DO X").

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

Frazer, FIG. 6 (excerpt, annotated).

a) Motivation to Combine Attard-Frazer-Hampiholi

273. A POSITA would have been motivated and found it obvious to modify Attard's $\Phi_{\min}$ based on Hampiholi's HDCL (severity rank R) teachings such that Attard's determination of sending a message 116, which *determin[es] a corrective action* (Claim 1(h)), *us[es] the competence level of the processor and the competence level of the human driver*. Namely, a POSITA would have found it obvious and been motivated to modify Attard accordingly to improve Attard's handover decision making by also accounting for the driver's current state in determining a corrective action to take. As I discussed in the Background, it was well known for various safety reasons to ensure a driver of an SDV was prepared to accept manual control of the vehicle when needed. *See* Section V.D.1.

274. Additionally, *Attard* provides a teaching, suggestion, or motivation to do so by teaching that parameter 117 (used to determine $\Phi_{\min}$) is “associated with a particular vehicle 101 operator.” *Attard*, 5:33-37, 10:53-11:4. For example, *Attard* teaches the parameter can be determined “according to operator age, level of driving experience etc.” *Attard*, 5:33-37; *see also* Section XI.A.3 (discussing a similar modification based on *DeRuyck*). However, *Attard* does not expressly teach using a parameter such as *Hampiholi*’s severity rank R. Thus, a POSITA would have found it obvious to use or substitute other driver-related information, i.e., *Hampiholi*’s severity rank R, into $\Phi_{\min}$ to provide a safer and/or more accurate method by which to determine the recommendation resulting from *Attard*’s message 116. For example, a POSITA would have found it obvious that a driving-experience-related parameter 117 for a less-experienced driver would have a lower associated threshold ($\Phi_{\min}$) to reduce the likelihood Φ is below $\Phi_{\min}$ so vehicle 101 is more likely to be driven autonomously.

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

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

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

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

277. Additionally, to the extent it is argued such a modification would have required hardware/software modifications to compute *Hampiholi's* severity rank R, a POSITA would have had a reasonable expectation of success in doing so as well.

First, *Attard* already teaches in vehicle sensors for analyzing the operator.

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

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

monitoring systems were well known before the '765 Patent, a POSITA would have had a reasonable expectation of success in modifying *Attard* based on *Hampiholi*'s teachings. See Section V.D.

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

12. Claim 6(k): “the computer system is capable of implementing the corrective action; and”

279. See Claim 1(d).

13. Claim 6(l): “the computer system is capable of issuing an alert indicating the corrective action;”

280. See Claim 1(e), 1(i).

14. Claim 6(m): “the system of sensors comprises a GPS sensor;”

281. See Claim 1(f).

15. Claim 6(n): “the operational state of the self-driving vehicle comprises a first road condition;”

282. See Claim 1(g).

16. Claim 6(o): “the vehicle fault comprises an absence of a sensor reading;”

283. *Attard* teaches faults with sensors and sensors not detecting lane markings. See Claim 1; *Attard*, 8:10-13, 8:33-35.

17. Claim 6(p): “the corrective action comprises querying a database for the proper action to take.”

284. *Frazer* teaches a fault-remediation table, which is stored in memory. A POSITA would have understood or found obvious that a fault-remediation table is a type of database that is queried for a “proper action to take.” *See* Claims 1(d), 6(o).

XIII. GROUND 6: CLAIM 8 IS OBVIOUS OVER HAMPIHOLI, ATTARD, FRAZER, DERUYCK, SCHUNDER

A. Claim 8

285. Claim 8 recites a combination of limitations already discussed above. Arguments and motivations to combine from the referenced limitations are hereby incorporated by reference.

1. ***Claim 8(Pre): “The computer program product of claim 7, wherein:”***

286. *See* Claim 7.

2. ***Claim 8(a): “the sensor readings comprise a reading from a GPS sensor and a reading from a speedometer;”***

287. *Attard* teaches a GPS sensor. *See* Claim 2(a). *Hampiholi* teaches a sensor for vehicle speed. *Hampiholi*, [0034], [0046].

3. ***Claim 8(b): “determining the competence level of the processor comprises weighted voting;”***

288. *See* Claim 3(a).

4. ***Claim 8(c): “determining the competence level of the human driver comprises weighted voting;”***

289. *Hampiholi-Attard-DeRuyck* teaches determining the competence level of the human driver comprises weighted voting. *See* Claim 5(a).

5. ***Claim 8(d): “determining the corrective action comprises using active learning data, said active learning data including information from other SDVs;”***

290. *Hampiholi-Attard-DeRuyck-Schunder* teaches using *active learning data including information from other SDVs*. See Claim 3. A POSITA would have understood or found obvious that such active learning data would also have been used to determine a corrective action (e.g., issuing a warning, slowing the vehicle). That is, because (a) the *active learning data* from the *Hampiholi-Attard-An-Kang-Schunder* system is used to *determine the competence level of the processor*, and (b), per Claim 6(j), the *corrective action* is based on *the competence level of the processor*, the combined system teaches or renders obvious Claim 8(d). Said another way, the *corrective action* is determined using the CPCL, which itself is determined using *active learning data* such that the *corrective action*, therefore, also uses said *active learning data* via its inclusion in the determination of the CPCL.

6. ***Claim 8(e): “the corrective action comprises querying a database for the proper action to take.”***

291. See Claim 6(p). Thus, *Hampiholi-Attard-DeRuyck-Schunder-Frazer* teaches 8(e).

XIV. GROUND 7: CLAIMS 10-11 ARE OBVIOUS OVER HAMPIHOLI, ATTARD, DERUYCK, AND GUNDERSON

A. Claim 10

1. ***Claim 10(Pre): “The computer program product of claim 7, further comprising:”***

292. See Claim 7.

2. ***Claim 10(a): “determining the competence level of the human driver comprises using a weighted voting system, the weighted voting system comprising: a plurality of inputs and a plurality of weights,”***

293. See Claim 5(a)-5(a)(i).

3. ***Claim 10(b): “The plurality of inputs comprising sensor readings from a camera sensor; and”***

294. See Claim 5(a)-5(a)(i).

4. ***Claim 10(c): “multiplying at least one of the plurality of inputs by a weight from among the plurality of weights;”***

295. See Claim 5(b).

5. ***Claim 10(d): “wherein the plurality of weights are based on active learning data that includes information about a cohort of human drivers of other SDVs.”***

296. See Claim 5(c).

B. Claim 11

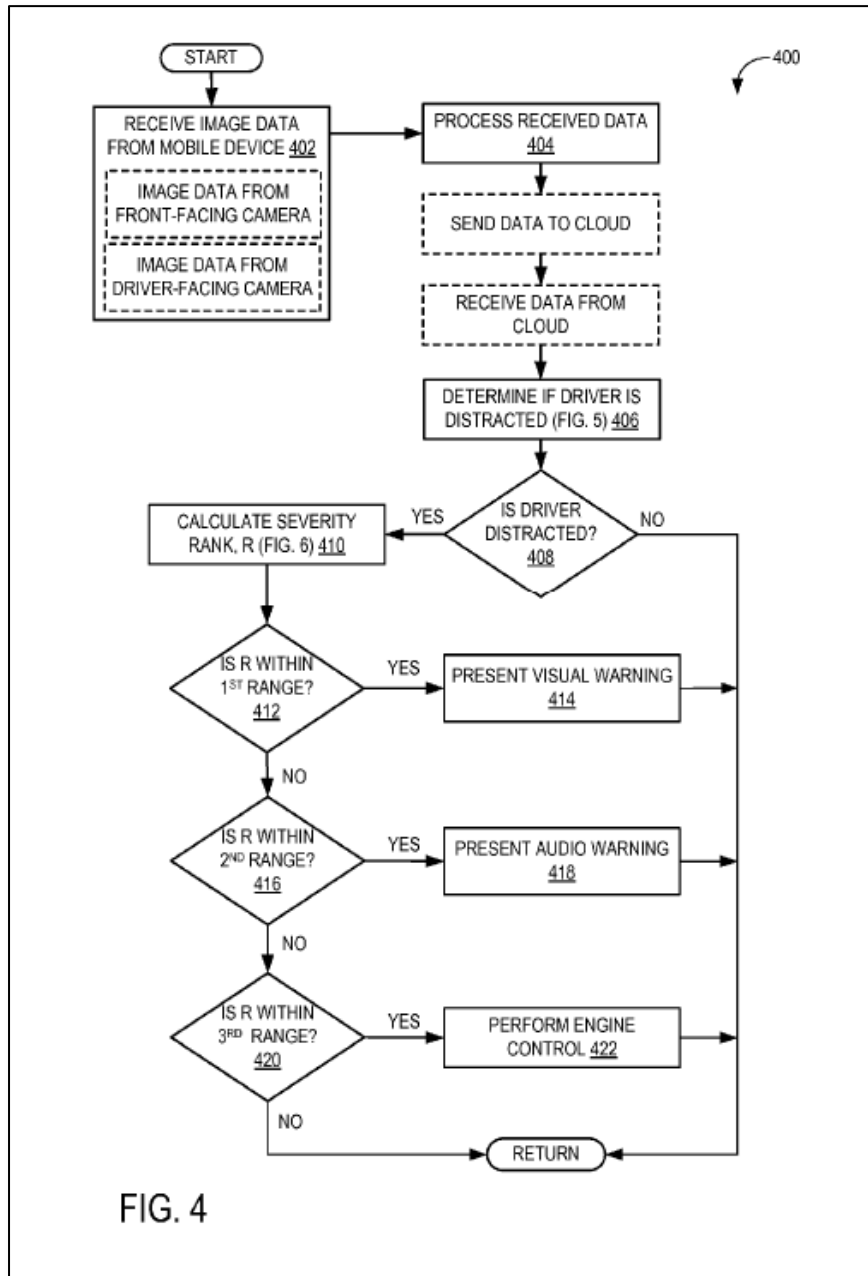
1. ***Claim 11(Pre): “The computer program product of claim 10, further comprising:”***

297. See Claim 10.

2. ***Claim 11(a): “when the competence level of the human driver is above a first threshold, the SDV autonomously controls the driver controls without requiring the human driver to operate the driver controls;”***

298. See Claims 1, 4(a), 7(b)-7(c). A POSITA would have understood or found obvious that when the HDCL is above a first threshold, the *Hampiholi-Attard* SDV would have continued operating in autonomous mode where the human driver

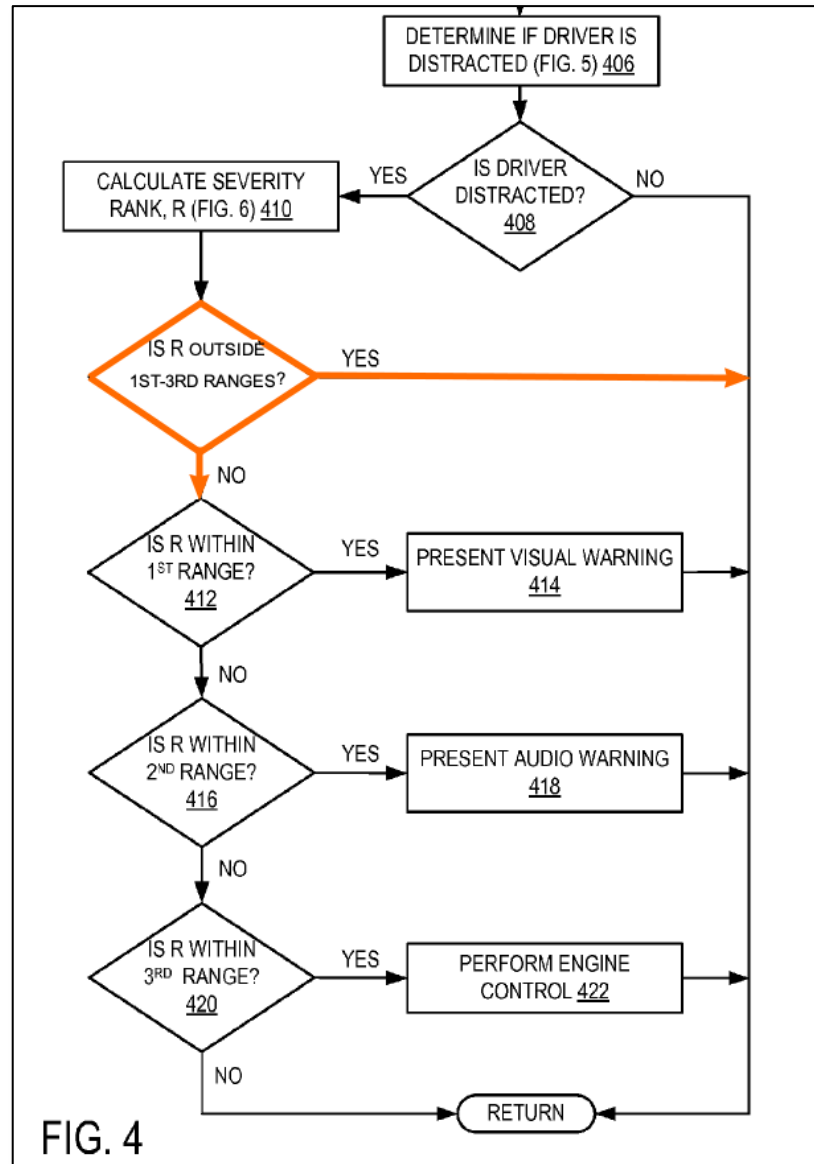
is not required to operate the driver controls. That is, because in *Hampiholi* being *above a first threshold* corresponds to a state in which the driver is not overly distracted (i.e., *Hampiholi* 's severity index, R, is low) and no change occurs, in the *Hampiholi-Attard* SDV, a state in which no change occurs would be the continuation of autonomous driving, i.e., *the SDV autonomously controls the drive controls without requiring the human driver to operate the driver controls*. Specifically, *Hampiholi* teaches (with regard to Fig. 4) a severity rank R (*human driver competence level*) is calculated when it is determined the driver is distracted, which is then compared to various ranges to determine a corrective action.



Hampiholi, Fig. 4. Specifically, *Hampiholi* states “[a]lthough three ranges are illustrated in FIG. 4, it is to be understood that any number of ranges...may be analyzed in the performance of method 400” and that “any severity rank outside of the three ranges may correspond to a **low enough severity rank to forego any**

warnings.” *Hampiholi*, [0057]. Logically this aligns with limitation 11(a), though it may not be immediately clear how it is shown in Figure 4.

299. Figure 4 is a flowchart representing how the *Hampiholi* method is performed. At step 406, it is determined that a user is distracted, but additional context regarding the severity of that distraction has not yet been determined. At step 210, the severity rank R is calculated, after which the severity rank is compared to a plurality of ranges for determining the appropriate corrective action. *Hampiholi*, [0057], Fig. 4. However, if the calculated severity rank R is below all of the ranges, the evaluations at each of steps 412, 416, and 420 will be NO, causing the method to proceed all the way down to RETURN at the bottom of the Figure. That is to say, when the competence level of the driver is sufficiently high (outside any of the ranges), the method returns to its initial state of continued self-driving without performing any corrective action, as recited in claim 11(a). A modified version of Fig. 4 is shown below, which represents precisely the same behavior as the unmodified, original Fig. 4 from *Hampiholi*, but more clearly shows how Fig. 4 teaches 11(a).



To be clear, this annotated Figure 4 does not directly appear in *Hampiholi* – it is presented merely for clarity and discussion. However, this Figure does represent an identical process to that illustrated in the unmodified Figure 4. If the level of distraction of the driver is “outside” any of the three ranges (where the third range extends all the way to the “maximum possible severity rank,” see *Hampiholi*, [0057]), the method does not perform any corrective action. As discussed above

regarding limitation 7(a), the values in *Hampiholi's* severity rank scale are inverted relative to the '765 (where *Hampiholi's* severity rank R is higher for a less-competent driver and lower for a more-competent driver). *See* 7(a). However, *Hampiholi's* severity rank R teaches the concept of 11(a) – that no corrective action is performed when the driver is sufficiently competent to not require any corrective action, which would have specifically resulted in continued autonomous control of the driver controls in the modified *Hampiholi-Attard* SDV. At most, a POSITA would have done basic, straightforward reprogramming and mathematics to invert the internal scale of the vehicle to teach claim 11, as explained above regarding 7(a).

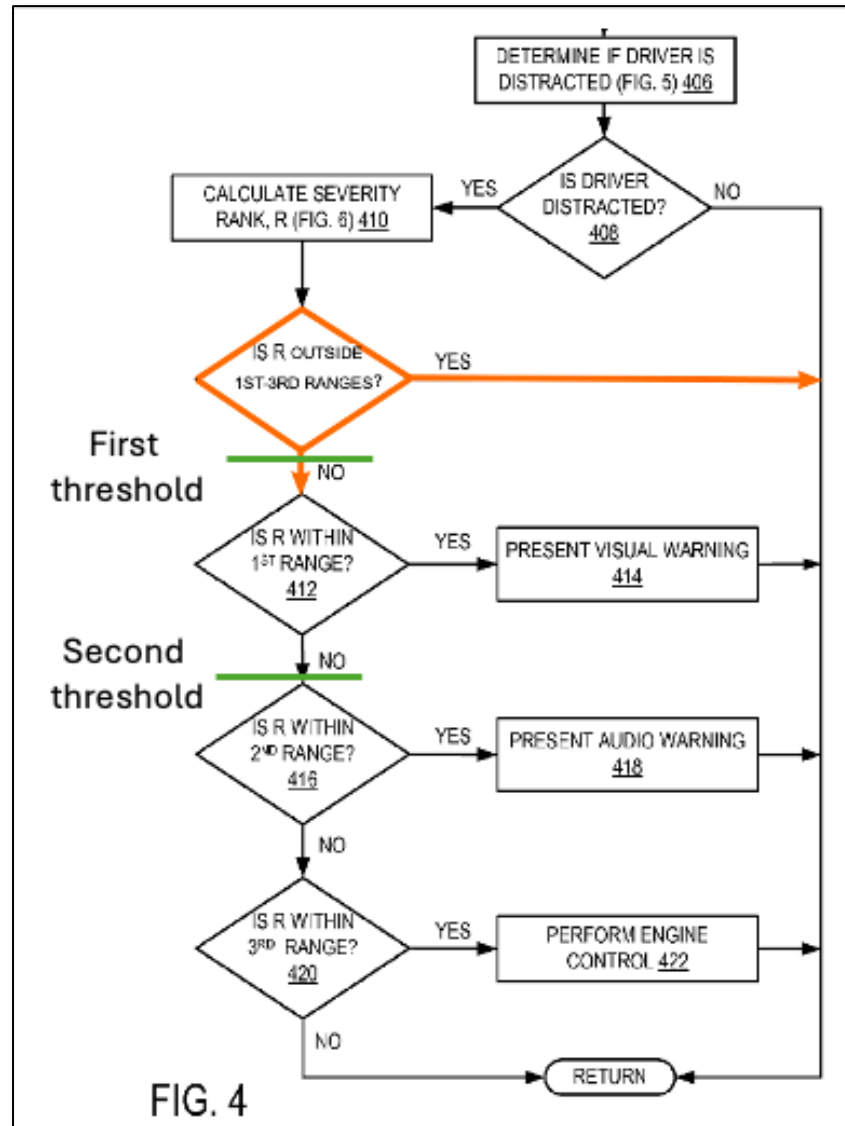
300. Thus, in the modified *Hampiholi-Attard* SDV, when the competence level of the human driver (R) is above a first threshold (low enough distraction to not even reach the first range of Fig. 4) the SDV autonomously controls the driver controls without requiring the human driver to operate the driver controls (autonomous driving continues).

3. ***Claim 11(b): “the SDV autonomously maintains a buffer of space from other vehicles around the SDV and the SDV autonomously controls the steering of the SDV while the SDV autonomously controls the driver controls, without requiring the human driver to operate the driver controls;”***

301. *See* Claim 4(b), 11(a).

4. ***Claim 11(c): “when the competence level of the human driver is below a second threshold, determining that a first fault has occurred;”***

302. See Claim 11(a). As depicted in *Hampiholi's* Fig. 4 below, if severity rank R is below a second threshold (e.g., block 412 – “Is R within 1st range? – YES”) then it is determined that a fault has occurred and a corrective action is taken (e.g., presenting warning). More specifically, *Hampiholi's second threshold* is a severity rank R beyond which *Hampiholi* takes a corrective action, e.g., presenting an audio warning 418. This severity rank R would be the lower rank R that forms the second range, e.g., if the second range depicted in FIG. 4 is from ranks 4-6, then severity rank 4 would form the *second threshold* beyond which *Hampiholi's* corrective action (audio warning) is carried out.



Hampiholi, Fig. 4 (annotated and including annotations from the Fig. 4 at ¶ 299).

5. **Claim 11(d): “determining the corrective action comprises determining a first corrective action corresponding to the first fault; and”**

303. A first corrective action corresponding to the first fault includes issuing a warning. See Claim 11(c).

6. ***Claim 11(e): “the first corrective action comprises issuing an alert while the SDV provides autonomous control of the driver controls without requiring the human driver to operate the driver controls.”***

304. A POSITA would have understood or found obvious that the *Hampiholi-Attard* SDV would have issued the alert while providing autonomous control of the driver controls without requiring the human driver to operate the driver controls because *Hampiholi* does not teach performing engine control (e.g., transitioning out of autonomous mode) in response to a first fault. See Claim 11(c). That is, in the combined *Hampiholi-Attard* SDV, a POSITA would have found it obvious to utilize *Hampiholi*'s teachings of issuing actions without changing the operation of the vehicle to likewise issue warnings to the driver while the SDV is driving autonomously. Because *Hampiholi* teaches the *first corrective action*, taken when the severity rank R is low (*competence level of the human driver is below the second threshold*, severity rank R is above a second threshold), is an audio warning for alerting the driver to grab their attention, a POSITA would have found it obvious to do the same in the *Hampiholi-Attard* SDV, i.e., alert the driver without adjusting the vehicle operations (*while the SDV provides autonomous control of the driver controls...*). Therefore, the *Hampiholi-Attard* SDV teaches or renders obvious Claim 11(e).

XV. GROUND 8: CLAIM 12 IS OBVIOUS OVER HAMPIHOLI, ATTARD, DERUYCK, GUNDERSON, AND MCNEW

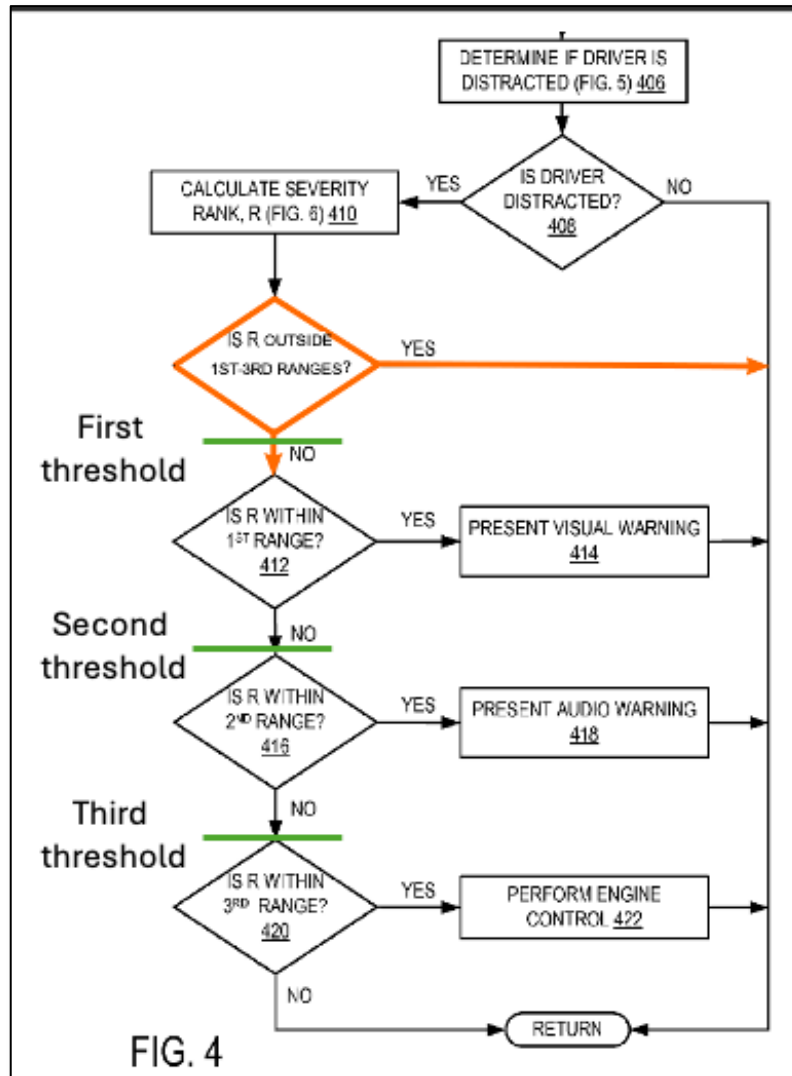
A. Claim 12

1. *Claim 12(Pre): “The computer program product of claim 11, further comprising:”*

305. *See Claim 11.*

2. *Claim 12(a): “when the competence level of the human driver is below a third threshold after taking the first corrective action, determining that a second fault has occurred;”*

306. Similar to determining a first fault has occurred when the *HDCL* is below a second threshold, it is determined a second fault has occurred when the *HDCL* is below a third threshold after taking the first corrective action. *See Claim 11(c). Hampiholi’s Fig. 4* below depicts first, second, and third thresholds, where the corrective action for falling below the third threshold (i.e., second fault) is performing engine control. Continuing with my above example where the *Hampiholi’s* second range is from 4-6 (with rank R of 4 forming a second threshold), then a range of 6-8 could be a third range, with the rank R of 6 forming the third threshold, which determin[es] that a second fault has occurred.



Hampiholi, Fig. 4 (annotated and including annotations from the Fig. 4 at ¶ 299).

3. ***Claim 12(b): “determining the corrective action further comprises determining a second corrective action corresponding to the second fault; and”***

307. See Claim 12(a). A second corrective action corresponding to the second fault includes performing engine control. As shown in FIG. 4, *Hampiholi* teaches performing engine control when R is in the third range. *Hampiholi*, FIG. 4. The engine control “may include automatically controlling the vehicle speed or

braking for example (e.g., without driver or other user instruction to perform such vehicle control)” and/or “may include automatically bringing the vehicle to a complete stop without driver or other user intervention.” *Hampiholi*, [0057].

4. Claim 12(c): “the second corrective action comprises transferring driver controls to manual control and alerting the human driver to take over.”

308. *Hampiholi-Attard-McNew* teaches transferring driver controls to manual and alerting the human driver to take over. *See* Claims 11, 12, 1(i). As discussed above, *Hampiholi* teaches combining corrective actions for a particular range of severity rank R, such that an alert would also be issued with performing engine control (e.g., transition to manual control, or braking) in the *Hampiholi-Attard-McNew* combination. I note that braking, as taught by *Hampiholi*, was a highly effective method of alerting and orienting a driver that they need to pay attention and would serve as both an alert and a notification that the driver needs to take over. *Hampiholi*, [0057] (braking as engine control); *Green* (Ex. 1036), [0037] (pulsing brakes to gain driver’s attention), [0106]. Indeed, *Hampiholi-Attard-McNew* teaches alerting a human driver to take over and transfer driver controls to manual and a POSITA would have been motivated to modify *Hampiholi-Attard-McNew* for the same reasons discussed above. *See* Claim 1(i).

309. Specifically, a POSITA would have found it obvious and been motivated to modify *Hampiholi-Attard* further with *McNew* such that the *Hampiholi-*

Attard-McNew SDV vehicle transfers driver controls to manual when the driver does not respond to the visual and audio warning. Such a combination is merely the combination of known prior art elements according to known methods to yield predictable results.

310. The only difference between the claimed invention and the prior art is the combination of known prior art elements into a single reference. When combined, each element would perform the same separately as together. That is, *Hampiholi's* system of slowing down the vehicle when the driver's severity ranking R is high, indicating the driver is severely distracted, and *McNew's* transfer to manual when the driver alerts are ignored would both work the same as when combined. A POSITA would have recognized that the *Hampiholi-Attard-McNew* SDV could be modified to both slow down and to give the driver control. Further, a POSITA would have recognized that doing such would have been a desirable safety measure to add to the modified *Hampiholi* system as it was known that disengaging an autonomous system was an effective safety measure when drivers were purposefully not supervising the autonomous system. *See, e.g., McNew*, 19:46-20:31 (disengaging autonomous driving when the driver is "abusing the system"), FIG. 7A; *Green*, [0005] ("The processor may disengage the autonomous driving system if the driver fails to exercise sufficient supervisory control of the vehicle"), [0016], [0037], [0051]. Of course, in the event the driver was not responding to warnings

due to being incapacitated, the autonomous system would do its best to place the vehicle in a safe spot, e.g., by pulling over to the shoulder. Thus, there would have been a reasonable expectation of success in making the combination.

XVI. GROUND 9: CLAIM 13 IS OBVIOUS OVER HAMPIHOLI, ATTARD, MCNEW, AN, KANG, AND SCHUNDER

A. Claim 13

1. *Claim 13(Pre): “The computer program product of claim 7, further comprising:”*

311. *See*, 7(Pre).

2. *Claim 13(a): “determining the competence level of the processor comprises using a weighted voting system, the weighted voting system comprising,”*

312. *See* Claim 3(a). Thus, *Hampiholi-Attard-McNew-An* teach 13(a).

3. *Claim 13(a)(i): “: a plurality of inputs and a plurality of weights, wherein the plurality of inputs comprise sensor readings from a camera sensor; and”*

313. *See* Claim 3(a)(i). Thus, *Hampiholi-Attard-McNew-An-Kang* teach 13(a)(i).

4. *Claim 13(b): “multiplying at least one of the plurality of inputs by a weight from among the plurality of weights;”*

314. *See* Claim 3(b). Thus, *Hampiholi-Attard-McNew-An-Kang* teach 13(b).

5. *Claim 13(b)(i): “wherein the plurality of weights are based on active learning data; and”*

315. *See* Claim 3(b)(i). Thus, *Hampiholi-Attard-McNew-An-Kang* teach 13(b)(i).

6. *Claim 13(b)(ii): “wherein the active learning data includes condition data from a 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.”*

316. See Claim 3(b)(i)(i). Thus, *Hampiholi-Attard-McNew-An-Kang-Schunder* teach 13(b)(ii).

XVII.GROUND 10: CLAIMS 14-15 ARE OBVIOUS OVER HAMPIHOLI, ATTARD, MCNEW, DERUYCK, GUNDERSON, AN, KANG, AND SCHUNDER

A. Claim 14

1. *Claim 14(Pre): “The computer program product of claim 7, further comprising:”*

317. See, 7(Pre).

2. *Claim 14(a)(i): “determining the competence level of the human driver comprises using a weighted voting system...”*

318. See Claim 5(a). Thus, *Hampiholi-Attard-McNew-DeRuyck* teach 14(a)(i).

3. *Claim 14(a)(ii): “...with a first plurality of inputs and a first plurality of weights, wherein: the first plurality of inputs comprises sensor readings from a first camera sensor; and”*

319. See Claim 5(a)(i). Thus, *Hampiholi-Attard-McNew-DeRuyck* teach 14(a)(ii).

4. *Claim 14(a)(iii): “at least one of the first plurality of inputs is multiplied by a weight from among the first plurality of weights,”*

320. See Claim 5(b). Thus, *Hampiholi-Attard-McNew-DeRuyck* teach 14(a)(iii).

5. ***Claim 14(a)(iv): “wherein the first plurality of weights are based on first active learning data, the first active learning data comprising information about a cohort of human drivers of other SDVs;”***

321. See Claim 5(c). Thus, *Hampiholi-Attard-McNew-DeRuyck-Gunderson* teach 14(a)(iv).

6. ***Claim 14(b): “determining the competence level of the processor comprises using the weighted voting system...”***

322. See Claims 3(a), 13(a). Thus, *Hampiholi-Attard-McNew-DeRuyck-Gunderson* teach 14(b).

7. ***Claim 14(b)(i): “with a second plurality of inputs and a second plurality of weights, wherein: the second plurality of inputs comprises sensor readings from a second camera sensor; and”***

323. See Claims 3(a)(i), 13(a)(i). Thus, *Hampiholi-Attard-McNew-DeRuyck-Gunderson-Kang* teach 14(b)(i).

8. ***Claim 14(b)(ii): “at least one of the second plurality of inputs is multiplied by a weight from among the second plurality of weights,”***

324. See Claims 3(b), 13(b). Thus, *Hampiholi-Attard-McNew-DeRuyck-Gunderson-Kang* teach 14(b)(ii).

9. ***Claim 14(b)(iii): “wherein the second plurality of weights are based on second active learning data,”***

325. See Claims 3(b)(i), 13(b)(i). Thus, *Hampiholi-Attard-McNew-DeRuyck-Gunderson-Kang-Schunder* teach 14(b)(iii).

10. ***Claim 14(b)(iv): “the second active learning data comprising condition data from a 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;”***

326. See Claims 3(b)(ii), 13(b)(ii). Thus, *Hampiholi-Attard-McNew-DeRuyck-Gunderson-Kang-Schunder* teach 14(b)(iv).

11. ***Claim 14(c): “the first camera sensor is different from the second camera sensor, the first plurality of inputs is different from the second plurality of inputs, and the first plurality of weights is different from the second plurality of weights;”***

327. In the *Hampiholi-Attard-McNew-DeRuyck-Gunderson-Kang-Schunder* combination, the first camera sensor is a driver-monitoring camera (e.g., *Hampiholi’s* and/or *DeRuyck’s* driver-monitoring camera, which monitors the driver), and the second camera sensor is *Attard’s* vehicle camera, which is used for autonomous driving functionality. See Claims 5(a)(i), 3(a)(i), 7(b); *Attard*, 4:11-17. Thus, the first camera sensor is different from the second camera sensor. Likewise, the first plurality of inputs is different from the second plurality of inputs because these inputs come from distinct cameras capturing different images. That is, *Hampiholi’s* and/or *DeRuyck’s* first camera sensor would capture a first set of images (*the first plurality of inputs*), and *Attard’s* second camera sensor would capture a second set of images (*the second plurality of inputs*). These inputs are

different at least by virtue of being from separate cameras and further because they are of different subject matter, i.e., the driver vs. the vehicle exterior. *DeRuyck's* driver weights and *Kang's* weather weights are the *first/second plurality of weights*, respectively, and are, therefore, different. See Claims 3(b), 5(a)(i). Specifically, these weights are *different* because they are applied to different inputs, i.e., to driver behavior data (*DeRuyck*) and to weather types (*Kang*). Therefore, *Hampiholi-Attard-McNew-DeRuyck-Gunderson-Kang-Schunder* teaches 14(c).

12. ***Claim 14(d): “when the competence level of the human driver is above a first threshold, the SDV autonomously controls the driver controls without requiring the human driver to operate the driver controls;”***

328. See Claim 11(a).

13. ***Claim 14(e): “the SDV autonomously maintains a buffer of space from other vehicles around the SDV and the SDV autonomously controls the steering of the SDV while the SDV autonomously controls the driver controls, without requiring the human driver to operate the driver controls;”***

329. See Claim 11(b).

14. ***Claim 14(f): “when the competence level of the human driver is below a second threshold, determining that a first fault has occurred;”***

330. See Claim 11(c).

15. ***Claim 14(g): “determining the corrective action comprises determining a first corrective action corresponding to the first fault; and”***

331. See Claim 11(d).

16. *Claim 14(h): “the first corrective action comprises issuing an alert while the SDV autonomously controls the driver controls without requiring the human driver to operate the driver controls.”*

332. See Claim 11(e).

B. Claim 15

1. *Claim 15(Pre): “The computer program product of claim 14, further comprising:”*

333. See, 7(Pre).

2. *Claim 15(a): “when the competence level of the human driver is below a third threshold, after taking the first corrective action, determining that a second fault has occurred;”*

334. See Claim 12(a).

3. *Claim 15(b): “determining the corrective action further comprises determining a second corrective action corresponding to the second fault; and”*

335. See Claim 12(b).

4. *Claim 15(c): “the second corrective action comprises transferring driver controls to manual control and alerting the human driver to take over.”*

336. See Claim 12(c).

XVIII. GROUND 11: CLAIM 16 IS OBVIOUS OVER HAMPIHOLI, ATTARD, MCNEW, DERUYCK, GUNDERSON, AN, KANG, SCHUNDER, AND FRAZER

A. Claim 16

1. *Claim 16(Pre): “The computer program product of claim 15, further comprising:”*

337. See, 7(Pre).

2. Claim 16(a): “when the competence level of the processor is below a fourth threshold, determining that a third fault has occurred;”

338. Claim 16 depends from Claim 15, which itself depends from Claim 14. Claims 14 and 15, collectively, recite *a first threshold, a second threshold, and a third threshold*. I note three important facts: (1) each of the first, second, and third thresholds are compared to the HDCL, (2) none of claims 14, 15, nor 16 recite any relationship between the first, second, third, and fourth thresholds; and (3) the *fourth threshold*, in contrast to the other three thresholds, is compared against *the competence level of the processor*, not the HDCL.

339. *Attard* teaches comparing *the competence level of the processor*, Φ , to a threshold, $\Phi_{\min}$. See 1(h); *Attard*, 7:62-63 (“In general, a message 116 may be provided by the computer 105 when $\Phi < \Phi_{\min}$.”). $\Phi_{\min}$, therefore, is *a fourth threshold*. Per *Attard*, when Φ is below $\Phi_{\min}$, “components of each of the vectors φ^{PL} and φ^{AL} maybe evaluated to determine whether a value of the vector component falls below a predetermined threshold for the vector component.” *Attard*, 7:65-8:1. When φ_i is below $\varphi_{\min}$, it is *determin[ed] that a third fault has occurred*. See Claim 1(b). Thus, *Hampiholi-Attard-McNew-DeRuyck-Gunderson-Kang-Schunder* teaches Claim 16(a).

3. Claim 16(b): “determining the corrective action further comprises determining a third corrective action corresponding to the third fault;”

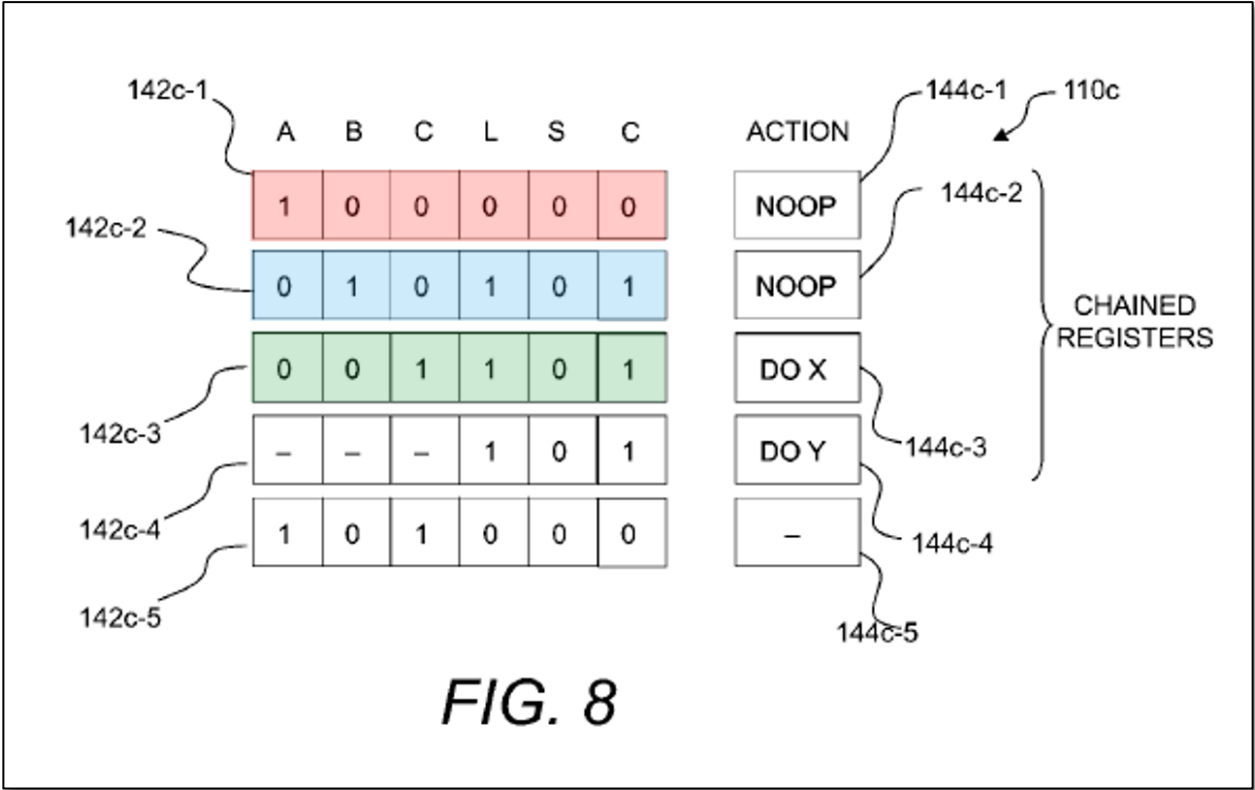
340. *Attard* teaches determining a corrective action corresponding to the fault. *See* 1(d). Thus, *Hampiholi-Attard-McNew-DeRuyck-Gunderson-An-Kang-Schunder* teaches Claim 16(b).

4. Claim 16(c): “determining the corrective action further comprises using a fault remediation table; and”

341. *Frazer* teaches determining a corrective action using a fault-remediation table. *See* 1(d). Thus, *Hampiholi-Attard-McNew-DeRuyck-Gunderson-An-Kang-Schunder-Frazer* teaches Claim 16(c).

5. Claim 16(d): “the fault remediation table comprises the first fault, the second fault, and the third fault.”

342. *Frazer*’s table 112 includes rows/conditions 142c that, when met, cause an action/instruction 144c to be taken. *See* Claim 1(d); *Frazer*, 21:33-43. Thus, conditions 142c-1, 142c-2, and 142c-3 are *the first fault, the second fault, and the third fault*, respectively.



Frazer, FIG. 8.

343. Therefore, *Hampiholi-Attard-McNew-DeRuyck-Gunderson-Kang-Schunder-Frazer* teaches Claim 16(d).

XIX. CONCLUSION

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

Date: May 2nd, 2025

By: 
Christopher Wilson

CHRISTOPHER K. WILSON

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Connected Vehicle & Telematics Consultant – Testifying Expert

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

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

Expertise in:

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

AREAS OF EXPERTICE (with representative dates)

Vehicle Telematics and Safety Systems

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

Sensors

Radar

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

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

Image sensors & algorithms (camera and video)

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

Lidar

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

Communications

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

Positioning

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

Maps

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

Vehicle Diagnostics

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

Cooperative Systems

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

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

Outreach

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

PROFESSIONAL EXPERIENCE

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

EDUCATION/TRAINING

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

PROFESSIONAL ASSOCIATIONS

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

PATENTS AND PUBLICATIONS

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

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

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

Widely quoted in publications such as Scientific American and Telematics Update

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

LITIGATION EXPERIENCE

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

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