

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

TESLA, INC.,

Petitioner

v.

CHARGELOGIC LLC,

Patent Owner

Inter Partes Review Case No. IPR2026-00382

U.S. Patent No. 11,909,011

DECLARATION OF SCOTT ANDREWS

TABLE OF CONTENTS

I.	INTRODUCTION.....	13
A.	EDUCATIONAL BACKGROUND AND PROFESSIONAL EXPERIENCE.....	13
II.	MATERIALS CONSIDERED.....	18
III.	OVERVIEW AND LEGAL STANDARDS.....	21
A.	PERSON OF ORDINARY SKILL IN THE ART	21
B.	OBVIOUSNESS	22
C.	CLAIM CONSTRUCTION	27
IV.	LEVEL OF A PERSON OF ORDINARY SKILL.....	28
V.	OVERVIEW OF THE '011 PATENT	30
A.	SUMMARY.....	30
1.	<i>Field of Endeavor</i>	30
2.	<i>Problem Solved by the Inventor</i>	31
3.	<i>Prosecution History</i>	32
VI.	OVERVIEW OF THE TECHNOLOGY	33
A.	ELECTRIC VEHICLES	33
B.	ELECTRIC VEHICLE HARDWARE	34
1.	<i>Chargers</i>	34
2.	<i>Controllers</i>	34
3.	<i>Displays</i>	35
C.	VEHICLE TIME TO CHARGE	37
1.	<i>Displaying Time to Charge</i>	37
2.	<i>Updating a Time to Charge</i>	38
D.	VEHICLE DISPLAYS INCLUDING BATTERY STATUS	39
E.	REMOTELY COMMUNICATING CHARGING INFORMATION WITH VEHICLE	40
F.	CHARGE COST CONSIDERATION.....	42
VII.	SUMMARY OF THE PRIOR ART REFERENCES	43
A.	KELTY-078	43

B.	FUJITA	44
C.	SUYAMA	46
D.	SUTARDJA	48
E.	KELTY-218	49
F.	JOHNSON	50
G.	HOTTA	51
H.	HOBBS	52
I.	POLLACK	54
VIII.	GROUND OF UNPATENTABILITY	55
IX.	OPINIONS REGARDING GROUND 1: CLAIMS 1-4, 6, 10-12 ARE OBVIOUS OVER KELTY-078, FUJITA, AND SUYAMA	56
A.	CLAIM 1	56
1.	<i>Claim 1[Pre]: “A system for charging a battery of a vehicle with a vehicular battery charger, the system comprising:”</i>	<i>56</i>
2.	<i>Claim 1[a]: “a controller configured to:”</i>	<i>60</i>
a)	“controller”	61
b)	“controller configured to” Perform Claimed Functionality	62
3.	<i>Claim 1[b]: “establish wireless communication with a portable controller of a user remote from the vehicle and the vehicular battery charger,”</i>	<i>63</i>
a)	“portable controller”	63
a)	“establish wireless communication”	68
4.	<i>Claim 1[c]: “receive a wireless signal from the portable controller”</i>	<i>74</i>
a)	’011 Specification Regarding “signal”	74
b)	Kelty-078’s Teachings	75
5.	<i>Claim 1[d]: “responsive to receiving the wireless signal, supply electricity from a source of power to</i>	

	<i>the battery of the vehicle with the vehicular battery charger, ...</i>	<i>76</i>
6.	<i>Claim 1[e]: “during charging of the battery with the vehicular battery charger: repeatedly receive at least one signal indicative of a level of charge of the battery,”</i>	<i>83</i>
	a) '011 Specification Regarding “repeatedly”	84
	b) Kelty-078’s Teachings	84
	c) Fujita’s Teachings	85
	d) Suyama’s Teachings.....	96
	e) Motivation to Combine	99
7.	<i>Claim 1[f]: “repeatedly estimate, based at least in part upon the at least one signal, an amount of time remaining to charge the battery, and”</i>	<i>103</i>
	a) Fujita’s Teachings	103
	b) Motivation to Combine	105
8.	<i>Claim 1[g]: “repeatedly display on a display mounted within the vehicle and within view of a user seated in the vehicle:”</i>	<i>112</i>
	a) Summary of the Combination for Claims 1(g)-1(i)	112
	b) Kelty-078’s Teachings	113
9.	<i>Claim 1[h]: “during charging ... repeatedly display ... information indicative of the amount of time remaining to charge the battery based at least in part upon the estimating step, and”</i>	<i>115</i>
	a) Kelty-078’s Teachings	115
	b) Fujita’s Teachings	116
	c) Motivation to Combine	121
10.	<i>Claim 1[i]: “during charging ... repeatedly display ... information indicative of the level of charge of the battery.”</i>	<i>125</i>
	a) Kelty-078’s Teachings	125

b)	Suyama’s Teachings.....	125
c)	Motivation to Combine	130
B.	CLAIM 2: “THE SYSTEM OF CLAIM 1, WHEREIN THE DISPLAY IS ELECTRICALLY COUPLED TO THE CONTROLLER.”	134
C.	CLAIM 3: “THE SYSTEM OF CLAIM 1, WHEREIN THE CONTROLLER IS FURTHER CONFIGURED TO DISPLAY A TIME OF DAY AT WHICH CHARGING WILL BE COMPLETED BASED AT LEAST IN PART UPON THE AMOUNT OF TIME REMAINING TO CHARGE THE BATTERY.”	136
1.	<i>Suyama’s Teachings</i>	136
2.	<i>Motivation to Combine</i>	138
D.	CLAIM 4: “THE SYSTEM OF CLAIM 1, WHEREIN THE CONTROLLER IS FURTHER CONFIGURED TO RECEIVE A SECOND WIRELESS SIGNAL FROM THE PORTABLE CONTROLLER AND, IN RESPONSE TO RECEIVING THE SECOND WIRELESS SIGNAL, STOP CHARGING OF THE BATTERY OF THE VEHICLE.”	141
E.	CLAIM 6: “THE SYSTEM OF CLAIM 1, WHEREIN THE CONTROLLER IS INCLUDED IN THE VEHICULAR BATTERY CHARGER.”	143
F.	CLAIM 10: “THE SYSTEM OF CLAIM 1, WHEREIN THE PORTABLE CONTROLLER IS DEFINED AT LEAST IN PART BY A PHONE.”	144
G.	CLAIM 11: “THE SYSTEM OF CLAIM 1, WHEREIN THE DISPLAY IS A FIRST DISPLAY, AND WHEREIN THE CONTROLLER IS FURTHER CONFIGURED TO DISPLAY ON A SECOND DISPLAY, DURING THE CHARGING OF THE BATTERY, AT LEAST ONE SELECTED FROM A GROUP CONSISTING OF THE INFORMATION INDICATIVE OF THE AMOUNT OF TIME REMAINING TO CHARGE THE BATTERY AND THE INFORMATION INDICATIVE OF THE LEVEL OF CHARGE OF THE BATTERY.”	145
a)	Kelty-078’s Teachings	145
b)	Suyama’s Teachings.....	147
c)	Motivation to Combine	150

H.	CLAIM 12: “THE SYSTEM OF CLAIM 11, WHEREIN THE SECOND DISPLAY IS ELECTRICALLY COUPLED TO THE PORTABLE CONTROLLER.”	153
X.	OPINIONS REGARDING GROUND 2: CLAIMS 7-8 ARE OBVIOUS OVER KELTY-078, FUJITA, SUYAMA, AND SUTARDJA	155
A.	CLAIM 7: “THE SYSTEM OF CLAIM 1, WHEREIN THE WIRELESS SIGNAL INCLUDES A TIME OF DAY AND WHEREIN THE CONTROLLER IS CONFIGURED TO SUPPLY ELECTRICITY FROM THE SOURCE OF POWER TO THE BATTERY BASED ON THE TIME OF DAY.”	155
	a) Kelty-078’s Teachings	155
	b) Sutardja’s Teachings	155
	c) Motivation to Combine	156
B.	CLAIM 8: “THE SYSTEM OF CLAIM 7, WHEREIN THE TIME OF DAY INCLUDES AT LEAST ONE SELECTED FROM A GROUP CONSISTING OF A TIME OF DAY TO START CHARGING AND A TIME OF DAY TO COMPLETE CHARGING.”	160
XI.	OPINIONS REGARDING GROUND 3: CLAIM 9 IS OBVIOUS OVER KELTY-078, FUJITA, SUYAMA, AND KELTY-218	160
A.	CLAIM 9: “THE SYSTEM OF CLAIM 1, WHEREIN THE WIRELESS SIGNAL INCLUDES A COST THRESHOLD AND WHEREIN THE CONTROLLER IS CONFIGURED TO SUPPLY ELECTRICITY FROM THE SOURCE OF POWER TO THE BATTERY BASED ON THE COST THRESHOLD.”	160
	1. <i>Motivation to Combine</i>	162
XII.	OPINIONS REGARDING GROUND 4: CLAIMS 13-14, 5 ARE OBVIOUS OVER KELTY-078, FUJITA, SUYAMA, KELTY-218, AND SUTARDJA	164
A.	CLAIM 13: “THE SYSTEM OF CLAIM 1, WHEREIN THE CONTROLLER IS A FIRST CONTROLLER AND THE PORTABLE CONTROLLER IS A SECOND CONTROLLER, AND WHEREIN THE FIRST CONTROLLER IS CONFIGURED TO RECEIVE DATA INDICATIVE OF A COST OF POWER FROM A THIRD	

CONTROLLER REMOTE FROM THE VEHICLE AND THE VEHICULAR BATTERY CHARGER.”	164
1. ’011 Specification Regarding “third controller”	165
2. Kelty-078’s Teachings	165
3. Sutardja’s Teachings and Motivations To Combine	167
4. Kelty-218’s Teachings and Motivations to Combine.....	170
B. CLAIM 14: “THE SYSTEM OF CLAIM 13, WHEREIN THE FIRST CONTROLLER IS CONFIGURED TO RECEIVE THE INFORMATION INDICATIVE OF THE COST OF POWER FROM THE THIRD CONTROLLER THROUGH THE SECOND CONTROLLER.”	172
1. Motivation to Combine	175
C. CLAIM 5: “THE SYSTEM OF CLAIM 1, WHEREIN THE CONTROLLER IS FURTHER CONFIGURED TO RECEIVE DATA INDICATIVE OF A COST OF POWER AND, BASED ON THE RECEIVED DATA INDICATIVE OF THE COST OF POWER, STOP CHARGING OF THE BATTERY OF THE VEHICLE.”	178
1. Motivation to Combine	180
XIII. OPINIONS REGARDING GROUND 5: CLAIMS 15-16 ARE OBVIOUS OVER KELTY-078, FUJITA, SUYAMA, AND JOHNSON.....	180
A. CLAIM 15: “THE SYSTEM OF CLAIM 1, WHEREIN THE CONTROLLER IS FURTHER CONFIGURED TO DISPLAY INFORMATION INDICATIVE OF A COST OF POWER ON THE DISPLAY.”	180
1. Kelty-078’s Teachings	180
2. Johnson’s Teachings	181
3. Motivation to Combine	182
B. CLAIM 16: “THE SYSTEM OF CLAIM 15, WHEREIN THE INFORMATION INDICATIVE OF THE COST OF POWER INCLUDES A COST OF POWER PER UNIT OF POWER.”	183

**XIV. OPINIONS REGARDING GROUND 6: CLAIM 17 IS
OBVIOUS OVER KELTY-078, FUJITA, SUYAMA, AND
POLLACK.....183**

- A. CLAIM 17: “THE SYSTEM OF CLAIM 1, WHEREIN THE
WIRELESS SIGNAL INCLUDES A SIGNAL TO START A
MANUAL CHARGE OF THE BATTERY.” 183
1. *'011 Specification Regarding “signal” and
“manual charge”* 183
 2. *Kelty-078’s Teachings* 184
 3. *Pollack’s Teachings* 185
 4. *Motivation to Combine* 187

**XV. OPINIONS REGARDING GROUND 7: CLAIM 18 IS
OBVIOUS OVER KELTY-078, FUJITA, SUYAMA,
KELTY-218, AND HOTTA 189**

- A. CLAIM 18 189
1. *Claim 18[a]: “The system of claim 1, wherein the
controller is further configured to: estimate a
latest time of day to begin charging of the
battery;”* 190
 2. *Claim 18[b]: “determine whether a cost of power
satisfies a cost threshold; and”* 195
 3. *Claim 18[c]: “in response to the cost of power not
satisfying the cost threshold, automatically start
charging the battery based on at least the
estimated latest time of day.”* 195

**XVI. OPINIONS REGARDING GROUND 8: CLAIMS 19-20
ARE OBVIOUS OVER KELTY-078, FUJITA, SUYAMA,
KELTY-218, AND HOBBS 198**

- A. CLAIM 19: “THE SYSTEM OF CLAIM 1, WHEREIN THE
WIRELESS SIGNAL IS A FIRST WIRELESS SIGNAL AND
WHEREIN THE CONTROLLER IS FURTHER CONFIGURED TO
TRANSMIT A SECOND WIRELESS SIGNAL TO THE PORTABLE
CONTROLLER, THE SECOND WIRELESS SIGNAL INCLUDING A
POWER INTERRUPTION NOTIFICATION.” 198

1.	<i>'011 Specification Regarding “power interruption notification” and “signal”</i>	198
2.	<i>Kelty-078’s Teachings</i>	198
3.	<i>Hobb’s Teachings</i>	199
4.	<i>Motivation to Combine</i>	200
B.	CLAIM 20: “THE SYSTEM OF CLAIM 19, WHEREIN THE POWER INTERRUPTION NOTIFICATION INDICATES AT LEAST ONE SELECTED FROM A GROUP CONSISTING OF AN INTERRUPTION BASED ON A COST OF POWER, AN INTERRUPTION BASED ON A DEMAND SURGE, AND AN INTERRUPTION BASED ON A TIME OF DAY.”	203
XVII. CONCLUSION		204

CLAIM LISTING

Claim Designation	Claim Language
Claim 1[Pre]	A system for charging a battery of a vehicle with a vehicular battery charger, the system comprising:
Claim 1[a]	a controller configured to:
Claim 1[b]	establish wireless communication with a portable controller of a user remote from the vehicle and the vehicular battery charger,
Claim 1[c]	receive a wireless signal from the portable controller,
Claim 1[d]	responsive to receiving the wireless signal, supply electricity from a source of power to the battery of the vehicle with the vehicular battery charger, and
Claim 1[e]	during charging of the battery with the vehicular battery charger: repeatedly receive at least one signal indicative of a level of charge of the battery,
Claim 1[f]	repeatedly estimate, based at least in part upon the at least one signal, an amount of time remaining to charge the battery, and
Claim 1[g]	repeatedly display on a display mounted within the vehicle and within view of a user seated in the vehicle:
Claim 1[h]	information indicative of the amount of time remaining to charge the battery based at least in part upon the estimating step, and
Claim 1[i]	information indicative of the level of charge of the battery.
Claim 2	The system of claim 1, wherein the display is electrically coupled to the controller.
Claim 3	The system of claim 1, wherein the controller is further configured to display a time of day at which charging will be completed based at least in part upon the amount of time remaining to charge the battery.
Claim 4	The system of claim 1, wherein the controller is further configured to receive a second wireless signal from the portable controller and, in response to receiving the second wireless signal, stop charging of the battery of the vehicle.
Claim 5	The system of claim 1, wherein the controller is further configured to receive data indicative of a cost of power and, based on the received data indicative of the cost of power, stop charging of the battery of the vehicle.

Claim Designation	Claim Language
Claim 6	The system of claim 1, wherein the controller is included in the vehicular battery charger.
Claim 7	The system of claim 1, wherein the wireless signal includes a time of day and wherein the controller is configured to supply electricity from the source of power to the battery based on the time of day.
Claim 8	The system of claim 7, wherein the time of day includes at least one selected from a group consisting of a time of day to start charging and a time of day to complete charging.
Claim 9	The system of claim 1, wherein the wireless signal includes a cost threshold and wherein the controller is configured to supply electricity from the source of power to the battery based on the cost threshold.
Claim 10	The system of claim 1, wherein the portable controller is defined at least in part by a phone.
Claim 11	The system of claim 1, wherein the display is a first display, and wherein the controller is further configured to display on a second display, during the charging of the battery, at least one selected from a group consisting of the information indicative of the amount of time remaining to charge the battery and the information indicative of the level of charge of the battery.
Claim 12	The system of claim 11, wherein the second display is electrically coupled to the portable controller.
Claim 13	The system of claim 1, wherein the controller is a first controller and the portable controller is a second controller, and wherein the first controller is configured to receive data indicative of a cost of power from a third controller remote from the vehicle and the vehicular battery charger.
Claim 14	The system of claim 13, wherein the first controller is configured to receive the information indicative of the cost of power from the third controller through the second controller.
Claim 15	The system of claim 1, wherein the controller is further configured to display information indicative of a cost of power on the display.
Claim 16	The system of claim 15, wherein the information indicative of the cost of power includes a cost of power per unit of power.

Claim Designation	Claim Language
Claim 17	The system of claim 1, wherein the wireless signal includes a signal to start a manual charge of the battery.
Claim 18[a]	The system of claim 1, wherein the controller is further configured to: estimate a latest time of day to begin charging of the battery;
Claim 18[b]	determine whether a cost of power satisfies a cost threshold; and
Claim 18[c]	in response to the cost of power not satisfying the cost threshold, automatically start charging the battery based on at least the estimated latest time of day.
Claim 19	The system of claim 1, wherein the wireless signal is a first wireless signal and wherein the controller is further configured to transmit a second wireless signal to the portable controller, the second wireless signal including a power interruption notification.
Claim 20	The system of claim 19, wherein the power interruption notification indicates at least one selected from a group consisting of an interruption based on a cost of power, an interruption based on a demand surge, and an interruption based on a time of day.

I, Scott Andrews, declare as follows:

I. INTRODUCTION

1. I have been retained by counsel for Petitioner as a technical expert in the above-captioned case. Specifically, I have been asked to render certain opinions regarding the IPR petition with respect to U.S. Patent No. 11,909,011 (“the ’011 Patent”). I understand that the Challenged Claims are 1-20, and my opinions are limited to those claims. A true and correct copy of my Curriculum Vitae, which provides further details about my background and experience, is appended to this Declaration.

A. Educational Background and Professional Experience

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

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

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

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

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

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

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

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

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

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

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

II. MATERIALS CONSIDERED

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

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

Exhibit	Description
Exhibit 1001	U.S. Patent No. 11,909,011
Exhibit 1002	U.S. Patent No. 11,909,011 File History (“the ’011 File History”)
Exhibit 1004	U.S. Patent No. 7,698,078 to Kelty et al. (“Kelty-078”)
Exhibit 1005	<i>Specification of the Bluetooth System Master Table of Contents & Compliance Requirements: Covered Core Package version: 2.0 + EDR</i> . 4 November 2004. (“Bluetooth Specification”)
Exhibit 1006	U.S. Patent No. 5,283,513 to Fujita et al. (“Fujita”)
Exhibit 1007	U.S. Patent No. 5,596,261 to Suyama (“Suyama”)
Exhibit 1008	U.S. Patent Application Publication No. 2009/0021218 to Kelty et al. (“Kelty-218”)
Exhibit 1009	U.S. Patent No. 5,650,710 to Hotta (“Hotta”)
Exhibit 1010	U.S. Patent Application Publication No. 2008/0136371 to Sutardja. (“Sutardja”)
Exhibit 1011	U.S. Patent Application Publication No. 2009/0021213 to Johnson (“Johnson”)
Exhibit 1012	U.S. Patent Publication No. 2006/0028178 to Hobbs (“Hobbs”)
Exhibit 1013	U.S. Patent Publication No. 2008/0039989 to Pollack et al. (“Pollack”)
Exhibit 1014	<i>Electric Vehicle Battery Systems</i> , Sandeep Dhameja, Newnes, 2002 (“Sandeep”)
Exhibit 1015	Nadal, M and Birbar, F. <i>Development of a Hybrid Fuel Cell/Battery Powered Electric Vehicle</i> . Iht. J. Hydrogen Energy. 1996. Vol. 21, No. 6. pp. 491-505. (“Nadal”)
Exhibit 1016	U.S. Patent No. 6,548,985 to Hayes et al. (“Hayes-985”)
Exhibit 1017	U.S. Patent No. 5,548,200 to Nor et al. (“Nor”)

Exhibit 1018	Aylor et al., <i>A Battery State-of-Charge Indicator for Electric Wheelchairs</i> , IEEE Transactions on Industrial Electronics, Vol. 39, No. 5, October 1992 (“Aylor”)
Exhibit 1019	<i>Your Palm® Treo™ 700P Smartphone User Guide</i> . 2006. (“PalmTreo700p”)
Exhibit 1020	U.S. Patent No. 6,225,944 to Hayes (“Hayes”)
Exhibit 1021	U.S. Patent Application Publication No. 2006/0145817 to Aikawa et al. (“Aikawa”)
Exhibit 1022	U.S. Patent Application Publication No. 2007/0153729 to Alapuranen (“Alapuranen”)
Exhibit 1023	U.S. Patent No. 5,573,090 to Ross (“Ross”)
Exhibit 1024	U.S. Patent No. 5,487,002 to Diller et al. (“Diller”)
Exhibit 1025	U.S. Patent No. 7,693,609 to Kressner et al. (“Kressner”)
Exhibit 1026	U.S. Patent No. 5,467,006 to Sims (“Sims”)
Exhibit 1027	U.S. Patent No. 2,309,941 to Drummond (“Drummond”)
Exhibit 1028	Intentionally left blank
Exhibit 1029	Intentionally left blank
Exhibit 1030	Intentionally left blank
Exhibit 1031	Intentionally Left Blank
Exhibit 1032	Willett Kempton and Jasna Tomić. <i>Vehicle-to-grid power fundamentals: Calculating capacity and net revenue</i> . Journal of Power Sources. 2005. 144. pp. 268–279 (“Kempton”)
Exhibit 1033	Chan, <i>The State of the Art of Electric and Hybrid Vehicles</i> , February 2002, Vol. 90, No. 2, IEEE (“Chan”)
Exhibit 1034	U.S. Patent No. 7,084,859 to Pryor (“Pryor”)
Exhibit 1035	International Application Publication 2006/124130 to Hanssen et al. (“Hanssen”)
Exhibit 1036	U.S. Patent No. 5,701,122 to Canedy (“Canedy”)
Exhibit 1037	U.S. Patent No. 6,181,996 to Chou et al. (“Chou”)
Exhibit 1038	U.S. Patent No. 5,623,194 to Boll et al. (“Boll”)
Exhibit 1039	Japanese Patent Application Publication 2006-74868 to Izuno et al. (“Izuno”)
Exhibit 1040	U.S. Patent No. 5,757,595 to Ozawa et al. (“Ozawa”)
Exhibit 1041	U.S. Patent Application Publication No. 2003/0230443 to Cramer et al. (“Cramer”)
Exhibit 1042	2006 Civic Hybrid Online Reference Owner’s Manual, Honda (“2006 Honda Civic Manual”)
Exhibit 1043	2000 Insight Online Reference Owner’s Manual, Honda (“2000 Honda Insight Manual”)

Exhibit 1044	U.S. Patent Application Publication No. 2003/0228879 to Witkowski et al. (“Witkowski”)
Exhibit 1045	U.S. Patent No. 7,596,391 to Himmelstein (“Himmelstein”)
Exhibit 1046	U.S. Provisional Application 61/134,646 (“Ambroziak”)
Exhibit 1047	<i>Installation Guide for Electric Vehicle Charging Equipment</i> , Massachusetts Division of Energy Resources, September 2000 (“Massachusetts”)
Exhibit 1048	U.S. Patent Application Publication No. 2009/0312903 to Hafner et al. (“Hafner”)
Exhibit 1049	U.S. Patent Application Publication No. 2007/0074031 to Adams et al. (“Adams”)
Exhibit 1050	U.S. Patent No. 6,963,186 to Hobbs (“Hobbs-186”)
Exhibit 1051	U.S. Patent No. 6,832,171 to Barsoukov et al. (“Barsoukov”)
Exhibit 1052	U.S. Patent Application Publication No. 2002/0061771 to Hwang et al. (“Hwang”)
Exhibit 1053	<i>First Intel-powered BlackBerry unveiled</i> . NBC News. Nov. 1, 2005. https://www.nbcnews.com/id/wbna9884936 (“Blackberry Article”)
Exhibit 1054	U.S. Patent No. 6,128,509 to Veijola et al. (“Veijola”)
Exhibit 1055	Japanese Patent Application Publication 2003-333706 to Hayashi (“Hayashi”)
Exhibit 1056	U.S. Patent Application Publication No. 2009/0313034 to Ferro et al. (“Ferro”)
Exhibit 1057	Suryavanshi, P. V., V. K. Sharma, and Rakhi Sharma. “ <i>Advance Computer Communication Systems in Hybrid Vehicles</i> .” 2006 IEEE Conference on Electric and Hybrid Vehicles. IEEE, 2006 (“Suryavanshi”)

13. I have considered these materials from the viewpoint of a POSITA as of the priority date of the '011 Patent. For the purposes of this declaration, the priority date of the '011 Patent is August 18, 2008, as I discuss below. *See* Section IV below. I note that my opinions provided in this Declaration are made from the perspective of a POSITA as of this priority date of the '011 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 ’011 Patent’s priority date (again, unless expressly stated otherwise). I merely use the present verb tense for ease of reading.

III. OVERVIEW AND LEGAL STANDARDS

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

A. Person of Ordinary Skill in the Art

15. I understand that the ’011 Patent, the record of the proceedings at the Patent Office (which I understand is called the “File History” or “Prosecution

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

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

B. Obviousness

17. I understand that a claim may be invalid under 35 U.S.C. § 103(a) if the subject matter described by the claim as a whole would have been “obvious” to a POSITA in view of a single or combination of prior art references at the time the claimed invention was made. I further understand that a POSITA is assumed to know and to have all relevant prior art in the field of endeavor covered by the patent-in-

suit and all analogous prior art. I understand that obviousness in an IPR review proceeding is evaluated using a preponderance of the evidence standard, which means that the claims must be more likely obvious than nonobvious.

18. I also understand that an obviousness determination includes the consideration of various factors including: (1) the scope and content of the prior art, (2) the differences between the prior art and the claim at issue, and (3) the level of ordinary skill in the pertinent art. I understand that secondary considerations of non-obviousness such as commercial success, long-felt but unresolved needs, failure of others, and so forth may be assessed as well. I have been informed that an obviousness analysis must consider the full scope of the claims to avoid impermissibly using hindsight to invalidate a patent.

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

20. I have been informed that for a prior art reference to be proper for use in an obviousness analysis, the reference must be “analogous art” to the claimed

invention. A reference is analogous art if: (1) the reference is from the same field of endeavor as the claimed invention (even if it addresses a different problem); or (2) the reference is reasonably pertinent to the problem faced by the inventor (even if it is not in the same field of endeavor as the claimed invention). For a reference to be “reasonably pertinent” to the problem, it must logically have commended itself to an inventor’s attention in considering the problem. In determining whether a reference is reasonably pertinent, one should consider the problem faced by the inventor, as reflected either explicitly or implicitly, in the specification. I believe that the documents I considered in forming my opinions in this IPR are well within the range of documents a POSITA would have consulted to address the type of problems described in the Challenged Claims.

21. I have been informed that to establish that a claimed invention was obvious based on a combination of prior art elements, an articulation of the reason(s) why a claimed invention would have been obvious must be provided. Specifically, I have been informed that the prior art, either as a single reference or a combination of multiple items of prior art, renders a patent claim obvious when there was an apparent reason for a POSITA, at the time of the invention, to combine or modify the prior art. Rationales for combining or modifying the prior art include, but are not limited to, any of the following: (A) combining prior art methods according to known methods to yield predictable results; (B) substituting one known element for

another to obtain predictable results; (C) using a known technique to improve a similar device in the same way; (D) applying a known technique to a known device ready for improvement to yield predictable results; (E) trying a finite number of identified, predictable potential solutions, with a reasonable expectation of success; (F) identifying that known work in one field of endeavor may prompt variations of it for use in either the same field or a different one based on design incentives or other market forces if the variations are predictable to one of ordinary skill in the art; or (G) identifying an explicit teaching, suggestion, or motivation in the prior art that would have led one of ordinary skill to modify the prior art reference or to combine the prior art references to arrive at the claimed invention.

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

23. I have been informed that the existence of an explicit teaching, suggestion, or motivation to combine known elements of the prior art is a sufficient,

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

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

25. I am informed that even if a case of obviousness is established, the final determination of obviousness must also consider “secondary considerations” if presented. Secondary considerations include: (a) commercial success of a product due to the merits of the claimed invention; (b) a long-felt, but unsatisfied need for

the invention; (c) failure of others to find the solution provided by the claimed invention; (d) deliberate copying of the invention by others; (e) unexpected results achieved by the invention; (f) praise of the invention by others skilled in the art; (g) lack of independent simultaneous invention within a comparatively short space of time; and (h) teaching away from the invention in the prior art.

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

C. Claim Construction

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

28. I have been instructed to apply the following construction for purposes of this proceeding:

“cost of power” (claims 5, 13-16, 18 and 20) – monetary price of power.

29. This phrase appears in dependent Claims 5, 13-16, 18 and 20. Claim 5 recites that the controller is configured to “receive data indicative of a cost of power and, based on the received data indicative of the cost of power, stop charging the battery of the vehicle.” EX1001, 47:37-40. Claim 13 similarly recites that a first controller “is configured to receive data indicative of a cost of power from a third controller remote from the vehicle and the vehicular battery charger.” EX1001, 48:14-19. Claim 15 further states that the controller is configured to “display information indicative of a cost of power” and Claim 16 specifies that the “cost of power includes a “cost of power per unit of power.” EX1001, 48:23-29. In Claim 18 the controller further determines “whether a cost of power satisfies a cost threshold[,]” and in Claim 20, a power interruption notification may indicate an interruption “based on a cost of power.” EX1001, 48:32-50.

IV. LEVEL OF A PERSON OF ORDINARY SKILL

30. Based on my review and analysis of the '011 Patent, the cited prior art, and the ordinary skill factors described in this section, a POSITA at the time of the '011 Patent would have had at least a bachelor's degree in electrical or mechanical engineering (or an equivalent field) and at least two years of work experience

involving automotive systems, including electric vehicle battery charging systems.

Additional industry experience or technical training may offset less formal education, while advanced degrees or additional formal education may offset lesser levels of industry experience. When I refer to the understanding of a POSITA, I am referring to the understanding of such a person as of August 18, 2008.

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

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

V. OVERVIEW OF THE '011 PATENT

A. Summary

33. The '011 Patent is directed to an electrical charging system for charging electric vehicles. EX1001, Abstract. The charging system includes a controller configured to establish wireless communication with a portable controller remote from the vehicle and supply electricity to the vehicle's battery upon receiving a wireless signal from the portable controller. EX1001, Abstract, 1:64-2:8, 10:15-37, 19:21-47. During charging of the battery, the controller further estimates an amount of time remaining to charge the battery and repeatedly displays information indicative of the amount of time remaining and the level of charge of the battery. EX1001, 13:1-28, 41:14-24, FIGS. 6-9.

1. Field of Endeavor

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

35. The '011 Patent relates to electric vehicle battery charging systems. EX1001, Abstract, 33:23-46. The '011 Patent is directed to enabling a user to control battery charging using a controller that is remote from the vehicle. EX1001, Abstract, 1:64-2:8, 3:61-4:9.

36. For these reasons, a POSITA would understand that the field of endeavor of the '011 Patent includes managing vehicle systems, such as electric vehicle (EV) charging, and EV control interfaces.

2. *Problem Solved by the Inventor*

37. I have been informed that a prior art reference is “reasonably pertinent” if a POSITA would have consulted it and applied its teachings when faced with the problems that the inventor was trying to solve. As such, I have been asked to analyze the '011 Patent and determine the problems that the inventors were trying to solve.

38. The '011 Patent describes establishing wireless communication with a controller remote from the vehicle. EX1001, Abstract, 1:64-2:8, 2:66-3:2, 9:13-19. For example, the '011 Patent describes a vehicle charger adapted for communication with a remote controller of a power utility. EX1001, 9:13-19.

39. The '011 Patent describes repeatedly estimated an amount of time remaining to charge the battery. EX1001, 41:14-24, 42:31-50. For example, the '011 Patent describes that the controller of the vehicle charging cord or power utility can calculate the amount of time needed to fully charge the battery based upon the required power. EX1001, 41:14-24.

40. The '011 Patent describes displaying the amount of time remaining to charge the battery. EX1001, 3:22-24, 13:14-25, FIGS. 6-9, 12, 14, 19. For example,

the '011 Patent describes a display coupled to the controller operable to display an amount of time remaining to complete charging of the battery. EX1001, 3:22-24.

41. The '011 Patent describes displaying the level of charge of the battery. EX1001, 12:40-53, 13:1-7, FIGS. 6-9, 12. For example, the '011 Patent describes a battery level indicator as a bar chart for displaying the percentage of full charge of a vehicle battery. EX1001, 12:40-53.

42. The '011 Patent describes using a controller/processor to perform processing operations. EX1001, 1:64-2:22, 8:64-9:19, 12:23-47, FIGS. 15, 17, 25. For example, the '011 Patent describes a controller responsive to a signal and changing a charging state of the vehicle charger. EX1001, 1:64-2:22.

3. Prosecution History

43. The '011 Patent was filed as U.S. Patent Application Number 17/949,911. I have reviewed the prosecution history for the '011 Patent (“the '011 File History”). During prosecution, the Examiner issued a Final Office Action on July 25, 2023, where the Examiner allowed select claims 21-22 and 24-30 and stated that:

“the prior art of record does not suggest or disclose the claimed combination of elements or steps as recited, not particularly the claimed, ‘receive a wireless signal from the portable controller, responsive to receiving the wireless signal, supply electricity from a source of power to the battery of the vehicle with the vehicular battery charger, and during charging of the battery with the vehicular battery

charger: repeatedly receive at least one signal indicative of a level of charge of the battery, repeatedly estimate, based at least in part upon the at least one signal, an amount of time remaining to charge the battery, and repeatedly display on a display mounted within the vehicle and within view of a user seated in the vehicle: information indicative of the amount of time remaining to charge the battery based at least in part upon the estimating step, and information indicative of the level of charge of the battery.””

EX1002, 606-614.

44. In response, the Applicant added new claims that depend from allowable claim 21, and a Notice of Allowance was issued.

VI. OVERVIEW OF THE TECHNOLOGY

45. I was asked to briefly summarize the background of the prior art from the standpoint of a person having ordinary skill in the art prior to August 18, 2008. As explained below, the charging of electric-powered vehicles described in the '011 Patent was based on well-known intelligent charging systems and technologies used for vehicles with electric drive systems. All the functionalities encompassed by the Challenged Claims were thus well-known and conventional prior to the invention of the '011 Patent.

A. Electric Vehicles

46. Electric vehicles (EV) “use an electric motor to provide all or part of the mechanical drive power.” EX1032-Kempton, 2, Section 3. “EVs may include

battery electric vehicles (BEVs), hybrid electric vehicles (HEVs), and fuel-cell electric vehicles (FCEVs).” EX1033-Chan, 1, Section I. The “EV was invented in 1834” and by “[b]y the mid-1970s, oil shortages led to aggressive development of EV programs[,]” with EVs being leased and sold in the USA starting in 1996. EX1033-Chan, 2, Section III.A; EX1014-Sandeep, 4; *see also*, EX1033-Chan, 19 at Table 2. Thus, electric vehicles, such as hybrid vehicles and fully electric vehicles, were readily available and well-known prior to the ’011 Patent.

B. Electric Vehicle Hardware

1. Chargers

47. Electric vehicles were known to require some form of charging to maintain the electric power source. EX1023-Ross, 2:10-15. For this reason, electric vehicles included chargers for charging the batteries on the vehicles. *See, e.g.*, EX1024-Diller, 3:30-31, 4:15-19 (generally describing the energy management system (EMS) on-board the vehicle that contains a “micro-controller” controlling the “charger 60 for the battery in the vehicle”); EX1023-Ross, 7:57-67 (describing an electric vehicle that includes an “onboard power receiving module 20” that “receives electrical power.”)

48. Thus, chargers were well-known to be part of electric vehicle hardware prior to the ’011 Patent.

2. Controllers

49. Managing EV charging within the vehicle itself was known, as EVs were known to include controllers for controlling charging of the vehicle. For example, EV systems had a controller on-board the vehicle for controlling charging of the batteries among other vehicle functions; for instance, Diller's EV includes a micro-controller 12 as a calculation engine and means for controlling the various systems of the electric vehicle." EX1024-Diller, 3:29-33. Ross also describes the EV including a "microprocessor controller 56, which is realized using a conventional processor-based system" as part of an on-board "power control unit 32." EX1023-Ross, 8:14-20 (describing the power control unit 32 on-board the vehicle directing charge to the "energy storage system"), 11:37-51, 16:47-50. The microprocessor controller 56 controls charging by "directing the power to and from the energy storage system," among other vehicle functions (e.g., "monitoring onboard vehicle sensors 60" and "receiving appropriate commands from the operator control devices 38"). *Id.*, 11:58-67 (describing many "tasks" carried out by the microprocessor "are the same as carried out with the operation of any EV").

50. Thus, the use of controllers in electric vehicles to monitor and control the charging process was well-known prior to the '011 Patent.

3. Displays

51. Electric vehicles also commonly included in-vehicle displays for displaying charging information. *See, e.g.*, EX1014-Sandeep, 144-145, EX1015-

Nadal, 5-6. For example, vehicles were known to have “a basic vehicle dashboard” comprising “tactile displays/and or touch screens 10-14” which “can be used for the basic control functions of the vehicle.” EX1034-Pryor, 2:38, 13:19-21. These displays were known to be connected to controllers via, e.g., communication buses. *See, e.g.*, EX1035-Hanssen, 12:5-7, 5:7-13 (generally describing the display of an electric vehicle may “receive[] information from the advanced battery” and “includes means for communication with the vehicle’s communication bus[.]”); EX1036-Canedy, 4:6-12 (“the microprocessor 100 controls a display 110 having a seven segment display array 115, via control bus 111”). Electronic control units typically interface with visual displays and sensors via a communication bus such as a SAE J1850 bus or a CAN-bus. EX1037-Chou, 3:1-13 (“a vehicle 100 having at least one sensor (e.g. sensor circuit) and more preferably a plurality of sensors located at different positions in the vehicle [], an electronic control unit (ECU) 140 [] for controlling sensor circuits, a vehicle communication bus 105 for carrying data and control signals to the ECU 140, an ECU 160 interfaced with the bus 105, and at least one interface device...including, for example, any one or more of a visual display 170”), 3:58-63 (“the car bus, such as a Society of Automotive Engineers (SAE) J1850 communication bus, or a Controller Area Network (CAN)”).

52. Thus, in-vehicle displays were well-known to be included in vehicles and were commonly connected to controllers in the vehicle, prior to the '011 Patent.

C. Vehicle Time to Charge

1. *Displaying Time to Charge*

53. It was well-known that displays of electric vehicles commonly displayed the time required to charge the battery. EX1038-Boll, 3:36-41, 2:57-62. For example, it was known that the time required to charge a vehicle would be displayed and provided to the user of the vehicle. *See e.g.*, EX1038-Boll, 3:36-41 (“...the computing unit 5 determines the required remaining charging time t_R to complete the charging operation, and emits a corresponding signal 9 to the display unit 7 **so that the remaining charging time t_R is displayed.**”); EX1039-Izuno, [0013] (“This enables the user to receive information such as the battery charge level, charge status, **time remaining until full charge**, remaining capacity...”), [0014] (“The communication terminal 50 may also be a display device or audio device installed in the vehicle system of the user’s vehicle.”).

54. Further, it was known that the display of the time required to charge the battery was important for monitoring purposes. EX1038-Boll, 2:57-62 (“The important monitoring function is the display of the remaining required charging time t_R ; that is, the time required to bring the battery from its present actual charging condition to a desired final charging condition, under defined charging parameters.”).

55. Thus, displaying the time to charge the vehicle was well-known prior to the '011 Patent.

2. Updating a Time to Charge

56. The process and function of updating a time to charge the battery of the vehicle was known at the time of the '011 Patent. For example, Ozawa discusses an “apparatus for displaying the state of charge of the battery of an electric vehicle.” EX140-Ozawa, 2:9-13. In this apparatus, there is a “display mode for displaying a remaining time needed until the battery is fully charged” in which the “remaining time needed until the battery is fully charged as hours or minutes in a digital representation.” EX1040-Ozawa, 3:62-67. During the operation of the battery charging display apparatus, a step is included in which “the management ECU 62 displays the state of charge of the battery 58 on the charging indicator 34 in the detected display mode” (step ST12). EX1040-Ozawa, 5:56-60. If it is detected that the selected display mode is the mode for displaying time needed until the battery is fully charge, then the “digital display unit 38 displays the remaining time needed until the battery is fully charged.” EX1040-Ozawa, 5:67-6:5. “After the step ST12, control returns to the step ST3, and the management EC 62 **repeats** the steps ST3-ST12 until the full charging of the battery 58 is detected in step ST4.” EX1040-Ozawa, 6:7-9.

57. Thus, updating the time required to charge an electric vehicle was well-known prior to the '011 Patent.

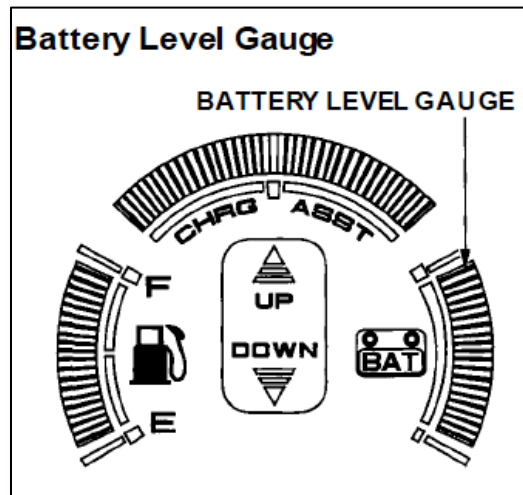
D. Vehicle Displays Including Battery Status

58. Instrument panels to display vehicle-related information within view of the user have been employed in vehicles well before the '011 Patent. *See, e.g.*, EX1027-Drummond, 2:26-30 (describing “instrument panel 10” found “on the dashboard of the automobile immediately in front of the driver so that it will attract his attention without any effort on his part” in 1943). An on-board vehicle display was known to be beneficial “for displaying information for the driver[,]” as vehicle displays “improve[d] occupant safety, environmental friendliness, ergonomics, and compatibility to modify, add, or upgrade vehicle features.” EX1041-Cramer, [0307].

59. It is essential for any system relying on a battery for power to have “[a]n accurate battery monitor” so as “to avoid the complete discharge of the batteries” and further “prevent a user from being stranded and avoid damaging the cells in the long run.” EX1018-Aylor, 1. Therefore, it was known to include a “battery charge indicator” in electric vehicles that includes “[a] miles-to-go indicator or a fuel gauge” along with “[a] warning light or an audible signal for a battery in a dangerous or faulty condition requiring immediate servicing as a ‘maintenance required’ command.” EX1014-Sandeep, 144-145. For example, “instrument panels on the [electric] vehicle dashboard and center console contain [] digital meter displays,

status and warning indicator lights” so that the user may “monitor the fuel cell.”

EX1015-Nadal, 5-6. Electric vehicles were known to have the battery status displayed, as shown below:



See, e.g., EX1042-2006 *Honda Civic Manual*, 69; EX1043-2000 *Honda Insight Manual*, 54.

60. Therefore, using displays to show battery status within vehicles was well-known prior to the '011 Patent.

E. Remotely Communicating Charging Information with Vehicle

61. At the time of the '011 Patent, it was well known that mobile devices were able to wirelessly communicate with vehicle systems. EX1044-Witkowski, Abstract, [0018], FIG. 1; EX1045-Himmelstein, 1:66-65, Abstract. For example, it was known that systems existed for “transfer of information between a motor vehicle and other electronic systems outside of the vehicle.” EX1044-Witkowski, [0018];

see also id., Abstract (“A system for communicating information includes a transceiver provided within a vehicle that is configured for wireless communication with a cellular phone and with a portable computing device.”); EX1045-Himmelstein, 1:55-65 (discussing that the method disclosed is for “providing communication between a cellular phone and vehicle”).

62. It was further known that this communication with the vehicle via a cellular phone would be desirable for the user of a vehicle. EX1044-Witkowski, [0004] (“In many environments, such as within an automobile, it would be desirable to be able to communicate voice and/or data in wireless fashion between various subsystems of the vehicle, such as overhead display subsystem of the vehicle, a cellular phone, notebook computer, PDA, pager or other personal electronic device which is carried on the person of an individual.”). Additionally, it was also known such users would desire communicating charging information remotely from a phone to a vehicle. *See, e.g.*, EX1046-Ambroziak, 11 (generally describing a user entering charging information, such as “charging parameters” via an “iPhone®” through Bluetooth).

63. Thus, wirelessly communicating charging information between a remote device and vehicle was well-known prior to the '011 Patent.

F. Charge Cost Consideration

64. Energy utility services and charging stations both provide energy to the vehicle at a certain cost. The cost of electricity fluctuates, being “controlled in real-time by either an integrated electric utility or an Independent System Operator.” EX1032-Kempton, 3, Section 4. Specifically, “during peak daytime hours (8 a.m. - 6 p.m., generally) the rates are considerably higher than regular residential rates” for “recharging an EV.” EX1047-Massachusetts, 20.

65. Thus, for an EV user, it is “desirable to optimize the battery charging of an electric vehicle to take maximum advantage of reduced cost time of day energy rates and to insure *[sic]* the battery is sufficiently charged for the next anticipated use of the vehicle.” EX1026-Sims, 1:36-39. To optimize battery charging, charging systems were known to schedule the charging of electric vehicles. *See, e.g.*, EX1025-Kressner, 7:65-8:6 (describing “[o]ne example of a recharge schedule” where the charging of “vehicles is arranged to maintain a constant electrical demand between 23:30 and 06:00[.]”). Through a charging schedule, “the vehicle is scheduled for a recharging period” and the schedule is based on factors including “the expected itinerary of the vehicle 152, the state of charge of each of the batteries 154, the recharge electrical consumption data 156, [and] the cost of electrical energy 158[.]” EX1025-Kressner, 8:66-9:2.

66. Scheduling the charge of an EV based on factors such as the cost was desirable for both users and utility providers. The user may customize preferences, such as

a maximum price per kilowatt hour to be paid by a party for electricity, a location where charging may occur, a location where charging may not occur, a rate of charging the electric vehicle, a minimum amount of charge, or any other preferences associated with charging the electric vehicle.

EX1048-Hafner, [0049].

67. Thus, using the monetary price of power based on a user preference to optimize scheduled charging of EVs (e.g., keep charging cost and demand on the energy network low) was well-known prior to the '011 Patent.

VII. SUMMARY OF THE PRIOR ART REFERENCES

A. Kelty-078

68. I have been instructed by counsel that Kelty-078 is prior art to the challenged patent.

69. Kelty-078 teaches an “electric vehicle communication interface 10” comprising a plurality of components such as a vehicle 12, user interface 24, display 30, and networks 16, 18. EX1004-Kelty-078, Abstract, 3:47-48 FIG. 1. Kelty-078 teaches VMS 32 “which is the onboard computer that monitors, controls and

coordinates various systems in the electric vehicle” including the electronic storage system (battery) and power electronics module 34.

70. VMS 32 communicates with vehicle 12 through communication chip 14 using interface device 24, which may be a cellphone.

71. Kelty-078 is analogous to the claimed invention of the '011 Patent because Kelty-078 is from a same field of endeavor: electric vehicle battery charging systems. EX1004-Kelty-078, Abstract, 1:63-2:14, 2:39-3:4, FIG. 3, with EX1001, Title, Abstract, 1:64-5:2.

72. Kelty-078 is also reasonably pertinent to particular problems with which the inventor of the '011 Patent was involved: (1) establishing wireless communication with a controller remote from the vehicle; EX1004-Kelty-078, 2:25-30, 4:16-21, 4:53-58, 5:2-3, FIGS. 2-3, with EX1001, Abstract, 1:64-2:8, 2:66-3:2, 9:13-19; (2) using a controller/processor to perform processing operations; EX1004-Kelty-078, 7:44-64, FIG. 2, with EX1001, 1:64-2:22, 8:64-9:19, 12:23-47, FIGS. 15, 17, 25.

B. Fujita

73. I have been instructed by counsel that Fujita is prior art to the challenged patent.

74. Fujita teaches “a battery charging device” comprising electronic control unit (ECU) 16 of electric vehicle 10 that “monitors constantly” the “residual amount

of electric energy” (C; e.g., charge level) of battery 30 (Steps S1-S2). EX1006-Fujita, 3:54-56. The user can input a “desired running distance L,” and the electronic control unit (ECU) 16 of the electric vehicle 10 “calculates a required amount C_L of electric energy of the battery to run the desired distance L (step S4)[.]” EX1006-Fujita, 3:58-62, 3:65-4:2. ECU communicates with the battery 30 via terminals a^+ and a^- to “detect” and otherwise “calculate a current residual amount C of electric energy of the battery[.]” EX1006-Fujita, 3:18-25, 3:65–4:2, FIGS. 2, 4, 5:41-45. If the ECU 16 determines that $C < C_L$, the user must charge the electric vehicle. EX1006-Fujita, 4:5-14. Based on parameters detected during charging, including battery temperature, current, and charge level, the charging efficiency (k) and charge time (t) are calculated. EX1006-Fujita, 3:46-47, 4:21-24, 4:27-30. Once the charge time is calculated, the “charge time t is displayed on the charge time display 44 of the alarm/ display means 22.” EX1006-Fujita, 4:32-34. Fujita teaches that during charging, if the current amount of electric energy of the battery (C_s) is less than the required amount of electric energy of the battery (C_L) (i.e., $C_s < C_L$), “the operations after step S9 are repeated.” EX1006-Fujita, 4:48-49, FIGS. 4-5. Conversely, if there is enough charge, “ECU 16 terminates the operation after displaying the completion of charging” (Step S17). EX1006-Fujita, 4:41-42.

75. Fujita is analogous to the claimed invention of the '011 Patent because Fujita is from a same field of endeavor: electric vehicle battery charging systems.

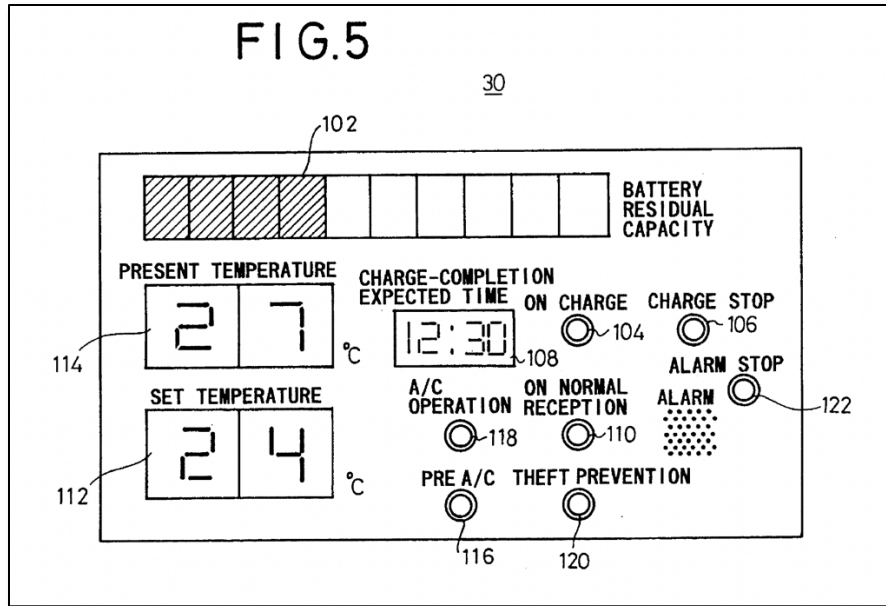
EX1006-Fujita, Title, Abstract, 1:52-2:42, FIGS. 1, 3, 6, with EX1001, Title, Abstract, 1:64-5:2.

76. Fujita is also reasonably pertinent to particular problems with which the inventor of the '011 Patent was involved: (1) repeatedly estimate an amount of time remaining to charge the battery; EX1006-Fujita, 4:27-34, 4:39-49, FIGS. 4-5, with EX1001, 41:14-24, 42:31-50; (2) display the amount of time remaining to charge the battery; EX1006-Fujita, 4:27-34, 4:59-64, FIGS. 5-6, with EX1001, 3:22-24, 13:14-25, FIGS. 6-9, 12, 14, 19; (3) using a controller/processor to perform processing operations; EX1006-Fujita, 3:9-13; 3:54-4:49, FIG. 2, with EX1001, 1:64-2:22, 8:64-9:19, 12:23-47, FIGS. 15, 17, 25.

C. Suyama

77. I have been instructed by counsel that Sutardja is prior art to the challenged patent.

78. Suyama teaches a “charge-status display system 10” for an “electric automobile or vehicle 12” and a “portable display card 14 for displaying the state of charging of the electric vehicle 12.” EX1007-Suyama, 5:48-50. The display card 14 includes a “display circuit 30” which includes a “battery residual-capacity indicator 102.” EX1007-Suyama, 5:66–6:2, 7:43-45, FIG. 5. The “battery residual-capacity indicator” is for “indicating the remaining capacity of the main battery,” as illustrated in FIG.5 below:



EX1007-Suyama, FIG. 5, 7:43-45.

79. Suyama is analogous to the claimed invention of the '011 Patent because Suyama is from a same field of endeavor: electric vehicle battery charging systems. EX1007-Suyama, Title, Abstract, 1:50-45, 2:5-14, 5:29-5:65, 6:25-59, FIGS. 1-2, with EX1001, Title, Abstract, 1:64-5:2.

80. Suyama is also reasonably pertinent to particular problems with which the inventor of the '011 Patent was involved: (1) display the amount of time remaining to charge the battery; EX1007-Suyama, 7:43-51, 9:6-19, FIGS. 4-5, with EX1001, 3:22-24, 13:14-25, FIGS. 6-9, 12, 14, 19; (2) display the level of charge of the battery; EX1007-Suyama, 7:43-45, 8:4-5, 9:13-15, 12:13-17, FIG. 5, with EX1001, 12:40-53, 13:1-7, FIGS. 6-9, 12; (3) using a controller/processor to perform

processing operations; EX1007-Suyama, 6:18-7:42, 8:4-19, 14:34-15:17, FIGS. 1-2, with EX1001, 1:64-2:22, 8:64-9:19, 12:23-47, FIGS. 15, 17, 25.

D. Sutardja

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

82. Sutardja is directed to “systems and methods for charging batteries in vehicles.” EX1010-Sutardja, [0002]. Sutardja teaches a user interface module 108 that communicates with control module 112 of a charge management module 104-1 of vehicle 12. EX1010-Sutardja, [0234], [0241], [0243], [0247], FIGs. 3A-3B. Specifically, a user can use a user interface module 108 to “set charging parameters for charging the battery 14.” EX1010-Sutardja, [0243]. These charging parameters can include “costs the users may pay if batteries are charged at higher than normal priority, etc.” EX1010-Sutardja, [0235]. When the charging parameters are input and communicated to the control module 112, the batteries are supplied power “according to the charging parameters generated by the users.” EX1010-Sutardja, [0233].

83. Sutardja is analogous to the claimed invention of the '011 Patent because Sutardja is from a same field of endeavor: electric vehicle battery charging systems. EX1010-Sutardja, Abstract, [0008]-[0207], with EX1001, Title, Abstract, 1:64-5:2.

84. Sutardja is also reasonably pertinent to particular problems with which the inventor of the '011 Patent was involved: (1) establishing wireless communication with a controller remote from the vehicle; EX1010-Sutardja, [0234], [0245]-[0247], FIGS. 3A-3B, with EX1001, Abstract, 1:64-2:8, 2:66-3:2, 9:13-19; (2) using a controller/processor to perform processing operations; EX1010-Sutardja, [0241]-[0244], FIG. 4A, with EX1001, 1:64-2:22, 8:64-9:19, 12:23-47, FIGS. 15, 17, 25.

E. Kelty-218

85. I have been instructed by counsel that Kelty-218 is prior art to the challenged patent.

86. Kelty-218 teaches “an electrical vehicle charging system 202.” EX1008-Kelty-218, [0022]. The system can include a battery 206 coupled to an electric vehicle 204, a charging circuit 208, and a charging cost circuit 21. EX1008-Kelty-218, [0022]-[0024], FIG. 2. Specifically, Kelty-218 teaches the “charging cost circuit 212” is included to “estimated a charging cost rate.” EX1008-Kelty-218, [0024]. Kelty-218 teaches charging an electric vehicle based on a “charging cost rate [that] is the instantaneous cost of energy transfer. Cost rate is in cost per energy transferred over time (e.g., \$0.06 United States Dollar per kilowatt hour).” EX1008-Kelty-218, [0024].

87. Kelty-218 is analogous to the claimed invention of the '011 Patent because Kelty-218 is from a same field of endeavor: electric vehicle battery charging systems. EX1008-Kelty-218, Title, Abstract, [0013]-[0014], [0023]-[0032], FIG. 2, with EX1001, Title, Abstract, 1:64-5:2.

88. Kelty-218 is also reasonably pertinent to a particular problem with which the inventor of the '011 Patent was involved: using a controller/processor to perform processing operations. EX1008-Kelty-218, [0035], FIG. 3, with EX1001, 1:64-2:22, 8:64-9:19, 12:23-47, FIGS. 15, 17, 25.

F. Johnson

89. I have been instructed by counsel that Johnson is prior art to the challenged patent.

90. Johnson teaches a system for charging electric automobiles via a self-service charging station, whereby the charging station automatically modifies grid electricity to be suitable for charging an array of automobiles. EX1011-Johnson, Abstract. Johnson further teaches that the price per kwh (kilowatt-hour) is displayed on a display touch screen 35 of the charging station. EX1011-Johnson, [0051], [0074], [0092] ("Price per KWH"), FIGS. 1, 5-6. If the automobile driver finds the displayed price acceptable, they may insert a credit card, answer additional questions related to the desired charge voltage and amperage, and plug in the charging cord to begin charging. EX1011-Johnson, [0093]-[0102]. When charging is complete, the

total cost of power delivered to the user's vehicle is displayed. EX1011-Johnson, [0116] ("_____ kwh delivered, Your cost _\$_____ Dollars. Thank you. Please come again.").

91. Johnson is analogous to the claimed invention of the '011 Patent because Johnson is from a same field of endeavor: electric vehicle battery charging systems. EX1011-Johnson, Title, Abstract, [0012], [0051]-[0055], FIG. 1, with EX1001, Title, Abstract, 1:64-5:2.

92. Johnson is also reasonably pertinent to particular problems with which the inventor of the '011 Patent was involved: (1) display the amount of time remaining to charge the battery; EX1011-Johnson, [0076], with EX1001, 3:22-24, 13:14-25, FIGS. 6-9, 12, 14, 19; (2) using a controller/processor to perform processing operations; EX1011-Johnson, [0051], [0060], FIG. 1, with EX1001, 1:64-2:22, 8:64-9:19, 12:23-47, FIGS. 15, 17, 25.

G. Hotta

93. I have been instructed by counsel that Hotta is prior art to the challenged patent.

94. Hotta teaches a method and system for starting and stopping the charging of an electric vehicle's battery based on relevant parameters. EX1009-Hotta, Abstract. The system includes a charging start time calculating circuit that determines the charging start time based on the charging period and indicated

scheduled boarding time of the vehicle. EX1009-Hotta, Abstract, 2:15-19. Hotta teaches that the calculated charging start time is used to prevent an electric vehicle battery from being “self-discharged when left to stand for a long period of time after it has been charged until the user enters the electric vehicle, and...to minimize a reduction in the temperature of the storage battery[.]” EX1009-Hotta, 1:64-2:3. Before the calculated charging state time is reached, the battery is maintained in a “charge holding mode ‘a’[.]” EX1009-Hotta, 6:22-34.

95. Hotta is analogous to the claimed invention of the '011 Patent because Hotta is from a same field of endeavor: electric vehicle battery charging systems. EX1009-Hotta, Title, Abstract, 1:64-2:63, FIGS. 1-2, with EX1001, Title, Abstract, 1:64-5:2.

96. Hotta is also reasonably pertinent to particular problems with which the inventor of the '011 Patent was involved: (1) repeatedly estimate an amount of time remaining to charge the battery; EX1009-Hotta, 2:9-30, 7:21-35, 8:43-56, FIGS. 3-4, with EX1001, 41:14-24, 42:31-50; (2) using a controller/processor to perform processing operations; EX1009-Hotta, 3:45-4:11, 5:30-45, 7:15-50, FIG. 1, with EX1001, 1:64-2:22, 8:64-9:19, 12:23-47, FIGS. 15, 17, 25.

H. Hobbs

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

98. Hobbs teaches an electric-vehicle charger capable of automatically identifying the type of connected battery and charging the battery “at or near the optimal or maximum rate.” EX1012-Hobbs, Abstract, [0009]. Hobbs teaches that charger 100 includes a screen 107 and key pad 104 to “provide diagnostics and manual control[.]” EX1012-Hobbs, [0037]. The screen 107 may be used to “indicate, for example, when charging is complete or if there is a fault detected in the charger or the batter.” EX1012-Hobbs, [0036]. If the voltage measured by the charger 100 is not within a defined range, charger 100 “may stop charging and provide a fault indication” via screen 107. EX1012-Hobbs, [0084]. Hobbs further teaches the “[t]he voltage, current, or power level at which charging is taking place...may be indicated, for example, in real time, via an LED or screen 107.” EX1012-Hobbs, [0109]. When the charging current drops below a threshold, the charger 100 may stop charging and indicate that charging is complete via screen 107. EX1012-Hobbs, [0109].

99. Hobbs is analogous to the claimed invention of the '011 Patent because Hobbs is from a same field of endeavor: electric vehicle battery charging systems. EX1012-Hobbs, Title, Abstract, [0004], [0009], [0029], FIG. 1, with EX1001, Title, Abstract, 1:64-5:2.

100. Hobbs is also reasonably pertinent to a particular problem with which the inventor of the '011 Patent was involved: using a controller/processor to perform

processing operations. EX1012-Hobbs, [0049], [0051], [0055], [0070], FIG. 1, with EX1001, 1:64-2:22, 8:64-9:19, 12:23-47, FIGS. 15, 17, 25.

I. Pollack

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

102. Pollack teaches a power aggregation system for providing energy to electric resources, including electric vehicles. EX1013-Pollack, Abstract, [0035], [0040]-[0041]. Pollack also teaches a user interface associated with an electric vehicle, whereby the user interface “may be displayed on a device associated with the owner of the electric resource, such as a cell phone or portable computer.” EX1013-Pollack, [0027]. Using the user interface, the user may input “power aggregation constraints...preferences[.]” EX1013-Pollack, Claims 1-4. For example, the vehicle owner may “override and request immediate charging if desired.” EX1013-Pollack [0202].

103. Pollack is analogous to the claimed invention of the '011 Patent because Pollack is from a same field of endeavor: electric vehicle battery charging systems. EX1013-Pollack, Abstract, [0047], [0052], [0093], FIGS. 1-2, with EX1001, Title, Abstract, 1:64-5:2.

104. Pollack is also reasonably pertinent to particular problems with which the inventor of the '011 Patent was involved: (1) establishing wireless

communication with a controller remote from the vehicle; EX1013-Pollack, [0201], [0227], FIG. 22, with EX1001, Abstract, 1:64-2:8, 2:66-3:2, 9:13-19; (2) using a controller/processor to perform processing operations; EX1013-Pollack, [0119], [0133], FIG. 8, with EX1001, 1:64-2:22, 8:64-9:19, 12:23-47, FIGS. 15, 17, 25.

VIII. GROUNDS OF UNPATENTABILITY

Proposed Grounds of Unpatentability of the '011 Patent	Exhibits
Ground 1: Claims 1-4, 6, 10-12 are obvious under §103(a) over Kelty-078, Fujita, and Suyama	EX1004-Kelty-078 EX1006-Fujita EX1007-Suyama
Ground 2: Claims 7-8 are obvious under §103(a) over Kelty-078, Fujita, Suyama, and Sutardja	EX1004-Kelty-078 EX1006-Fujita EX1007-Suyama EX1010-Sutardja
Ground 3: Claim 9 is obvious under §103(a) over Kelty-078, Fujita, Suyama, and Kelty-218	EX1004-Kelty-078 EX1006-Fujita EX1007-Suyama EX1008-Kelty-218
Ground 4: Claims 13-14, 5 are obvious under §103(a) over Kelty-078, Fujita, Suyama, Kelty-218, and Sutardja	EX1004-Kelty-078 EX1006-Fujita EX1007-Suyama EX1008-Kelty-218 EX1010-Sutardja
Ground 5: Claims 15-16 are obvious under §103(a) over Kelty-078, Fujita, Suyama, and Johnson	EX1004-Kelty-078 EX1006-Fujita EX1007-Suyama EX1011-Johnson
Ground 6: Claim 17 is obvious under §103(a) over Kelty-078, Fujita, Suyama, and Pollack	EX1004-Kelty-078 EX1006-Fujita EX1007-Suyama EX1013-Pollack
Ground 7: Claim 18 is obvious under §103(a) over Kelty-078, Fujita, Suyama, Kelty-218, and Hotta	EX1004-Kelty-078 EX1006-Fujita EX1007-Suyama EX1008-Kelty-218

	EX1009-Hotta
Ground 8: Claims 19-20 are obvious under §103(a) over Kelty-078, Fujita, Suyama, and Hobbs	EX1004-Kelty-078 EX1006-Fujita EX1007-Suyama EX1008-Kelty-218 EX1012-Hobbs

IX. OPINIONS REGARDING GROUND 1: CLAIMS 1-4, 6, 10-12 ARE OBVIOUS OVER KELTY-078, FUJITA, AND SUYAMA

A. Claim 1

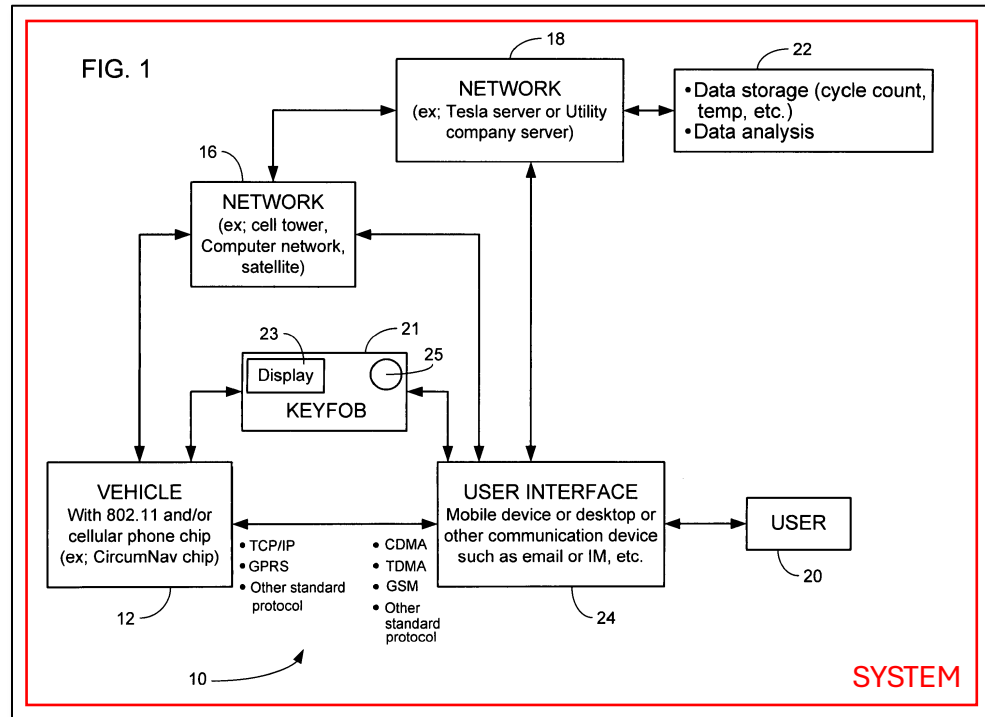
1. Claim 1[Pre]: “A system for charging a battery of a vehicle with a vehicular battery charger, the system comprising:”

105. To the extent the preamble is limiting, Kelty-078 teaches a *system for charging a battery of a vehicle*¹, namely the components of FIGS. 1-2, including interface 10, vehicle 12, user interface 24, display 30, networks, 16, 18, and

¹ Claim language provided in italics. All drawing annotations and emphases added unless otherwise noted. Citations to a claim limitation (e.g., Claim 1[a]) and/or section number are to the limitations mapping such claim limitation and are incorporated by reference, including the motivations to combine and showing of reasonable expectation of success provided in the cross-referenced section. All reasonable expectation of success include the benefits described for the respective motivations to combine.

communication chip 14 form *a system for charging a battery...*, as discussed below.

EX1004-Kelty-078, Abstract, 3:47-48, FIGS. 1-2.

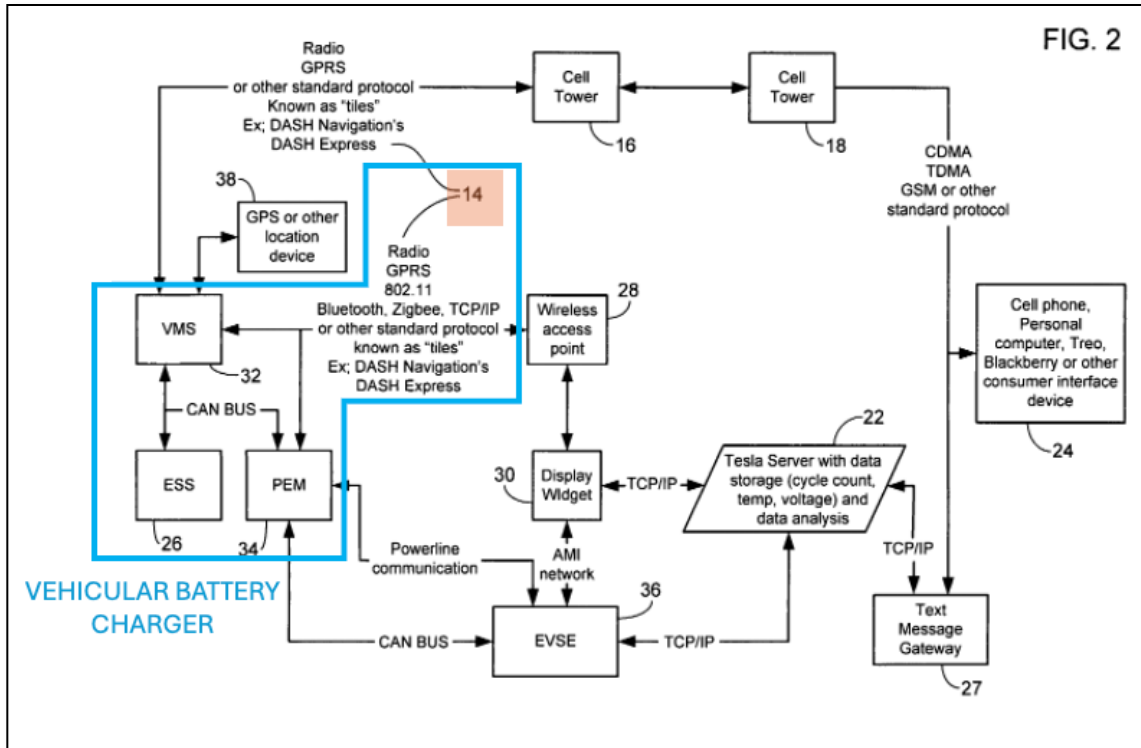


EX1004-Kelty-078, FIG. 1, 3:16-17. FIG. 1 depicts these components and provides bidirectional arrows indicating communications between said components. Kelty-078 teaches “an electric vehicle communication interface that will allow for communication between the electric vehicle and a user via either a user interface or networks connected to the vehicle.” EX1004-Kelty-078, 1:11-14. “In one contemplated controlling methodology for the communication interface 10, the user 20 may be capable of querying or monitoring the electric vehicle’s battery pack and cells 26 for its state of charge (SOC) (step 309)” for example. EX1004-Kelty-078, 5:9-13, FIG. 3. Kelty-078 teaches interface 10 of the *system* is “specifically designed

for use in an all electric vehicle 12” that “will operate completely on battery power for all propulsion and other automotive related needs” and using “a battery pack made of sheets of cells of lithium ion batteries.” EX1004-Kelty-078, 3:27-35.

106. Interface 10 performs steps for “controlling and monitoring a battery in the electric vehicle,” including *charging* electric vehicle 12’s battery 26 and powering on/off battery charging operations. EX1004-Kelty-078, Abstract, 3:49-54, FIG. 3 (Step 317).

107. Kelty-078 teaches charging the vehicle using *a vehicular battery charger*, namely the collective vehicle management system (VMS) 32, power electronics module (PEM) 34, energy storage system (ESS; battery) 26, and communication chip 14, which collectively control charging of battery 26. Like Kelty-078’s *vehicular battery charger*, the ’011 Patent similarly describes how “the vehicle battery charger...can be at least partially integrated into the vehicle.” EX1001, Abstract.



108. VMS 32 “is the onboard computer that monitors, controls and coordinates various systems in the electric vehicle 12 including” PEM 34 and ESS 26. EX1004-Kelty-078, 7:47-51. Kelty-078 teaches that VMS 32 “monitors, controls and coordinates various systems in the electric vehicle 12 including the power electronics module [(PEM)] 34, the energy storage system (ESS) 26 and the HVAC system along with the user interface 24.” EX1004-Kelty-078, 7:47-51. ESS 26 “is

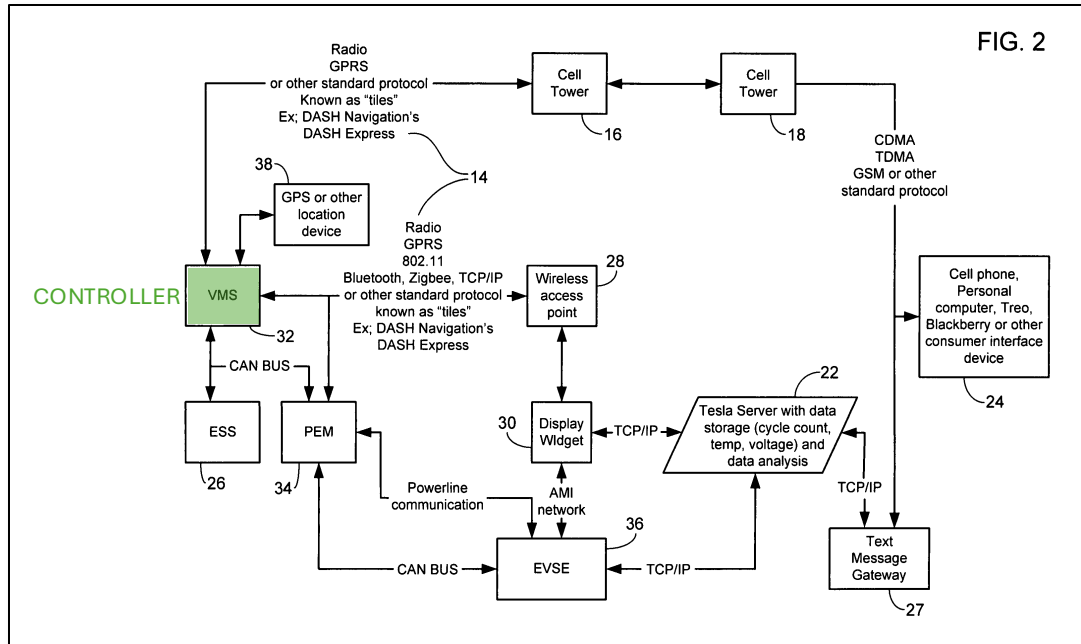
controlled by the vehicle management system 32 via a CAN BUS or any other known communication interface or path” and PEM 34 “is also controlled by the vehicle management system 32...” EX1004-Kelty-078, 7:53-62.

109. ESS 26 “includes the battery pack of the electric vehicle 12 which is used to provide the power necessary to propel the electric vehicle 12,” and PEM 34 “house[s] a DC to AC inverter for a traction motor, a AC to DC rectifier for charging and the control PCB’s for drive and charge of the electric vehicle energy storage system.” EX1004-Kelty-078, 7:53-64. Vehicle 12’s communication chip 14, which is installed in vehicle 12, communicates with VMS 32 and the power electronics module (PEM) 34. EX1004-Kelty-078, 3:53-59, 7:44-53. As depicted in FIG. 2 above, Kelty-078 contemplates numerous types of wireless communication protocols. *See* FIG. 2. Specifically, “communication chip 14 using the GPRS, which is a general packet radio service protocol, 802.11 standard, TCP/ IP or any other standard protocol may communicate with a vehicle management system 32...The communication chip 14 may also communicate with...the power electronics module 34.” EX1004-Kelty-078, 7:44-53. The PEM 34 charges the batteries of the energy storage system 26 based on control from the VMS 32. EX1004-Kelty-078, 7:59-64.

2. Claim 1[a]: “a controller configured to:”

a) “controller”

110. Kelty-078 teaches *a controller*, namely, VMS 32 “which is the onboard computer that monitors, controls and coordinates various systems in the electric vehicle.” EX1004-Kelty-078, 7:44-51; *see* ¶ 108 (*citing* Kelty-078, 7:47-64 describing systems controlled by VMS 32). The VMS 32 as an “onboard computer” satisfies a *controller*, as the ’011 Patent repeatedly equates a controller with a computer. EX1001, 28:31-32 (describing “controller 444 (e.g., a computer)”), 21:51-52 (describing “another controller, such as the processor of a user’s computer”); EX1001, 28:31-32 (describing “controller 444 (e.g., a computer)”), 21:51-52 (describing “another controller, such as the processor of a user’s computer”); 9:8-9 (describing that the “controller can be one or more processors of a personal computer”), 13:49-50 (describing “controller 50 of a computer of the power utility 48.”). Thus, Kelty-078’s controller satisfies a controller as described in the ’011 Patent.



EX1004-Kelty-078, FIG. 2.

b) “controller configured to” Perform Claimed Functionality

111. Because Kelty-078’s VMS (*controller*) performs all control, monitoring, and coordination of the electric vehicle’s systems, the VMS, alone or as modified by Suyama and/or Fujita (modifications as discussed in Claims 1[e]-1[i] below), *is configured to* perform each of the claimed functions. EX1004-Kelty-078, 7:43-53. I note that I provide additional opinions regarding Kelty-078’s controller (alone or modified by Suyama and/or Fujita) being “configured to” perform the claimed functions for each of the limitations where such being “configured to” is relevant. *See* Claims 1[e]-1[i].

3. Claim 1[b]: “establish wireless communication with a portable controller of a user remote from the vehicle and the vehicular battery charger,”

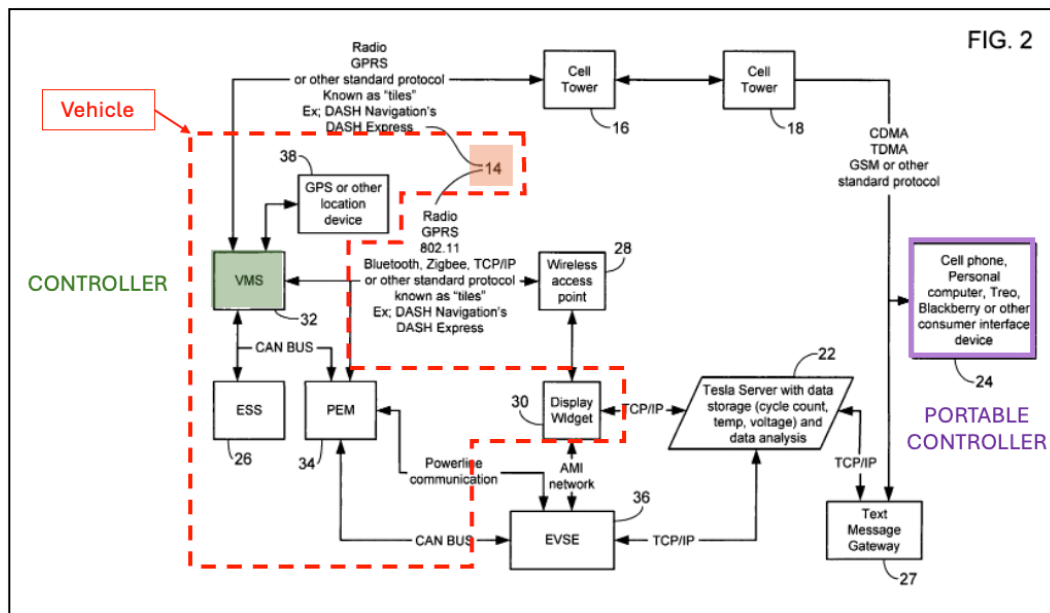
a) “portable controller”

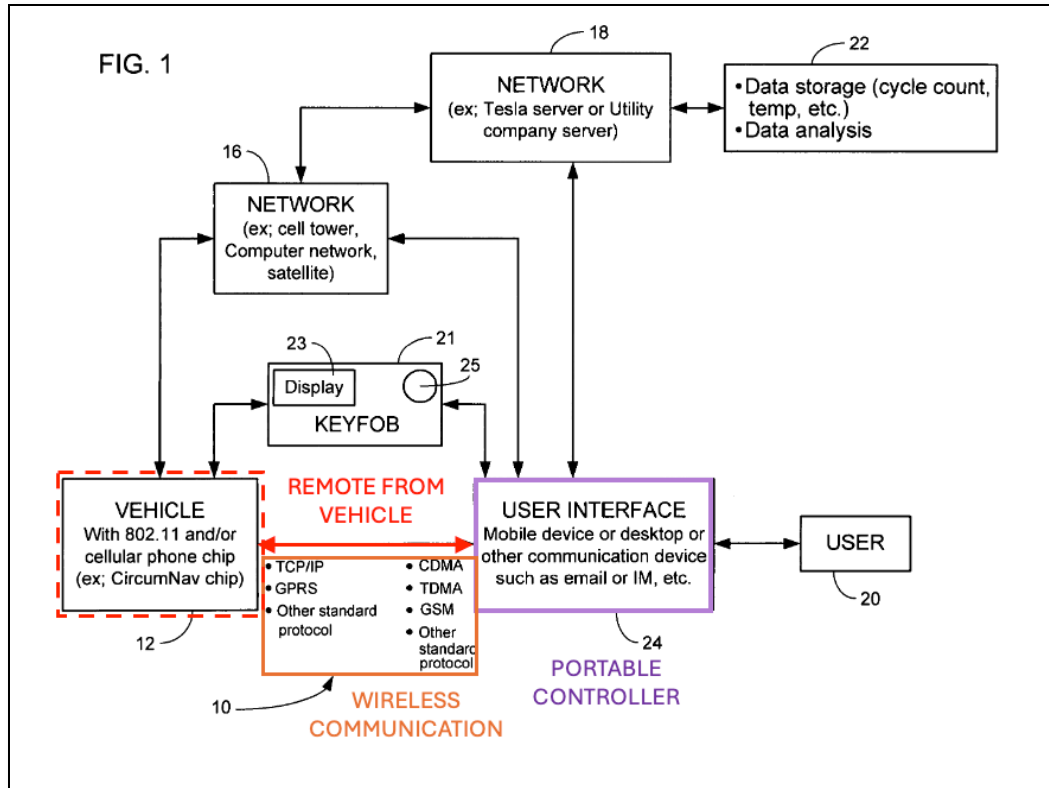
112. The '011 Patent states a “controller can be one or more **processors of** a personal computer, **phone**, PDA, or other processor-based device associated with a user....” EX1001, 9:8-10. Dependent Claim 10 of the '011 Patent recites “the portable controller is defined at least in part by a phone.” EX1001, 48:3-4. Therefore, the claimed *portable controller* is at least a processor of a portable phone.

113. Kelty-078 teaches *a portable controller of a user*; namely, a processor of user **interface device 24** that is a “**portable device**.”² EX1004-Kelty-078, 4:58-65, 5:2-5, 8:40-44. Kelty-078 teaches a “user 20 will be capable of communicating...directly with the vehicle 12 via any **user interface device 24** (step 305). Contemplated user interface devices 24 may include...**mobile devices, such as cellphones**.” EX1004-Kelty-078, 4:16-21, FIG. 3. Kelty-078 provides “Blackberry” and “Treo” as examples of interface 24 in FIG. 2 (below). EX1004-Kelty-078, FIG. 2. In particular, Kelty-078 expressly discloses “Cell phone, Personal

² As used herein, mappings referencing Kelty-078’s user interface device 24 and disclosed functionality should be understood to be referencing the **processor** of device 24.

computer, Treo, Blackberry or other consumer interface device” in FIG. 2. *See* Fig. 2. Specifically regarding a cell phone, a POSITA would have understood that the Treo interface device 24 that Kelty-078 discloses was a mobile device such as a cellphone. For example, the Palm® Treo™ 700p was known in the prior art to include cellular phone capabilities and was even described as being a smartphone in the prior art. EX1019-PalmTreo700p, 7 (describing the Palm® Treo™ 700p as an “advanced mobile smartphone”), 16 (further describing the Palm® Treo™ 700p as a “mobile phone”). Similarly, Blackberry devices were well-known to include cellular phone and personal digital assistant (PDA) capabilities and a processor. EX1053-Blackberry Article, 3 (“RIM and Intel announced in September they were partnering to produce the device, which uses a high end **Intel processor** and is the first Blackberry to run on EDGE...”).





EX1004-Kelty-078, FIGS. 1-2. Here, FIG. 1 depicts user interface device 24 includes a “mobile device,” which a POSITA would have understood would have included the mobile devices depicted as exemplary user interface devices 24 in Fig. 2 (for example, a Treo, Blackberry, cell phone).

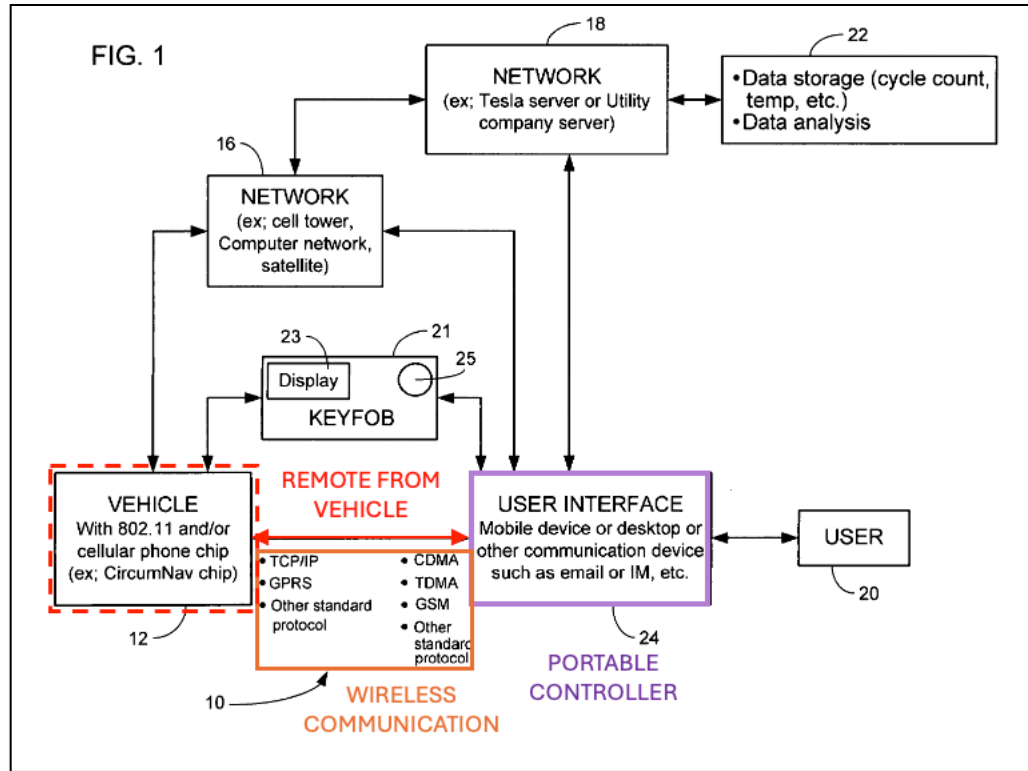
114. Kelty-078’s **interface device 24** comprises a *controller*, e.g., a processor. A POSITA would have understood that a controller was used synonymously with processor in the prior art. EX1054-Vejola, 5:5-11 (discussing that a controller can be comprised of “a Master Control Unit (MCU) 21, **typically a microprocessor device**, and a Digital Signal Processor (DSP)”); EX1049-Adams, (“Mobile device 100 comprises a number of components, **the controlling**

component being a microprocessor.”); see also EX1001, 9:8-10. First, Kelty-078 discloses exemplary user interface devices are the Blackberry and Treo, each of which was known to include a processor. As an example, prior art describing the Palm® Treo™ 700p (the same Treo device model I discussed above) expressly discloses that the Treo included a processor, as would have been expected of a smartphone device. EX1019-PalmTreo700p, 247 (Describing the Palm® Treo™ 700p’s “Processor Specifications” comprising an “Intel XScale® processor, 312MHz”). A POSITA would have understood that this processor would have controlled the device functions of the Palm® Treo™ 700p or a similar Treo device, such as one that Kelty-078 discloses. *See* Fig. 2.

115. Second, Kelty-078 repeatedly describes functionality performed by interface **device 24** requiring a processor, such as “**controlling** and monitoring the battery for charging the vehicle,” communicating with networks or the vehicle via **device 24**, remotely powering on/off the vehicle’s battery, implementing functionality “via programming by a **user interface device 24**,” and storing location data in the interface device 24. EX1004-Kelty-078, 4:58–5:1, Claim 1, 4:16-39, 5:40-44, 8:32-37, 9:3-8. Additionally, cellphones were well known to include processors. I note that this was commonly understood in the prior art. For example, Hayes and Aikawa are prior art references that teach a mobile terminal device including a processor, such as a microprocessor. EX1020-Hayes, 4:33-43

(discussing the processor of a mobile terminal device being “any standard mobile phone processor that handles user inputs”); EX1021-Aikawa [0036]-[0037] (discussing how “mobile terminal 200” includes “information processing unit 270, which is based on a microprocessor or the like”), FIG. 1 (illustrating that “mobile telephone 200” includes “information processing unit 270”). A POSITA would have understood that the processor in such a device would have controlled functions of the device and would have executed programming instructions to perform device functions. Because (1) the '011 Patent claims that the portable controller is defined at least in part by a phone (Claim 10) and Kelty-078 describes cellphones as exemplary interface devices 24; (2) Kelty-078 teaches an exemplary user interface is a commercially-available device known to have a processor; (3) Kelty-078's user interface device 24 performs functionality requiring a processor; and (4) cellphones were well known to include processors, Kelty-078 teaches a *portable controller*.

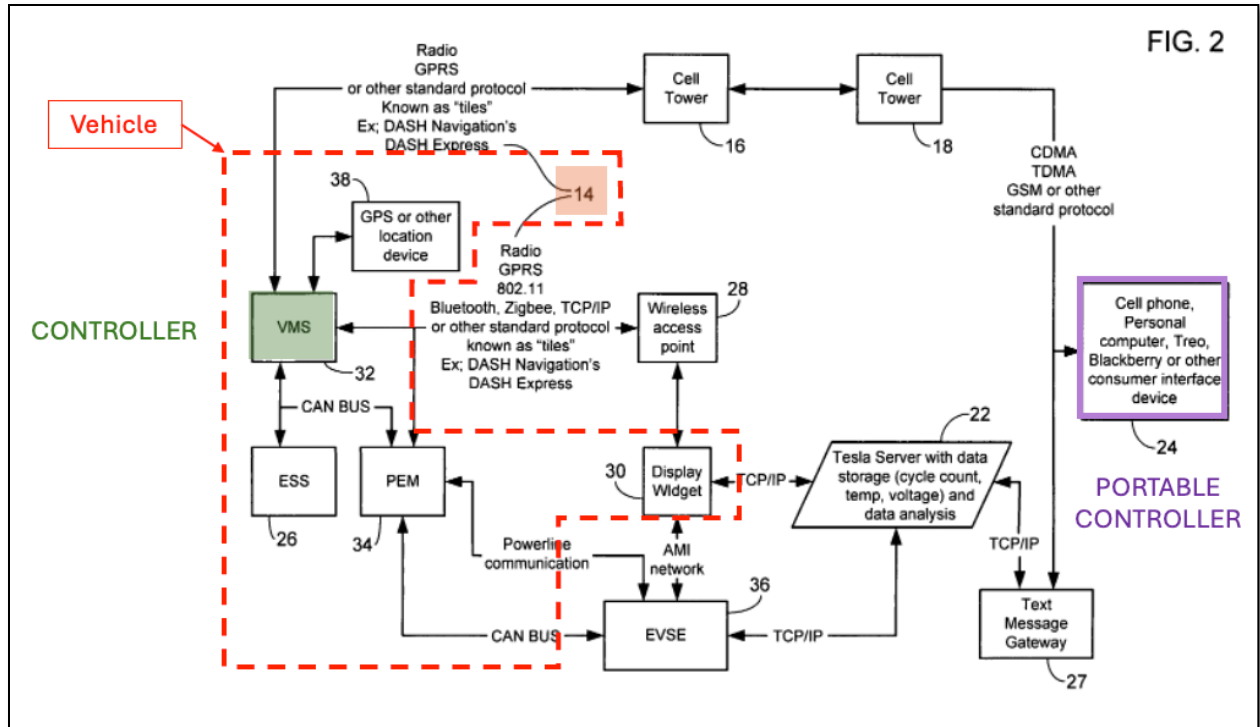
116. Additionally, Kelty-078 teaches that “portable communication devices may be placed in a home or at another **location of the user 20**,” i.e., a location *remote from the vehicle and vehicular battery charger*. EX1004-Kelty-078, 5:2-3, FIG. 1.



EX1004-Kelty-078, FIG. 1. Further reinforcing that the *portable device is remote from the vehicle and vehicular battery charger*, Kelty-078 teaches “Bluetooth” being used to communicate “between the user interface devices 24” and “the vehicle 12,” further indicating the *portable device is remote from the vehicle and vehicular battery charger*. EX1022-Alapuranen, [0041] (describing wireless communications over “an ad hoc networking air interface” such as “BLUETOOTH”).

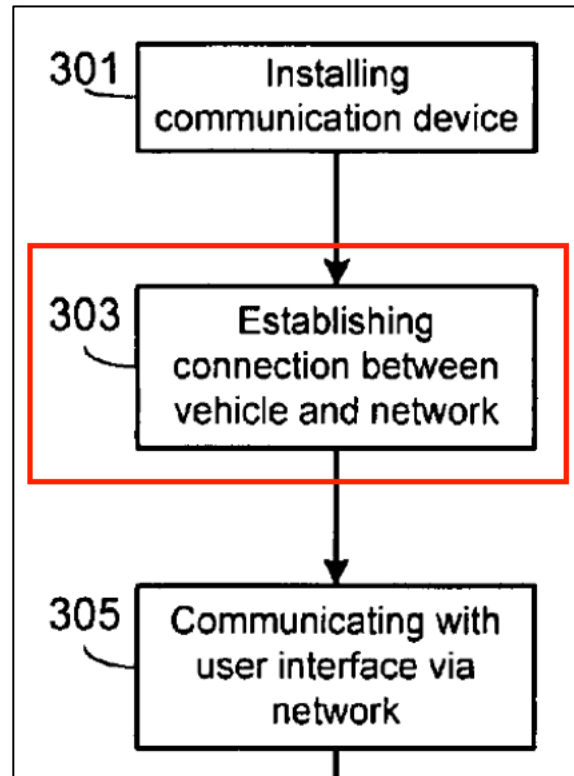
a) “establish wireless communication”

117. Kelty-078 teaches *controller* (VMS 32) utilizes communication chip 14 to establish wireless communication (via Bluetooth) with the *portable controller* (interface device 24).



EX1004-Kelty-078, FIG. 2.

119. Kelty-078 expressly teaches the VMS 32 (*controller*) *establish[es] wireless communication*. Kelty-078 teaches “[e]stablishing connection between vehicle and network” and “[c]ommunicating with user interface [24] via network”:



EX1004-Kelty-078, FIG. 3 (excerpt), Abstract (“establishing a connection **from** the vehicle to a network”), 2:25-30 (disclosing “establishing a connection,” including “contacting a user interface device via the network”), 9:64 (Claim 1).

120. Because Kelty-078 teaches (1) VMS 32, i.e., the claimed *controller* in the vehicle, establishes a connection with a network (FIG. 3, Step 303) via communication chip 14; (2) the connection can be established **from** the vehicle; (3)

VMS 32 “controls” the “various systems in the electric vehicle”; and (4) the communication chip/device 14 is arranged in the vehicle and “may also be incorporated into the computer controlling the vehicle internal network,” the VMS (*controller*) is configured to establish wireless communication. EX1004-Kelty-078, Abstract, 7:44-51, 3:53-59. In particular, Kelty-078 teaches “BlueTooth” as one such “other standard protocol” to permit wireless “communications between the user interface devices 24 and either the first and second network 16, 18 or the vehicle 12...” A POSITA would have understood that Bluetooth would have allowed either the vehicle or the phone to establish communications, as this was a standard part of the Bluetooth Specification. EX1005-Bluetooth Specification, 1 (stating “Bluetooth” makes “wireless connections” easy). It was also known that the Bluetooth Specification included various steps for pairing devices to establish communication between the two devices. See, generally, EX1005-Bluetooth Specification.

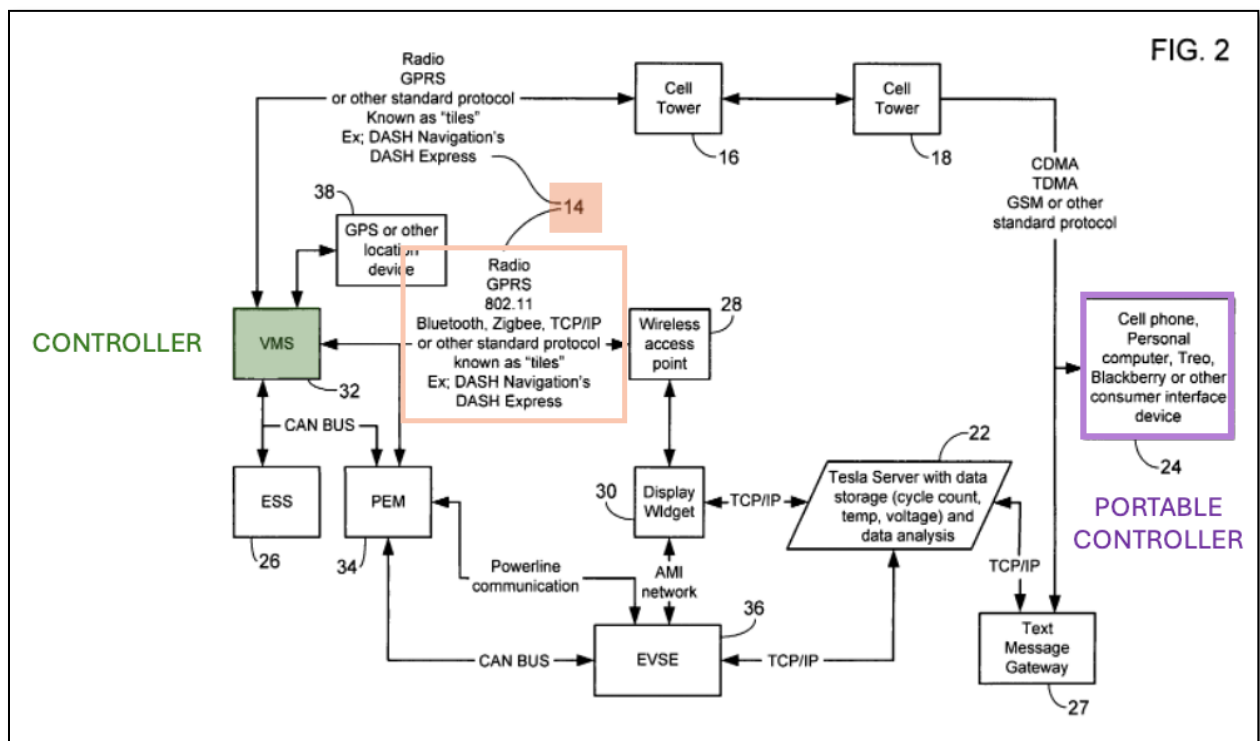
121. Regarding communication with a *portable controller*, Kelty-078 further teaches “[t]he user 20 will be capable of communicating with either the first network 16, the second network 18 or directly with the vehicle 12 **via any user interface device 24** (step 305).” EX1004-Kelty-078, 4:16-19. Kelty-078 teaches establishing a Bluetooth connection through communication chip/device 14. EX1004-Kelty-078, 3:53-67, 4:24-39, 7:43-47, FIG. 2. The Bluetooth Specification

provides express description of the steps by which Kelty-078's VMS 32 would establish communication with the processor of its portable device 24 using communication chip 14. The Bluetooth Specification teaches that "**Bluetooth wireless technology** is a short-range **communications system** intended to replace the cable(s) connecting portable and/or fixed electronic devices" (*establish wireless communication*). EX1005-Bluetooth Specification, 13. "The Bluetooth core system consists of an RF [radio frequency] transceiver, baseband, and protocol stack. The system offers services that **enable the connection of devices** and the exchange of a variety of classes of data between these devices." EX1005-Bluetooth Specification, 13. A POSITA would have further understood that the Bluetooth connection (via radio frequency) is *wireless*. EX1005-Bluetooth Specification, 13 ("The Bluetooth RF (physical layer) operates in the unlicensed ISM band at 2.4 GHz.").

122. "The Bluetooth system provides a point-to-point connection" wherein "the physical channel is shared between two Bluetooth devices." EX1005-Bluetooth Specification, 63, FIG. 1.1(a). "Two Bluetooth devices use a shared physical channel for communication. To achieve this their transceivers need to be tuned to the same RF frequency at the same time, and they need to be within a nominal range of each other." EX1005-Bluetooth Specification, 34, 63, FIG. 1.1.

123. "In order to establish new connections the paging procedure is used." EX1005-Bluetooth Specification, 154. In the Kelty-078 system using Bluetooth

communications, the paging procedure establish[es] wireless communication between a master (“the paging device,” Kelty-078’s communication chip 14 under the control of VMS 32) and slave (“the page scanning device,” similar Bluetooth functionality connected to the processor of Kelty-078’s portable device 24) devices. EX1005-Bluetooth Specification, 76. Steps of the paging procedure including both devices for pairing entering a “CONNECTION” state and sending packets between the two devices. EX1005-Bluetooth Specification, 159-162, FIGS. 8.1, 8.3, Table 8.3.



EX1004-Kelty-078, FIG. 2. Thus, Kelty-078 would utilize Bluetooth to establish a connection between VMS 32 and device 24. As I discussed above in detail, it was

well known that Bluetooth is a communication protocol that establishes wireless communication between devices. *See* ¶¶ 120-123.

124. Because Kelty-078 teaches a vehicle (using VMS 32) wirelessly communicates with user interface device 24 via the network and the established communication (FIG. 3, Step 305), Kelty-078 teaches the *controller* (VMS 32) *is configured to establish wireless communication* through communication chip 14 over Bluetooth with a portable controller, namely user interface device 24 including a processor. *See* ¶¶ 120-123.

4. Claim 1[c]: “receive a wireless signal from the portable controller”

a) ’011 Specification Regarding “signal”

125. The ’011 Patent gives an example of a “wireless signal” transmitted using “wireless communication.” EX1001, 22:39-44 (“As another example, the controller 44 of the vehicle charging cord 22 can transmit a wired or wireless signal to the user's computer and/or to the power utility 48 (i.e., to the controller 50 of the power utility 48) in any of the manners of communication described above in connection with the controller 50...”), 10:38-53 (“communication along any portion or all of the distance between the controller 50 of the power utility 48 and the vehicle charging cord 22 can include wireless communication. In such cases, any number of wireless transmitters and receivers (and associated antennae) can be used to send

and receive communications between the controller 50 of the power utility 48 and the vehicle charging cord 22.)”).

b) Kelty-078’s Teachings

126. Kelty-078 similarly sends signals (for example, instructions) using wireless communication (for example, Bluetooth), as discussed below. EX1004-Kelty-078, 4:4-39, 4:53–5:18, 8:44-48, FIG. 2.

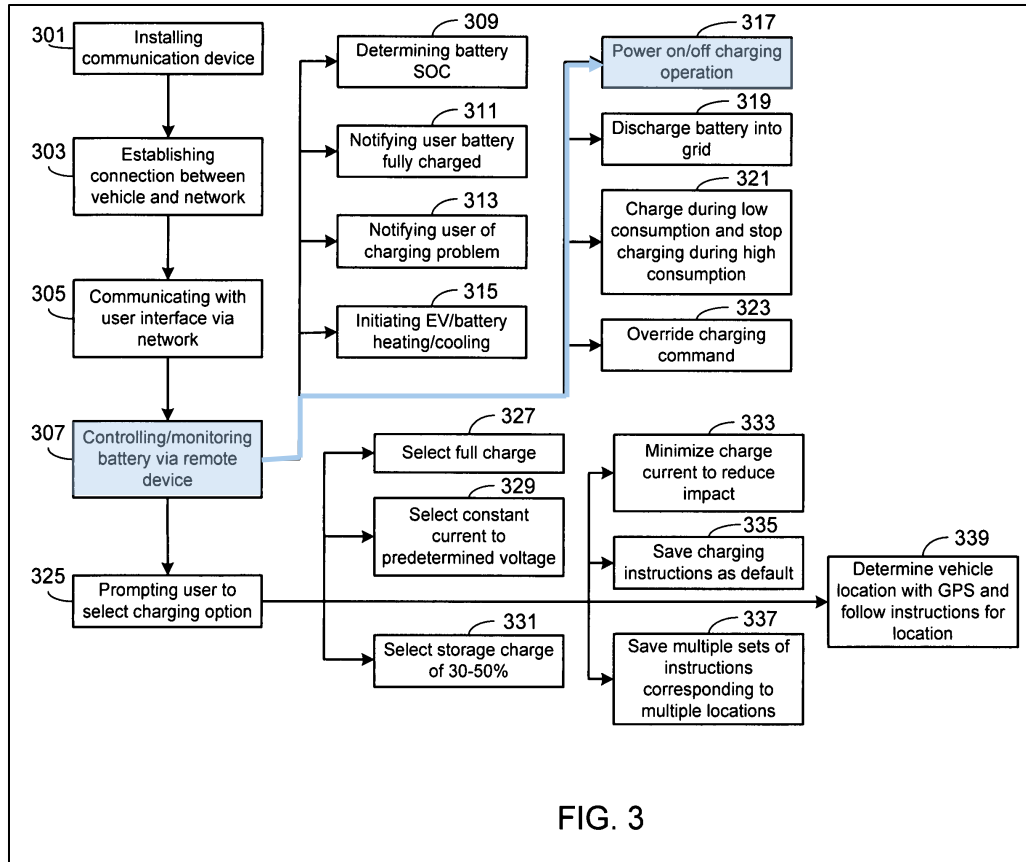
127. Kelty-078 teaches *receive a wireless signal from the portable controller*, namely receive instructions or other communications from user interface device 24 via, for example, Bluetooth. EX1004-Kelty-078, 4:58–5:1. As I note in detail below, Kelty-078 utilizes Bluetooth for transmitting/receiving instructions wirelessly. Kelty-078 teaches “that the user or driver 20 of the vehicle is [] capable of communicating with the electric vehicle 12 from their portable device such as a cell phone...to program and **send specific instructions** to the electric vehicle 12 for controlling and monitoring the battery system 26 arranged within the electric vehicle 12 (step 307).” EX1004-Kelty-078, 4:58–5:1, FIG. 3. Kelty-078 teaches the user 20 communicating “directly with the vehicle 12 via any user interface device 24 (step 305).” EX1004-Kelty-078, 4:16-19, FIG. 3.

128. As discussed in Claim 1[a] above, VMS 32 (*controller*) “monitors, controls and coordinates various systems in the electric vehicle 12 including” ESS 26 (the electric vehicle battery). EX1004-Kelty-078, 7:44-51.

129. Similar to the '011 Patent's wireless signal transmitted via Bluetooth, Kelty-078's instruction communicated via Bluetooth provides a *signal*. EX1001, 18:53-55. Indeed, Kelty-078's instruction communicated via Bluetooth would have been transmitted wirelessly to the receiving device, which a POSITA would have understood to be similar to the descriptions in the '011 Patent. Therefore, wirelessly instructing using Bluetooth to “send...instructions” from the portable user interface device 24 to the VMS 32 includes VMS 32 *receiv[ing] a wireless signal*, and thus VMS 32 *is configured to receive* said *wireless signal*, as claimed. EX1004-Kelty-078, 4:53-58, 8–5:18, 8:44-48; EX1005-Bluetooth (generally describing signals being sent between paired devices via Bluetooth when sending information). Examples of such “instructions” are illustrated in FIG. 3 and include user 20 “powering on and off” charging of battery 26 and “discharging the battery 26 into the electricity or electric grid.” EX1004-Kelty-078, 4:66, 5:40-52, FIG. 3 (*see* steps 317 and 319). Another “instruction[]” illustrated in Kelty-078's FIG. 3 includes permitting “the user 20 to override the utility company instruction of stopping charging (step 323) because of high power consumption if the user 20 of the electric vehicle 12 needs the battery 26 charged at the current time in order to use the vehicle in the near future.” EX1004-Kelty-078, 6:12-16, FIG. 3.

5. Claim 1[d]: “responsive to receiving the wireless signal, supply electricity from a source of power to the battery of the vehicle with the vehicular battery charger,

130. Kelty-078 teaches “an interface that will allow for communication between the user and the vehicle to enable the user to control certain aspects of **charging of the battery...**” EX1004-Kelty-078, 2:41-43. Per Claim 1[c], Kelty-078 teaches that the user interface device 24 can communicate with the vehicle 12 through the networks 16, 18 to “program and send specific instructions to the electric vehicle 12 for controlling and monitoring the battery system 26 arranged within the electric vehicle 12 (step 307).” EX1004-Kelty-078, 4:59–5:1. An exemplary instruction from the user interface device 24 to the vehicle includes “the user 20 capable of powering on and off in predetermined cycles and at predetermined times the charging of the battery 26 from a user interface device 24 (step 317).” EX1004-Kelty-078, 5:40-44.



EX1004-Kelty-078, 6:16-21, FIG. 3 (*see* steps 307, 317), 7:44–8:6 (describing communication between user interface 24 and the VMS 32 (*controller*) via communication chip 14). Kelty-078 teaches an embodiment including a keyfob, where “[t]he vehicle user 20 may also **control the starting and stopping of charging of the battery pack** via the means 25 of keyfob along with other communication and control of the electric vehicle 12. Furthermore, the options **may also be added to a cell phone connection or other mobile device** to follow the network connections of the first and second network 16, 18 as described above **to**

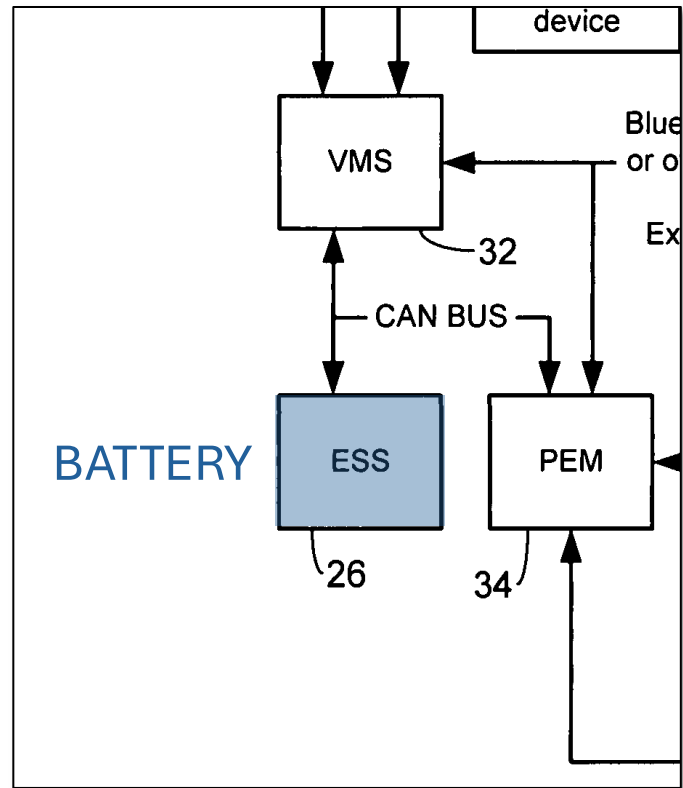
allow for choosing of one the charging options and setting any default via any user interface device 24.” EX1004-Kelty-078, 7:35-43.

131. Kelty-078’s teaching of “charging” the battery pack (7:34-38), powering on/off charging of the battery (5:40-44), or powering on/off charging operation (FIG. 3, Step 317) individually or collectively teaches *supply[ing] electricity...to the battery of the vehicle*, namely ESS 26 comprising a battery pack. Indeed, charging a battery would have been understood as supplying electricity to the battery. Additionally, Kelty-078 expressly and repeatedly teaches utilizing the user interface device 24 to send instructions to the vehicle, including instructions to power on/off the charging operation, start/stop charging of the battery pack, or otherwise select charging options. Thus, the user interface device in communication with the vehicle is what prompts said supplying electricity to the battery. Kelty-078 teaches VMS 32 is the onboard vehicle computer that controls various vehicle systems, including the ESS 26 (battery) and PEM 34 (responsible for charging battery 26), thus teaching the *controller configured to perform Claim 1[d]’s functionality*. EX1004-Kelty-078, 7:44-64; *see also* Claim 1[a] (discussing Kelty-078’s *controller* teachings).

132. The charging of the battery (i.e., *supply electricity*) is *responsive to receiving the wireless signal*, as claimed, because the charging of the battery is in response to an instruction (i.e., *wireless signal*) received by the VMS 32 from device

24 over Bluetooth to begin charging. *See* ¶¶ 120-123; *see also* Mapping for Claims 1[b]-1[c] (discussing Kelty-078's receipt of a signal with instructions to begin charging).

133. Kelty-078 teaches that the supplying power is *with the vehicular battery charger*. As mapped for Claim 1[Pre], the *vehicular battery charger* comprises the collective VMS 32 (*controller*), power electronics module (PEM) 34, and ESS 26 (*battery*). Kelty-078 teaches ESS 26 “which is controlled by the vehicle management system 32 via a CAN BUS or any other known communication interface or path, includes the battery pack of the electric vehicle 12 which is used to provide the power necessary to propel the electric vehicle 12 without the need for an internal combustion engine.” EX1004-Kelty-078, 7:53-59.



EX1004-Kelty-078, FIG. 2 (excerpt). PEM 34 (part of the *vehicular battery charger*) “house[s] a AC to DC rectifier for **charging** and the control PCB’s for drive and **charge of the electric vehicle energy storage system**” (battery 26). EX1004-Kelty-078, 7:59-64. An AC to DC rectifier was a common component of on-board vehicle chargers for converting AC electrical power from a *source of power* (e.g., an electrical grid) into DC electrical power to charge the vehicle battery. It was known in the prior art to utilize such an AC to DC rectifier to take the AC electrical power and convert it to DC electrical power for charging the battery, with one example being taught by Hayes-985. *See* EX1016-Hayes-985, 1:29-33 (describing how “high-frequency AC power that is provided by the inductive charger is transformer-

coupled to the electric vehicle via the inductive inlet. The high frequency AC power is rectified and filtered to generate a DC current that charges the batteries.”), FIG. 1. Therefore, the *supply* [of] *electricity...to charge the battery of the vehicle* is performed *with the vehicular battery charger*, namely Kelty-078’s collective VMS 32, PEM 34, and ESS 26.

134. Regarding the claimed *supply[ing] electricity*, Kelty-078 teaches “charging” the battery using device 24. EX1004-Kelty-078, 5:40-44, FIG. 3 (*see* step 317). Kelty-078 also expressly associates *electricity* with charging and discharging the battery. For example, Kelty-078 teaches that user 20 desires (1) “**charging** the battery pack of the electric vehicle 12” when “cost of **electricity**” is low (8:65–9:3) and (2) “discharging the battery 26 into the electricity or electric grid (Step 319) of the locale in which the electric vehicle 12 is either **charged** or stored” (5:44-52). EX1004-Kelty-078, FIG. 3 (*see* step 321). As an example, Hobbs-186 teaches that “chargers located on vehicles may also be configured to plug into the electric power grid.” EX1050-Hobbs-186, 1:34-39.

135. Given these collective teachings, Kelty-078 teaches *supply[ing] electricity* to the battery, such as by charging a lithium ion battery. Notably, Kelty-078 expressly discloses a lithium-ion battery. “The electric vehicle 12 of the present invention uses a battery pack made of sheets of cells of lithium ion batteries arranged in a predetermined pattern. This battery pack will allow for propulsion of the electric

vehicle 12 Some distance before recharge is necessary.” EX1004-Kelty-078, 3:33-37.

136. Finally, an electricity grid (for example, operated by a utility company) is a *source of power*. The '011 Patent describes how “sources of power 12 can supply the electricity needs of the community, such as one or more power plants generating electric power” and repeatedly describes a “power utility” supplying power to an electric vehicle. EX1001, Abstract, 6:44-51, 9:12-19, 17:14-17, 20:1-4; EX1032-Kempton (generally describing an “electric power grid” providing power to electric vehicles).

137. Kelty-078 teaches supplying electricity *from a source of power*, namely a utility company controlling an electricity grid. Kelty-078 teaches “a vehicle to [electricity] grid application” for “allowing [] certain operations to be performed by the **utility company** and the user 20 on the electric vehicle 12” such as controlling “charging” of the vehicle. EX1004-Kelty-078, 5:48-52, 5:58-67.

6. Claim 1[e]: “during charging of the battery with the vehicular battery charger: repeatedly receive at least one signal indicative of a level of charge of the battery,”

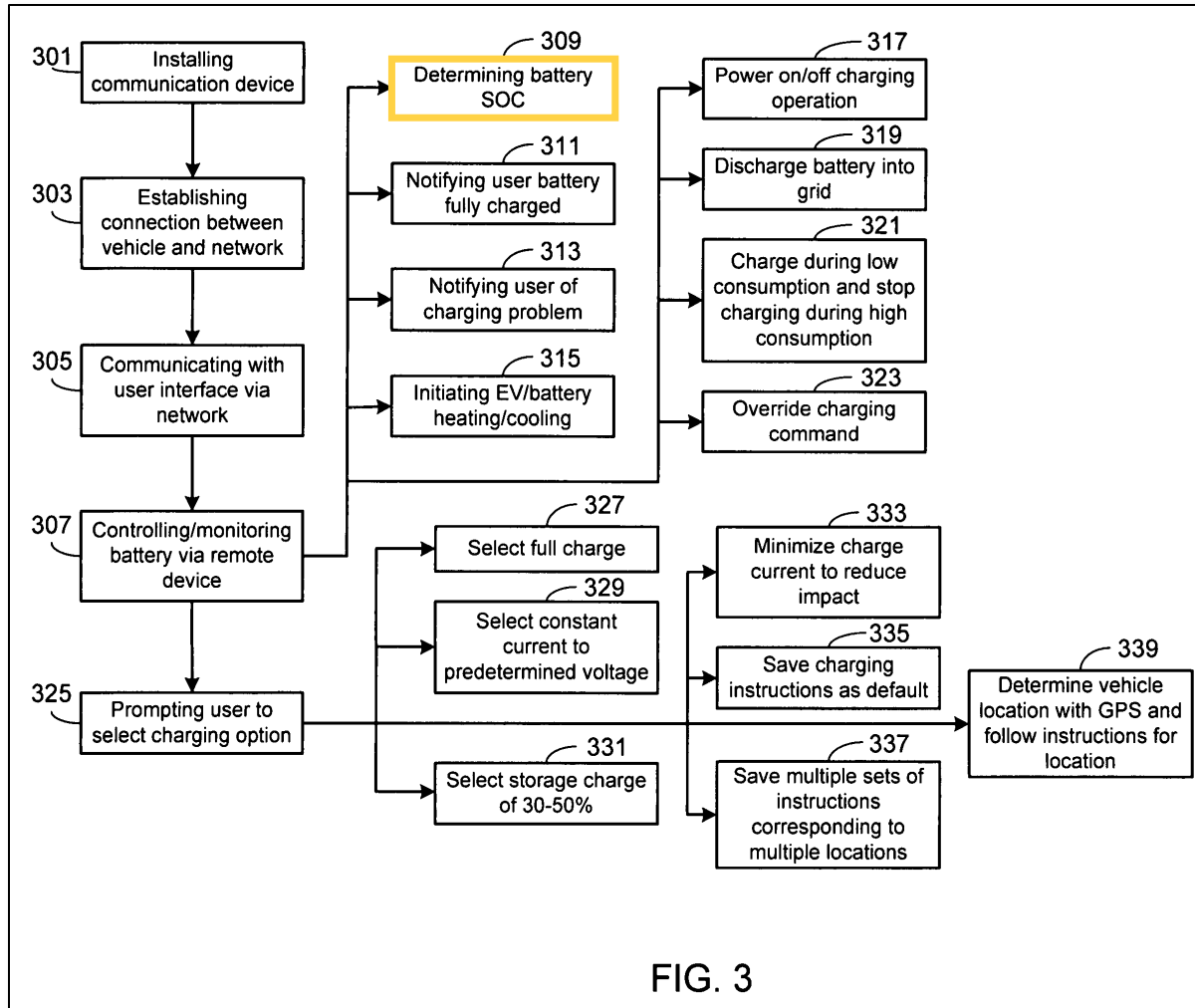
138. Kelty-078 in combination with Fujita alone or in further combination with Suyama teaches Claim 1[e].

a) '011 Specification Regarding “repeatedly”

139. The word “repeatedly” does not appear in the '011 Specification. The closest support is found at EX1001, 13:60-14:13, generally describing “continually” or “periodically” updating, “such as every second, minute, or other time interval.” EX1001, 13:60-14:13. I note that the '011 Patent provides this description: “For example, the charge time remaining indicator 66 can be updated by the controller 44 every second or minute based upon battery charge calculations made at the beginning of the charging session or made periodically during the charging session.” EX1001, 13:65–14:3.

b) Kelty-078’s Teachings

140. Kelty-078 teaches “user 20 may be capable of querying or monitoring the electric vehicle’s battery pack and cells 26 for its state of charge (SOC) (step 309). This will allow the user 20 to determine if the battery 26 is capable of driving the distance the user 20 must travel.” EX1004-Kelty-078, 5:9-15, FIG. 3. Thus, Kelty-078 teaches that SOC (*level of charge*) is capable of being queried or monitored.



EX1004-Kelty-078, FIG. 3.

c) Fujita's Teachings

141. I will begin with an overview of Fujita's teachings before turning to the mapping of Fujita for Claim 1[e].

142. Like Kelty-078, Fujita is similarly directed to an electric vehicle. Compare EX1004-Kelty-078, Abstract, 1:63-67, with EX1006-Fujita, Abstract, 1:7-10. Fujita teaches "a battery charging device" comprising electronic control unit (ECU) 16 of electric vehicle 10 that "monitors constantly" the "residual amount of

electric energy” (C; e.g., charge level) of battery 30 (Steps S1-S2). EX1006-Fujita, 3:54-56. When charge level (C) is less than the amount of charge required to travel a “desired distance inputted by the driver” (C_L ; Steps S3-S6, S8), the driver connects vehicle 10 to “a high-voltage power source” to begin charging battery 30 (Step S8). EX1006-Fujita, 2:24-25, 3:29-31, 3:64-65. ECU 16 then begins calculating “a time required for charging the battery” (t) by setting the required charge time to zero (“ $t=0$ ”; Step S9) to initiate the following calculations. EX1006-Fujita, 3:45-46.

143. ECU 16 “calculates a charging efficiency” of the battery (k; Steps S10-S11) based on battery 30’s temperature (T_B), current (I), and charge level (C). EX1006-Fujita, 3:46-47. Based in part on the charging efficiency (k), ECU 16 then calculates and displays “the time required to charge” (t; Steps S12-S13) battery 30 on “the alarm/display means.” EX1006-Fujita, 4:59-60, FIGS. 3, 6. Said “charge time t represents the required time after the charge current I, temperature T_B and residual amount C of the battery are revised.” EX1006-Fujita, 4:19-21.

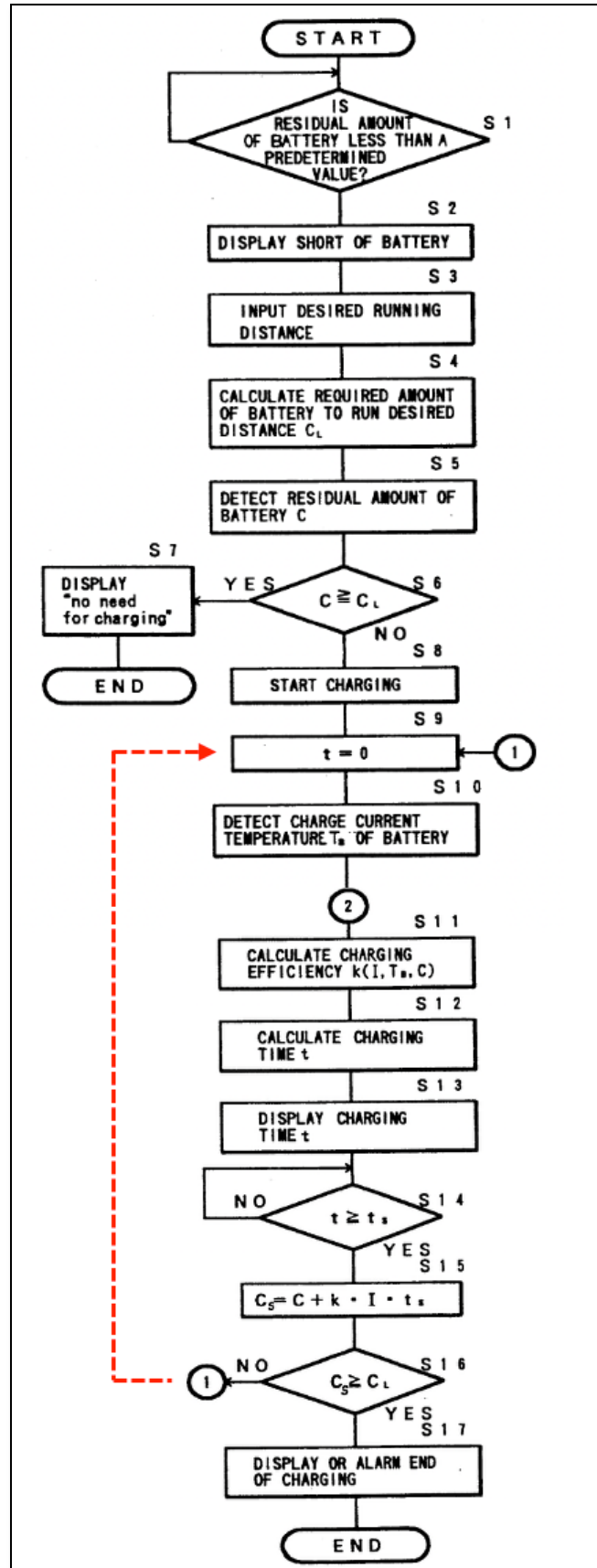
144. After a predetermined amount of time (t_s) elapses “during the charging,” ECU 16 refreshes the value of the battery’s charge level (C_s ; Steps S14-S15). If the “revised” residual charge in the battery (C_s) is not enough to travel the user’s desired distance (C_L), “the operations after the step of S9 are repeated” (Step S16). EX1006-Fujita, 4:48-49. The required charge time is again set to zero (“ $t=0$ ”) to restart the timer for the cycle calculating the time to charge, as discussed above

(Steps S9-S16; depicted with the red arrow in modified FIGS. 4-5 below). EX1006-

Fujita, 4:15. Conversely, if there is enough charge, “ECU 16 terminates the operation

after displaying the completion of charging” (Step S17). EX1006-Fujita, 4:41-42.

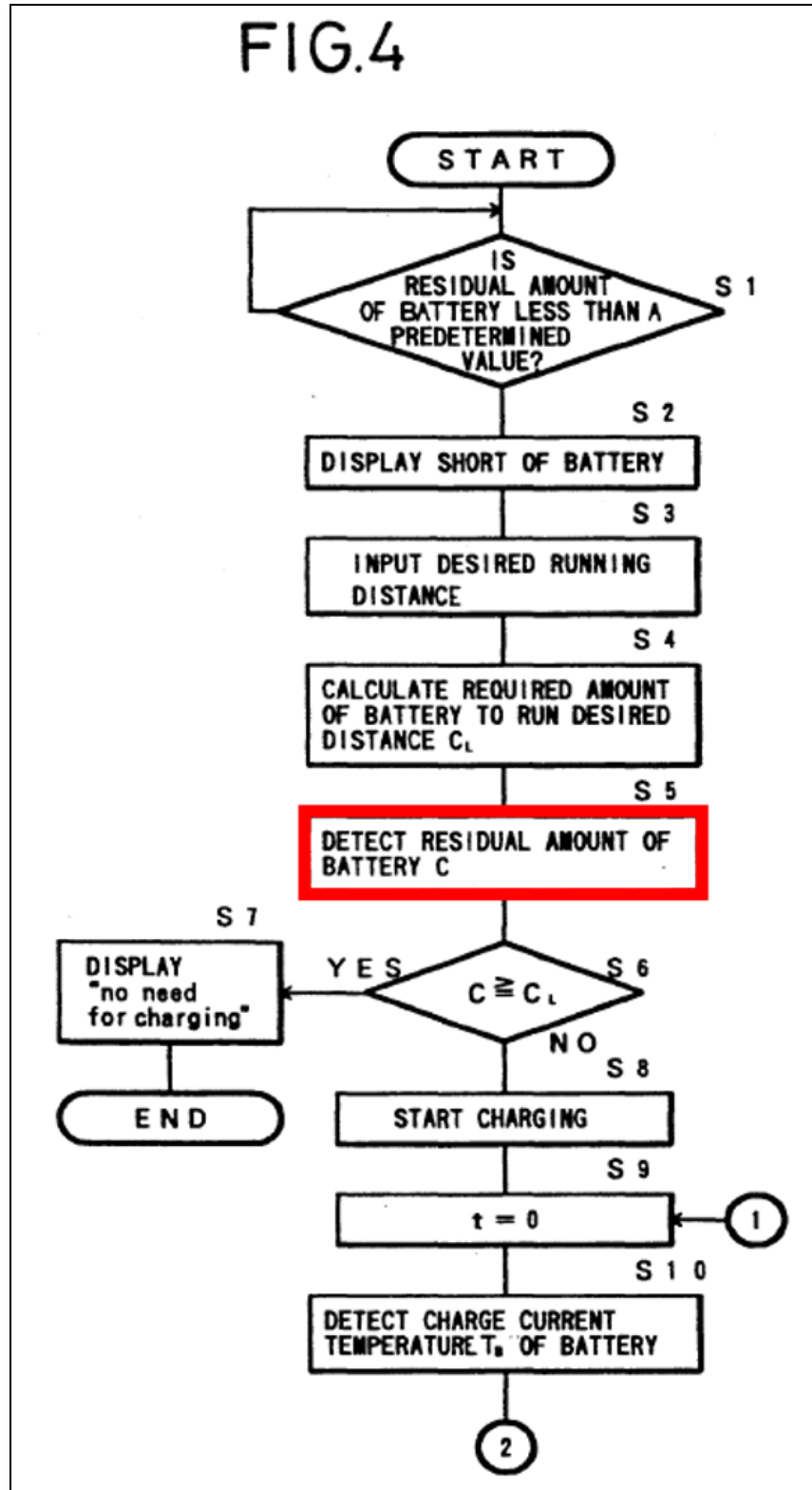
These steps are shown in FIGS. 4-5 below:



EX1006-Fujita, FIGS. 4-5 (combined to show the collective “operations performed by the battery charging device” per Fujita). EX1006-Fujita, 2:62-63. I note that here, FIGS. 4 and 5 were simply spliced together to show the full set of steps in a single image.

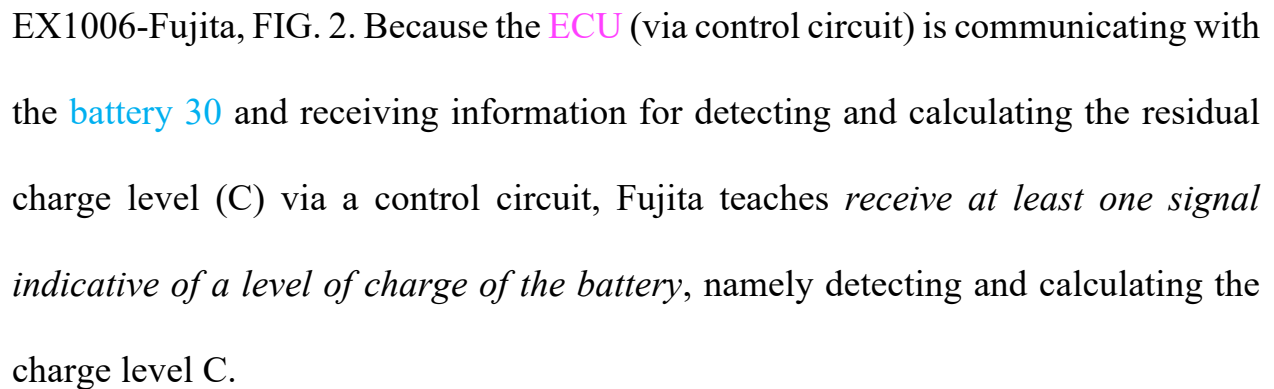
145. Turning to Claim 1[e]’s mapping, Fujita teaches a *controller configured to receive a signal indicative of the level of charge, namely Fujita’s electronic control unit (ECU) 16*. EX1006-Fujita, 3:9-13. ECU 16 controls the charging process (3:9-13, 3:22-25) and informs the driver of the charging state via display 46. EX1006-Fujita, 3:9-13, 3:22-25, 3:54–4:14. ECU further connects the vehicle’s battery 30 with a “high-voltage power source” “to rapidly charge the battery.” EX1006-Fujita, 3:27-31, 3:18-37, 4:5-14 (describing a battery charger). In the combination with Kelty-078, it would have been obvious for Kelty-078’s VMS to be configured to receive Fujita’s residual amount C of the battery. *See* Claim 1(e) Motivation to Combine.

146. Fujita teaches receive at least one signal indicative of a level of charge of the battery, namely “DETECT RESIDUAL AMOUNT OF BATTERY C” when calculating charge time (t):



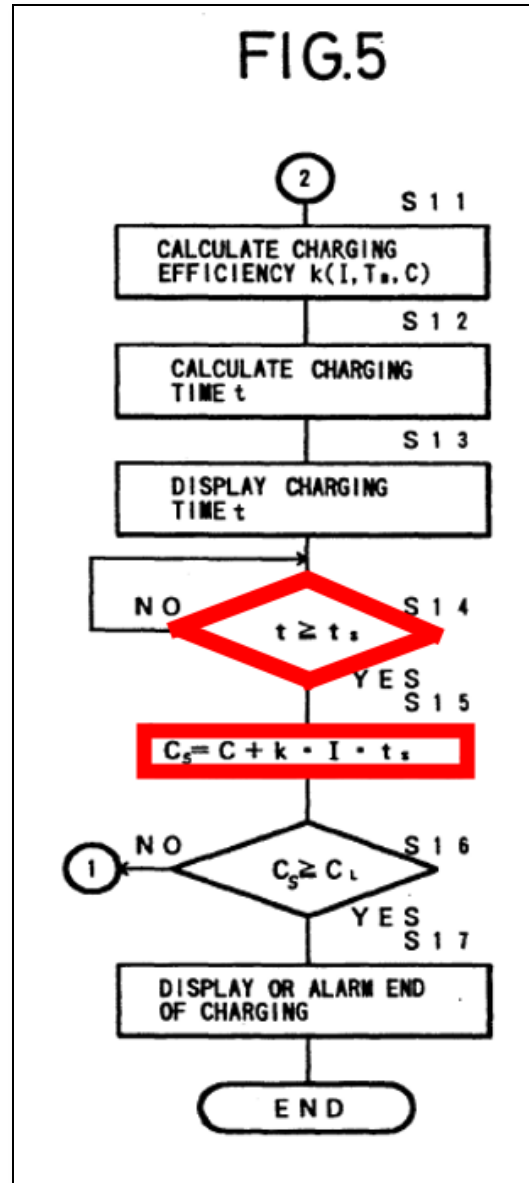
EX1006-Fujita, FIG. 4 (Step S5).

147. Fujita teaches that ECU communicates with the battery 30 via terminals a+ and a- to “detect” and otherwise “calculate a current residual amount C of electric energy of the battery (Step S5)....” EX1006-Fujita, 3:18-25, 3:65–4:2, FIGS. 2, 4, 5:41-45 (Claim 3). Fujita teaches a broad embodiment where a switching means comprises a control circuit and switch, and a more specific embodiment where the switching means comprises ECU and switch 24. *Cf. id.*, 2:8-13, *with id.*, 3:22-25. Fujita discloses and claims “a control circuit connected to the battery, said control circuit comprising first calculating means for calculating a residual amount of electric energy of the battery.” EX1006-Fujita, 6:18-22 (Claim 8), 5:41-45 (Claim 3), 2:14-19 (disclosing calculating circuit for calculating residual amount of energy of battery). Similarly, Fujita provides a more specific disclosure that ECU “monitors constantly during navigation whether the residual amount of electric energy of the battery is beyond a predetermined level...” and “calculates a current residual amount C of electric energy of the battery (step S5)....” EX1006-Fujita, 3:54-68. Indeed, because at least one signal related to the charge level C is received multiple times, Fujita teaches receiving at least one signal related to the charge level C.



148. Fujita teaches *repeatedly* receiving the signal indicative of the residual charge level (C) *during charging of the battery*. Fujita teaches calculating the charge time (t) “during the charging” of vehicle 10 until battery 30’s residual charge (C) reaches at least “the required electric energy to run the desired distance” (CL)

entered by the driver. EX1006-Fujita, 2:41-42, 4:35-49, Claim 12. Charge time (t) is calculated based on charging efficiency (k), which ECU 16 of vehicle 10 determines “from the charge current I, temperature TB and **residual amount C of the battery** (step S11).” EX1006-Fujita, 4:21-24. The charge time (t) is compared with a lapse of time t_s ; after each time t_s is detected, the “residual amount C of the battery [is] renewed” to obtain a “revised” residual charge amount (Cs) according to stated formula (Steps S14-S15):



EX1006-Fujita, 4:35-40, FIG. 5. Until battery 30 has enough residual charge to drive the user's desired distance, "the operations after the step of S9 are **repeated**," where such operations are performed *during charging*. EX1006-Fujita, 4:48-49. Because the residual charge (C) is revised and renewed during charging, and because at least Step S15 is repeated, Fujita teaches *repeatedly* receiving a signal indicative of the charge level of the battery *during charging*.

149. Fujita's receipt of the *level of charge of the battery*, i.e., detection of the residual amount C, is also *during charging of the battery with the vehicular battery charger*. This is because Fujita teaches receiving signals and performing calculation steps after charging begins. This is also simply a logical step to take, as the charge level would be more or less static over a short time period if charging were not occurring. But after charging is initiated, the charge level will begin to increase, and then such detections would have more utility. Fujita teaches that step S8 "start[s] the charging," and the repeated *receive signal* and calculation steps are performed **after** Step S8. EX1006-Fujita, FIGS. 4-5.

150. Fujita provides teachings of this. For example, "the ECU 16, then, calculates a required amount CL of electric energy of the battery to run the desired distance L (step S4), calculates a current residual amount C of electric energy of the battery (step S5)." EX1006-Fujita, 3:67-68, 4:5-14). "If $C < CL$, the driver stops the electric vehicle 10 near a gasoline engine vehicle 12 and the ECU 16 connects the terminals a+ and a- on the battery 30 side of the switch 24 with the terminals c30 and c- on the DC-DC converter 34 side by controlling the switch 24, while the driver connects the second connector 36 with the battery 14 of a gasoline engine vehicle 12 to start the charging (step S8). ECU 16 can inform the driver of the state of 'under charging' by turning-on the charging state display 46 of the alarm/display means 22."). Specifically, Fujita teaches a looped process beginning at Step S9 and

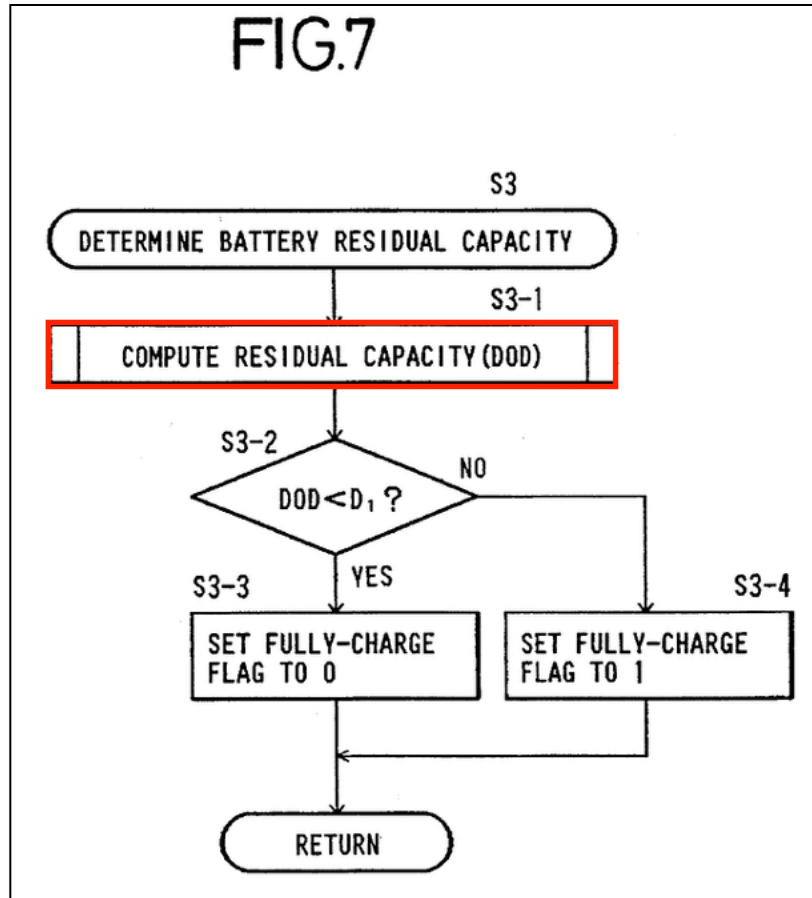
continuing through Step S16 until the required charge level C_L is reached. *See* Section V.A.6.d, above, explaining Fujita's process; EX1006-Fujita, 4:48-49 ("If $C_S < C_L$, the operations after the step of S9 are **repeated**").

d) Suyama's Teachings

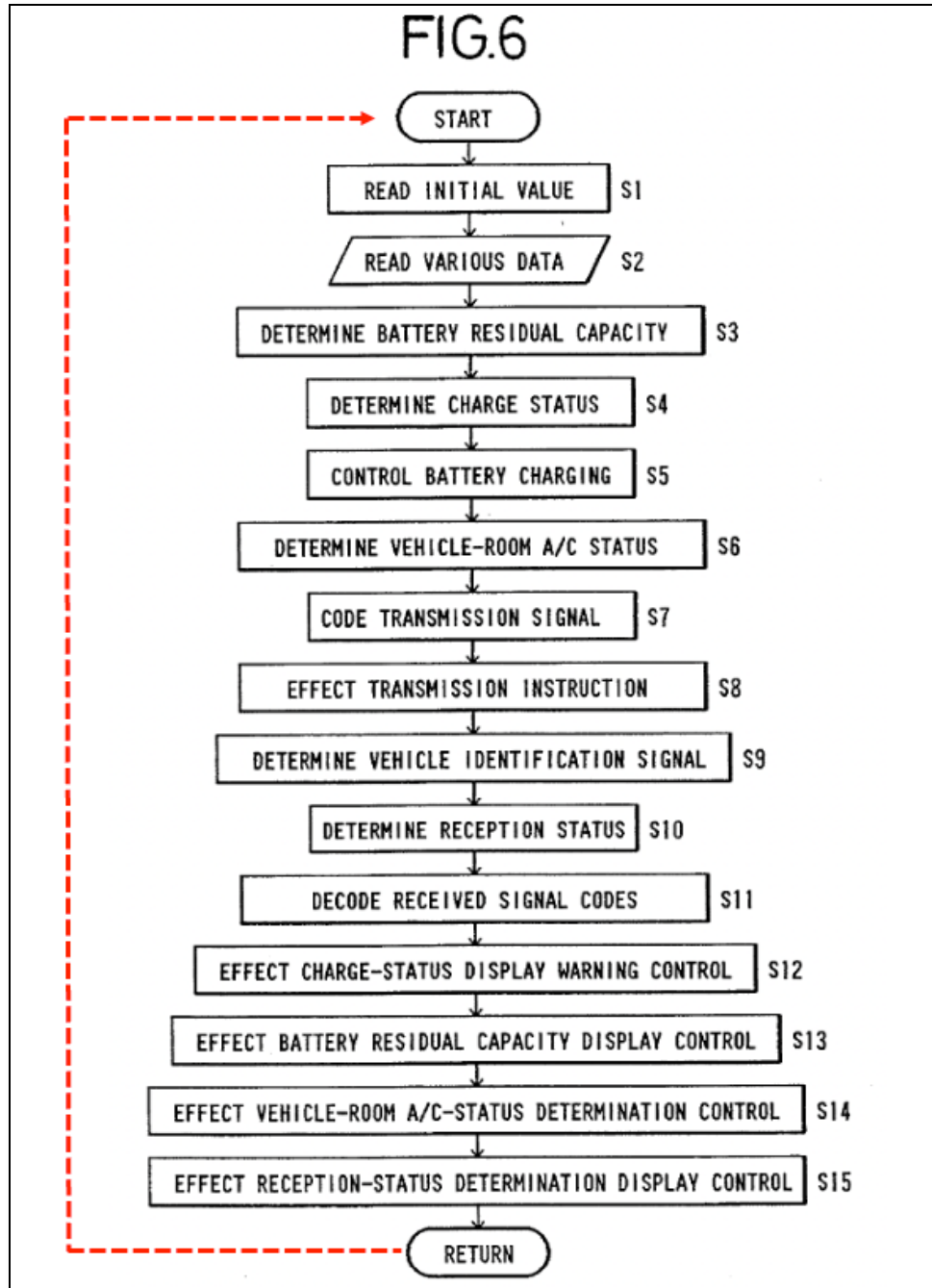
151. Suyama also teaches Claim 1[e]. Suyama teaches *receive at least one signal indicative of a level of charge of the battery*, namely "determining the residual capacity of the main battery 18" from "the **signal read or detected from the battery residual capacity meter 54** (Step S3-1 in FIG. 7)." EX1007-Suyama, 8:58–9:19, FIGS. 6-7. Suyama also teaches that "FIG. 7 is a flowchart for describing, in detail, a routine used in the sequential routine for displaying the detected information shown in FIG. 6." EX1007-Suyama, 4:55-57. Additionally, Suyama teaches "a routine for determining the residual capacity of the main battery 18 is executed in Step S3. That is, the charge-status determining ECU 48 computes the remaining capacity DOD of the main battery 18 based on the signal read or detected from the battery residual capacity meter 54 (Step S3-1 in FIG. 7)." EX1007-Suyama, 8:58-63. Thus, a POSITA would have understood that FIG. 7 is the sub-routine of Step S3 shown in FIG. 6.

152. The residual capacity is determined *during charging of the battery* because the residual capacity is determined while "under the charge." EX1007-Suyama, 5:55-57. The residual capacity is *repeatedly* received because Steps S1

through S15 are **repeatedly** executed” including *signal receiv[ing]* Step S3. EX1007-Suyama, 8:46-51, FIG. 6, Claim 1 (reciting “detecting a plurality of operating conditions of said main battery during charging” and “**repeatedly** determining a present status of charging of said main battery”). Additionally, Suyama teaches “The charge status determining ECU 48 reads the remaining capacity of the main battery 18 from a battery residual capacity meter 54 and also reads the temperature of the main battery 18 using a temperature sensor 56.” EX1007-Suyama, 6:33-36. Further, Suyama teaches “the display circuit 30 displays the state of charging of the main battery while being charged and the like based on the result of the decoding.” EX1007-Suyama, 8:36-38.



EX1007-Suyama, FIG. 7.



EX1007-Suyama, FIG. 6.

e) Motivation to Combine

153. A POSITA would have found obvious and been motivated to modify Kelty-078 to include either Fujita's or Suyama's repeated estimating the level of

charge of the battery during charging to obtain numerous, known advantages. A POSITA would have appreciated that “[a] good SOC [state of charge] calculator provides the following advantages for EVs:

- Longer battery life
- Better battery performance
- Improved power system reliability
- Avoid no-start conditions
- Reduced electrical requirements
- Smaller/lighter batteries
- Improved fuel economy
- Prefailure warning of the battery pack
- Decreased warranty costs.”

EX1014-Sandeep, 57. A POSITA would have further valued repeatedly detecting the battery charge level to “provide optimization of recharge without detriment to battery life.” EX1014-Sandeep, 58. A POSITA would have appreciated the resultant improvement in the battery’s longevity. Indeed, Kelty-078 discusses how charging battery 26 to “30 to 50% charge” (instead of “a full charge”) “will allow for the maximum life and durability of the battery pack system 26 in the electric vehicle 12.” EX1004-Kelty-078, 6:53-59, 7:15-21. Thus, repeatedly detecting the battery

charge level to ensure that the battery charge level reaches the desired level would have been an advantageous result of the proposed combination with Kelty-078.

154. It would have also been desirable to repeatedly receive information indicative of the level of charge, including calculating the level of charge, during charging of the battery to determine when approaching or have reached a desired battery level. Charging to a pre-set charge level that was less than 100% charged was common, and therefore, it would have been desirable for the system to know during charging when had reached the pre-set charge level to indicate such to the user and otherwise terminate charging. Indeed, this would have been a straightforward and advantageous technique for the system to determine where it is at in the charging process and when the charge level has reached the desired level.

155. A POSITA would have also valued that repeated monitoring of the level of charge would improve the user's safety by quickly detecting charging faults. EX1004-Kelty-078, 5:21-23 (describing "vehicle 12 notifying the user or driver 20 that a problem occurred during charging of the battery 26 (step 313)..."), FIG. 3. The modification would have improved Kelty-078's overall performance by repeatedly monitoring the vehicle's battery to prevent detrimentally overcharging or discharging. EX1014-Sandeep, 57 (describing how "SOC prevents overcharging of the battery when fully charged and prevents accidental discharge."). A user would have appreciated such improved safety and avoidance of battery damage via

overcharging or discharging including because batteries for electric vehicles were expensive. Damaging a battery would have led to needing to replace the battery earlier than anticipated, leading to user frustration at additional expenses. Instead, the combination herein would have helped mitigate such issues by monitoring battery more frequently, thus avoiding the problems mentioned above and avoiding damaging the battery from such preventable causes.

156. The modification is a simple combination of prior art elements (receiving information indicative of charge remaining in an electrical vehicle battery, per Fujita alone or Fujita in combination with Suyama, and an electric vehicle charging system, per Keltz-078) according to known methods to yield predictable results (improved monitoring of an electric vehicle while charging, and more timely updates to the user about the state of the charging operation). This modification is also a use of a known technique of battery monitoring to improve similar electric vehicle battery charging systems and vehicles in the same way.

157. A POSITA would have had a reasonable expectation of success in making the combination. Monitoring batteries during charging, and in turn estimating and displaying information relevant to battery charging, was very well-known to a POSITA at the time. The prior art mapped herein provides such teachings to a POSITA. Further, this would have been obvious to a POSITA that monitoring a component would have provided more information about such component (e.g.,

vehicle battery), which would have allowed for earlier detection of when a problem has arisen compared to not utilizing such monitoring. As I note below, the modification would have been routine, straightforward, and well-within the skillset of a POSITA. Kelty-078 already teaches “querying or monitoring” the “state of charge (SOC)” of the battery pack 26 and notifying the user when fully charged. EX1004-Kelty-078, 5:9-21, FIG. 3; IX.A.6.b. Therefore, modifying to repeatedly receive SOC information during charging is a simple programming modification well within a POSITA’s skill. In this way, a POSITA would have had an express teaching, suggestion, or motivation for modifying the Kelty-078 combination to achieve the aforementioned benefits, which would have had a reasonable expectation of success as the modifications required would have required only straightforward and routine changes to programming instructions, which would have been well-within the skillset of a POSITA.

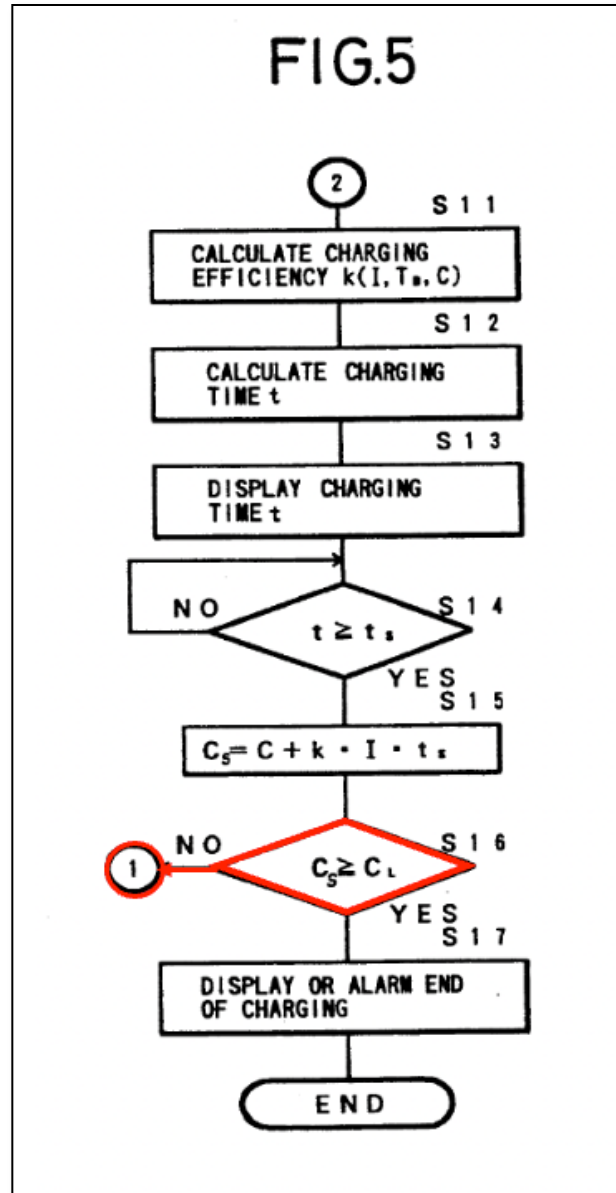
7. Claim 1[f]: “repeatedly estimate, based at least in part upon the at least one signal, an amount of time remaining to charge the battery, and”

a) Fujita’s Teachings

158. As discussed in §§IX.A.6.c-d, above, Fujita teaches repeatedly estimat[ing] the charge time (t) (an amount of time remaining to charge the battery) “during the charging” of vehicle 10 until battery 30’s residual charge (C) reaches at

least “the required electric energy to run the desired distance” (CL) entered by the driver. EX1006-Fujita, 2:41-42, 4:35-49, Claim 12, FIGS. 4-5.

159. Fujita teaches that “the charge time t is calculated according to the formula (step [S]12): $t=(C_L-C)/(k*I)$ ” based on the battery’s charging efficiency (k) (calculated using temperature (T_B), current (I), and charge level (C)). EX1006-Fujita, 4:21-30, FIG. 5. When a predetermined time (t_s) lapses, “the values of the charge current I , temperature T_B and residual amount C of the battery are renewed” and the residual amount of battery is re-calculated (C_s). EX1006-Fujita, 4:35-40. If C_s is less than the required charge to travel (C_L), the estimat[ion] steps after S9 “are repeated” as shown in Step S16 of FIG. 5. EX1006-Fujita, 4:40-49, FIGS. 4-5. Because the residual amount of electric energy of the battery 30 is revised after a lapse of time t_s , Fujita expressly teaches repeatedly calculating the charge time t at a periodicity of t_s (i.e., after every t_s period of time). Fujita teaches displaying the charge time t on display 44 and 50, included on the alarm/display means 22 and 49, as discussed in §IX.A.6.b below.



EX1006-Fujita, FIG. 5.

b) Motivation to Combine

160. A POSITA would have found obvious and been motivated to modify the modified Kelty-078 system to further repeatedly estimate an amount of time remaining to charge during charging. It was well-known the level of charge (SOC)

of an electric vehicle's battery fluctuates in response to environmental variables (e.g., changes in temperature, the user drawing power during charging by running the A/C or radio, age of the battery, grid load and "charging of the vehicle during periods of low power consumption"). EX1004-Kelty-078, 6:1-2. Thus, repeatedly monitoring the battery and estimating charging time ensures a driver is alerted with minimal delay when the time remaining to charge is extended or otherwise altered due to changing charging conditions.

161. Further, a user would have appreciated being alerted quickly when the electric vehicle was sufficiently charged for use. Claims 1[h]-1[i]. Repeatedly estimating and updating the time to charge also allows the user to plan their trip, e.g., determine whether the user has time to wait until the vehicle is fully charged. Kelty-078 also at least suggests the modification in teaching the user may monitor the SOC. EX1004-Kelty-078, 5:9-21; §IX.A.6.b; motivations to combine, §IX.A.6.e.

162. As another example of this concept being known in the prior art, Hayashi teaches this. EX1055-Hayashi, [0029]-[0030] ("The information displayed in the aspect of the invention described above (claim 8) may consist solely of direct information related to the charging status of the charging device, but preferably includes the predicted time until charging is complete, as this allows the user to plan the next scheduled use of the charging device.").

163. The combination would have been obvious at least because of the numerous, known advantages obtained from repeatedly estimating the level of charge and time to charge. Sandeep (EX1014) teaches that “state of charge (SOC)” “provides an indication of the amount of electrical energy remaining in the battery pack.” EX1014-Sandeep, 57. A POSITA would have appreciated that

“[a] good SOC calculator provides the following advantages for EVs:

- Longer battery life
- Better battery performance
- Improved power system reliability
- Avoid no-start conditions
- Reduced electrical requirements
- Smaller/lighter batteries
- Improved fuel economy
- Prefailure warning of the battery pack
- Decreased warranty costs.”

EX1014-Sandeep, 57. Therefore, a POSITA would have valued repeatedly detecting the battery charge level and charging time to “provide optimization of recharge without detriment to battery life.” EX1014-Sandeep, 58.

164. A POSITA would have further valued repeatedly estimating a time remaining to charge because it was well-known that the SOC of an electric vehicle’s

battery fluctuates in response to environmental variables (e.g., changes in temperature, the user drawing power during charging by running the A/C or radio, age of the battery, grid load and “charging of the vehicle during periods of low power consumption”). EX1004-Kelty-078, 6:1-2. In this manner, repeatedly estimating a time remaining to charge would have provided a more accurate time estimate for a user instead of only estimating a time to charge at the beginning of a charging session, for example, and then not performing another estimate. Therefore, repeatedly estimating the time remaining would have accounted for environmental variables and advantageously yielded a more accurate estimate for time remaining to charge.

165. Thus, repeatedly monitoring the battery and estimating charging time ensures a driver is alerted with minimal delay when the time remaining to charge is extended or otherwise altered due to changing charging conditions. This is because the user would have been made aware of changes to the time estimate on a repeated basis, thus allowing the user to be prepared for when the charging should end. Further, a user would have appreciated being alerted quickly when the electric vehicle was sufficiently charged for use. *See* Claims 1[h]-1[i] below. Alerting a user quickly would have been advantageous to allow a user to resume using the charged vehicle. Conversely, if charging completes and the user is not made aware of this, a

user would have to wait additional time, potentially leading to user frustration at having waited additional time when such was unnecessary.

166. A POSITA would have also valued that repeated monitoring would improve the user's safety by quickly detecting charging faults. EX1004-Kelty-078, 5:21-23 (describing "vehicle 12 notifying the user or driver 20 that a problem occurred during charging of the battery 26 (step 313)..."), FIG. 3. Applying Fujita's teachings alone or Fujita and Suyama's teachings to the modified Kelty-078 system would have improved its overall performance by consistently monitoring the vehicle's battery to prevent detrimentally overcharging or discharging. EX1014-Sandeep, 57 (describing how "SOC prevents overcharging of the battery when fully charged and prevents accidental discharge."). A user would have appreciated such improved safety and avoidance of battery damage via overcharging or discharging including because batteries for electric vehicles were expensive. Damaging a battery would have led to needing to replace the battery earlier than anticipated, leading to user frustration at additional expenses. Instead, the combination herein would have helped mitigate such issues by monitoring battery more frequently, thus avoiding the problems mentioned above and avoiding damaging the battery from such preventable causes.

167. The combination would have been use of a known technique (Fujita's repeatedly estimating the time (t) to charge during charging) to improve Kelty-078's

similar charging system in the same way as Fujita's (i.e., user is informed of the time to charge).

168. The modification is a simple combination of prior art elements (receiving information indicative of charge remaining in an electrical vehicle battery and using that information to calculate remaining charge time, per Fujita alone or Fujita in combination with Suyama, and an electric vehicle charging system, per Kelty-078) according to known methods to yield predictable results (improved monitoring of an electric vehicle while charging, and more timely updates to the user about the state of the charging operation).

169. A POSITA would have had a reasonable expectation of success in making the combination for at least the reasons provided for Claim 1[e]. In particular, the modification is simple programming of repeatedly monitoring the time to charge, where Kelty-078 already teaches monitoring the level of charge and sophisticated techniques for controlling charging of the battery, including time-based charging. EX1004-Kelty-078, 5:9-57, pinpoint at 5:5:40-44. Therefore, the modification requires programming well within the POSITA's skill. The prior art mapped herein provides such teachings to a POSITA. Further, this would have been obvious to a POSITA that monitoring a component would have provided more information about such component (e.g., vehicle battery), which would have allowed for earlier detection of when a problem has arisen compared to not utilizing such

monitoring. As I note below, the modification would have been routine, straightforward, and well-within the skillset of a POSITA.

170. First, in the modification, the estimat[ion] is based at least in part Fujita or Suyama's detection of residual charge in the battery. See §§IX.A.6.c-.e above. Fujita teaches that "when a lapse of time t_s is detected, the values of the charge current I , temperature T_B and residual amount C of the battery are renewed..." EX1006-Fujita, 4:35-40. Thus, there would have been a reasonable expectation of success of combining Suyama's express signal teachings with Fujita's express teachings of calculating time remaining to charge (charge time t) in the modified Kelty-078 system because Fujita already contemplates regularly detecting and updating the amount of residual electric energy C in the battery. Thus, the prior art provides teachings that would have informed a POSITA for performing the routine and straightforward modification.

171. Second, Suyama and Fujita both measure residual battery levels as part of their estimations. Suyama calculates charge-expected completion time based on the residual capacity depth-of-discharge (percent used) of the battery, similar to Fujita's calculation of charging time t is based in part on "a current residual amount C of electric energy of the battery...." EX1007-Suyama, 8:4-9; EX1006-Fujita, 3:67-68. Implementing these techniques would therefore have had a reasonable expectation of success including because of their similarity.

172. Third, Kelty-078 already contemplates that “the user 20 may be capable of querying or monitoring the electric vehicle’s battery pack and cells 26 for its state of charge (SOC) (step 309).” EX1004-Kelty-078, 5:9-13. In this way, a POSITA would have had an express teaching, suggestion, or motivation for modifying the Kelty-078 combination to achieve the aforementioned benefits, which would have had a reasonable expectation of success as the modifications required would have required only straightforward and routine changes to programming instructions, which would have been well-within the skillset of a POSITA.

8. Claim 1[g]: “repeatedly display on a display mounted within the vehicle and within view of a user seated in the vehicle:”

a) Summary of the Combination for Claims 1(g)-1(i)

173. Kelty-078 teaches Claim 1[g]’s display mounted within the vehicle in view of a user (i.e., display device 30). *See* §IX.A.8.b. Fujita teaches Claim 1[h]’s information repeatedly calculated and displayed during charging (*see* §IX.A.9), and Suyama teaches Claim 1[i]’s information repeatedly calculated and displayed during charging (*see* §IX.A.10). Claim 1[g]’s step of repeatedly display certain information must be performed during charging, as recited in Claim 1[e]. In the combination, the information repeatedly calculated in Claims 1[h]-1[i] is repeatedly display[ed] on Kelty-078’s display 30 and during charging (per Claim 1[e]). Namely, Fujita teaches repeatedly display[ing] the amount of time remaining to charge (i.e., display 44/50),

and Suyama teaches repeatedly display[ing] information indicative of the charge level (i.e., capacity indicator 102). *See* Claims 1[e] and 1[f] (above), 1[h] and 1[i] (below).

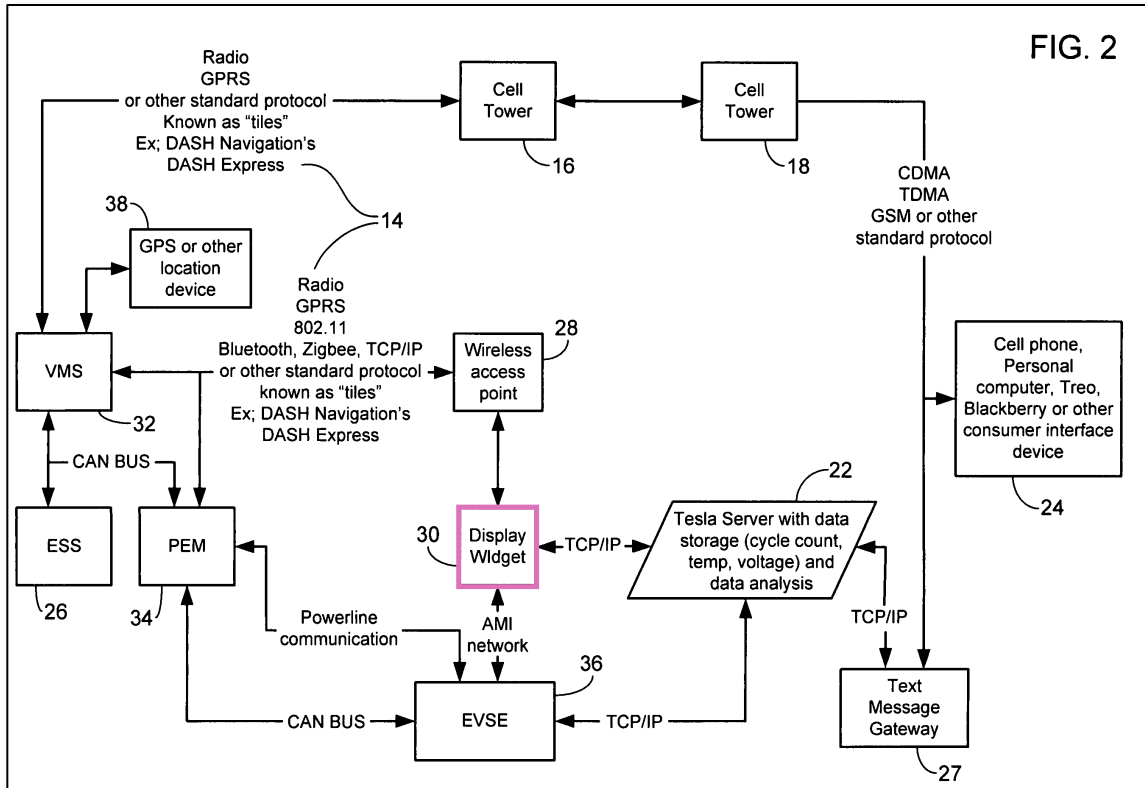
174. A motivation to repeatedly display certain information taught by Fujita and Suyama for respective Claims 1[h]-1[i] is provided immediately below the mapping, and a motivation to combine Kelty-078 with Fujita and Suyama for Claims 1[g]-1[i] is provided in §IX.A.10.c (at the end of the Claim 1[i] mapping).

b) Kelty-078's Teachings

175. Kelty-078 teaches that “electric vehicle communication interface 10 also may include an in vehicle display 30,” which is further taught as “dashboard display 30...arranged in any part of the vehicle 12 including but not limited to sun visors, heads up displays, [and] anywhere in the instrument panel...” (mounted within the vehicle). EX1004-Kelty-078, 6:32-39, FIG. 2. “[T]he user 20 may be prompted via the display device 30 in the vehicle 12 to choose or select one of a plurality of predetermined charging options for the electric vehicle battery pack 26 (step 325)” when turning off the vehicle. EX1004-Kelty-078, 6:40-45, FIG. 3. Kelty-078's display 30 is within view of a user seated in the vehicle, as it is (1) taught by Kelty-078 to be on the “dashboard,” a “heads up display,” and “in the instrument panel”; and (2) prompts users (specifically including the “driver of the vehicle”) to “select” charging options, indicating users view the display for selecting while

seated in the vehicle. EX1004-Kelty-078, 6:35-45. Dashboard displays, displays in in the instrument panel, and heads up displays were readily known to be within view of a user seated in the vehicle were well known in the prior art. *See* §VI.B.3. For example, Drummond discusses an “instrument panel 10” that is “on the dashboard of the automobile immediately in front of the driver so that it will attract his attention without any effort on his part.” EX1027-Drummond, 2:26-30; *see also* EX1041-Cramer, [0307] (describing how “the user interface can include a multi-functional flat-panel display screen for displaying information for the driver.”).

176. Kelty-078 teaches VMS 32 is the onboard vehicle computer that controls various vehicle systems, including the ESS 26 (battery) and PEM 34 (responsible for charging battery 26). As shown in FIG. 2, VMS 32 controls display 30 via “CAN BUS” through PEM 34 and electric vehicle service equipment module (EVSE) 36. EX1004-Kelty-078, 7:64–8:2, FIG. 2. Thus, Kelty-078 teaches the controller (VMS 32) is configured to perform Claim 1[g], [h] and [i]’s functionality. EX1004-Kelty-078, 7:44-64; *see also* Claims 1[a] (discussing Kelty-078’s controller teachings), 1[h]-1[i] (below; discussing information the controller is configured to repeatedly display on display 30, per Fujita and Suyama).



EX1004-Kelty-078, FIG. 2.

177. Claim 1[g]’s mapping for *during charging...repeatedly display* is discussed below for Claims 1[h]-1[i] in the combination, as noted above for the Summary of the Combination at §IX.A.8.a.

9. Claim 1[h]: “during charging ... repeatedly display ... information indicative of the amount of time remaining to charge the battery based at least in part upon the estimating step, and”

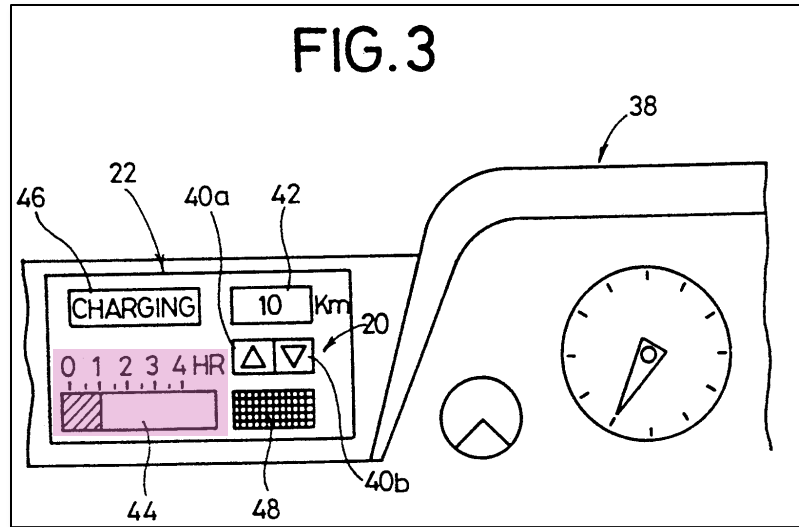
a) Kelty-078’s Teachings

178. As discussed above in §V.A.8.b, Kelty-078 teaches “in vehicle” display device 30 (*a display mounted within the vehicle*). EX1004-Kelty-078, 6:32-39, FIG. 2; *see* Claim 1[g].

b) Fujita's Teachings

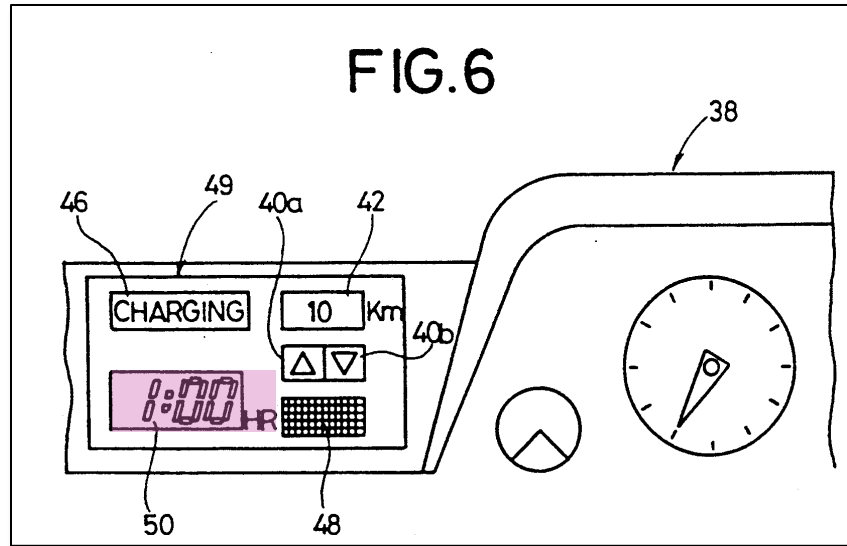
179. Fujita teaches *during charging...repeatedly display...information indicative of the amount of time remaining to charge the battery based at least in part upon the estimating step*, namely charge time display 44 and/or 50. EX1006-Fujita, 4:31-33, 4:59-64.

180. Per Claim 1[f]'s mapping, Fujita teaches repeatedly estimating, during charging, a charge time t remaining to charge the battery. Specifically, Fujita teaches that **“charge time t is displayed on the charge time display 44 of the alarm/display means 22, as the residual time before the completion of charging (step [S]13).”** EX1006-Fujita, 4:31-33. Additionally, Fujita teaches “a still further object of the present invention is to provide a battery charging device for electric vehicles, in which the above-mentioned judging circuit generates an alarm signal to activate alarm means when the electric energy of the battery reaches, during the charging, the required electric energy to run the desired distance.” EX1006-Fujita, 2:37-42. Fujita teaches two embodiments for displaying time to charge (t). Fujita teaches “alarm/display means 22 includes a charge time display 44 for displaying a time required for charging the battery,” as shown in FIG. 3:

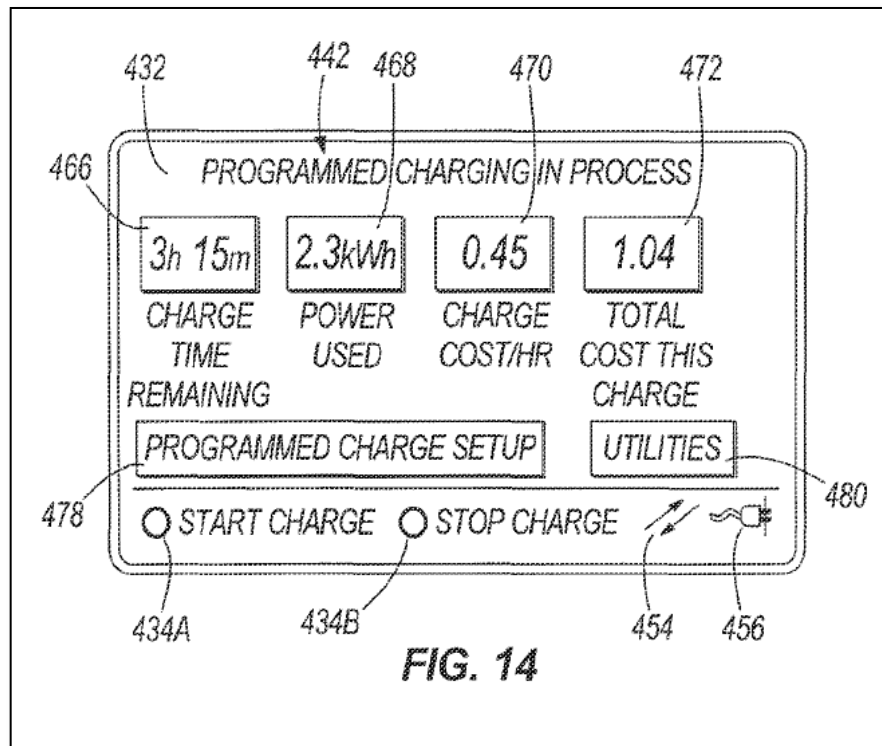


EX1006-Fujita, 3:45-47, FIG. 3. Further, Fujita teaches “this charge time t is displayed on the charge time display 44 of the alarm/display means 22, as the residual time before the completion of charging (step 513).” EX1006-Fujita, 4:32-34.

181. Fujita also teaches that “alarm/display means 49 makes a display 50 of the charge time digitally using, for instance, a seven-element LCD display” per FIG. 6 shown below:



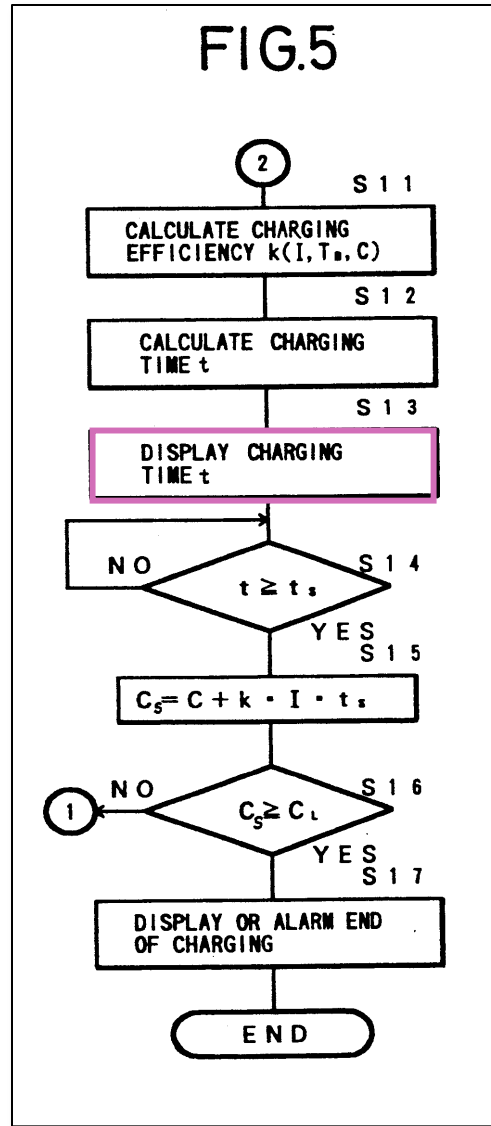
EX1006-Fujita, 4:60-62, FIG. 6, *cf.* with EX1001, FIG. 14. FIG. 14 of the '011 Patent is depicted below:



EX1001, FIG. 14.

182. A POSITA would have understood that display 44 of FIG. 3 and display 50 of FIG. 6 present the same charge time t , but FIG. 6 displays the information “digitally” instead. EX1006-Fujita, 4:60-62 (“In this embodiment, the alarm/display means 49 makes a display 50 of the charge time digitally using, for instance, a seven-element LCD display.”). Because Fujita teaches displaying the charge time t (e.g., 1 hour as shown in both FIGS. 5-6) on display 30 “before the completion of charging,” Fujita teaches *during charging...display information indicative of the amount of time remaining to charge the battery*). EX1006-Fujita, 4:32-34.

183. Further, Fujita teaches that “operations after the step of S9 are **repeated**” (including *display* Step S13) until “residual amount C of the battery” reaches the level required to drive the user’s desired distance (C_L). *See generally* EX1006-Fujita, 4:27-49. FIG. 5 below depicts a flowchart including step S13, which displays charging time t . EX1006-Fujita, 4:32-34 (“This charge time t is displayed on the charge time display 44 of the alarm/display means 22, as the residual time before the completion of charging (step S13).”).



EX1006-Fujita, FIG. 5. Calculation of charge time t is performed at Step S12, and display of charge time t is performed at Step S13, so the estimation and display of the updated charge time t is repeated, per Step S16, when the required charge level C_L is not reached. EX1006-Fujita, 4:48-49 ("If $C_s < C_L$, the operations after the step of S9 are **repeated**."). As noted above, Fujita teaches that steps S10-S15 (which includes display step S13) are repeated. Because step S13 (the displaying step) is

repeated, the charge time t is repeatedly displayed. Therefore, Fujita teaches *repeatedly display[ing]* the charge time t *during charging*. As noted above, the displaying step occurs while charging occurs, and the displaying repeats while charging occurs until C_S is greater than or equal to C_L . EX1006-Fujita, 4:28-49, 4:59-64.

184. Fujita teaches that the displayed charge time (t) is based at least in part upon the estimating step. *See* Claim 1[f].

c) Motivation to Combine

185. *See* Claims 1[f], 1[i].

186. A POSITA would have been motivated and found it obvious to repeatedly display the remaining charge time, per Fujita's charge time display, on Kelty-078's display 30 within view of the driver in the modified Kelty-078, for the reasons described below. As discussed above, Kelty-078's VMS 32 onboard vehicle computer is the *controller configured to* perform Claim 1[h]'s functionality. EX1004-Kelty-078, 7:44-64; *see also* Claim 1[a]. Providing the amount of time to charge during charging on an in-vehicle display allows the user to wait in their car while completing charging and stay repeatedly informed on the time to charge, especially considering the time to charge may fluctuate based on temperature and other power draws (such as A/C running).

187. First, if the user wishes to remain inside the vehicle during charging due to inclement weather or for safety purposes, for example, the user would have appreciated viewing the updated amount of time they would need to wait for the car to complete charging. Updating a display with new information was a well-known practice in the prior art. For example, a display may be updated when a user receives a text message, alerting the user that he or she may desire to look at the device's display to read the new message. EX1052-Hwang, [0019] (discussing a message display method in which the steps include “**receiving a message**, detecting message information from the received message, and **displaying detected caller information** on LCD by scroll system”).

188. Second, it was well-understood prior to the '011 Patent that temperature dramatically impacts the rate at which batteries recharge. I noted this above. *See* Claims 1[e]-1[f] where I opined regarding the prior art teaching temperature impacting battery charging rate. Therefore, a POSITA would have appreciated repeated updates regarding the expected completion time considering the ambient temperature either slows or accelerates the charging rate in real-time. Indeed, charging may take hours to complete, and on a hot or cold day, the temperature may increase or decrease, leading to changes in expected completion time for charging. By repeatedly providing updates regarding expected completion time, the temperature fluctuations are accounted for, and the user is advantageously able to

receive more accurate charging time estimates compared to only receiving a single estimate.

189. Third, if a user was drawing power while charging the vehicle by listening to the radio or running the air conditioning or heater, for example, a POSITA would have valued knowing how those choices impacted how long it would take to charge the car in case they need to leave the charging station at a certain time to reach their destination. Indeed, a user would have been able to make a more informed choice to turn certain features on or off (e.g., air conditioning, headlights) if the user wishes for charging to complete sooner.

190. Fourth, a POSITA would have understood it is valuable to consistently monitor batteries to ensure they are charging appropriately and detect if the vehicle is not charging as predicted. This would have informed a user of charging abnormalities such as a potential problem with the vehicle or charging station. A user may waste time because charging may be stopped or interrupted due to a problem, and if the user is unaware of such an issue, this would lead to user frustration. Thus, informing the user would have been advantageous. Further, the vehicle itself monitoring the charging process (even if a user is not informed of such) would have been advantageous to detect abnormalities that would best be addressed by stopping charging or taking some other corrective action, for example.

191. Finally, it was well-known that visuals presented on dashboard displays are useful tools for drivers to quickly interpret information. Indeed, it was known that including “instrument panels on the vehicle dashboard” (e.g., comprising “digital meter displays”) permits the driver to easily “monitor” the vehicle’s systems including the battery. EX1015-Nadal, 5. Therefore, a POSITA would have greatly appreciated an easily interpretable number (e.g., 1:00 HR, per Fujita’s display 50) to quickly understand how long charging would take.

192. The modification is a simple combination of known prior art elements (displaying the length of time left to charge an electric vehicle, and a vehicle’s display) according to known methods (displaying calculated information to a screen) to yield predictable results (providing a driver information about an electric vehicle’s charging status). This modification would also been using of a known technique to improve similar devices in the same way.

193. This modification would have had a reasonable expectation of success and been well-within the expertise of a POSITA given the ubiquitousness of using displays to provide users information relevant to a vehicle, such as Fujita’s own display means 22 and 46 “provided on an instrument panel 38 of the electric vehicle 10.” EX1006-Fujita, 3:38-40; *see above* §VI.B.3; EX1027-Drummond, 2:26-30; EX1041-Cramer, [0307].

194. Further, Kelty-078 already contemplates displaying information to the user on display 30, such as “charging options” or “messages” like “servicing requirements or tips to increase the efficiency of the vehicle 12, such as checking tire pressure, battery temperature and the like.” EX1004-Kelty-078, 6:40-45, 8:49-52. Thus, the modification would have been able to leverage Kelty-078’s existing hardware and information displaying and would only have had to add additional information for display. This would have required only straightforward and routine changes to programming instructions, which would have been within the skillset of a POSITA. Therefore, the combination would be straightforward and well within a POSITA’s expertise.

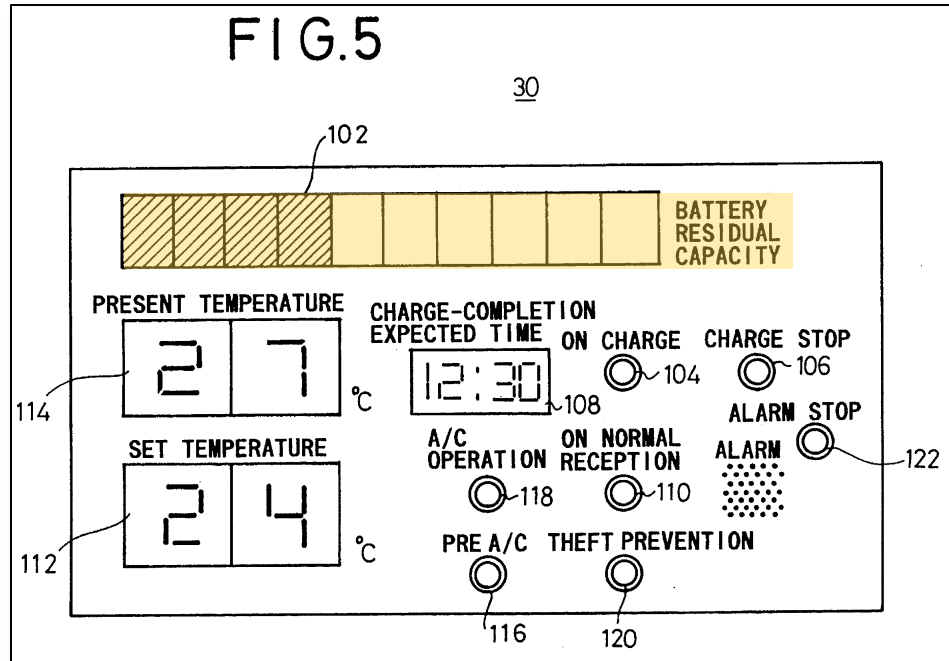
10. Claim 1[i]: “during charging ... repeatedly display ... information indicative of the level of charge of the battery.”

a) Kelty-078’s Teachings

195. As discussed above in Claim 1[g], Kelty-078 teaches “in vehicle” display device 30 (*a display mounted within the vehicle*). EX1004-Kelty-078, 6:32-39, FIG. 2; *see* Claim 1[g].

b) Suyama’s Teachings

196. Suyama teaches *display[ing] information indicative of the level of charge of the battery*, namely displaying the residual capacity of the battery during charging, namely battery residual-capacity indicator 102:



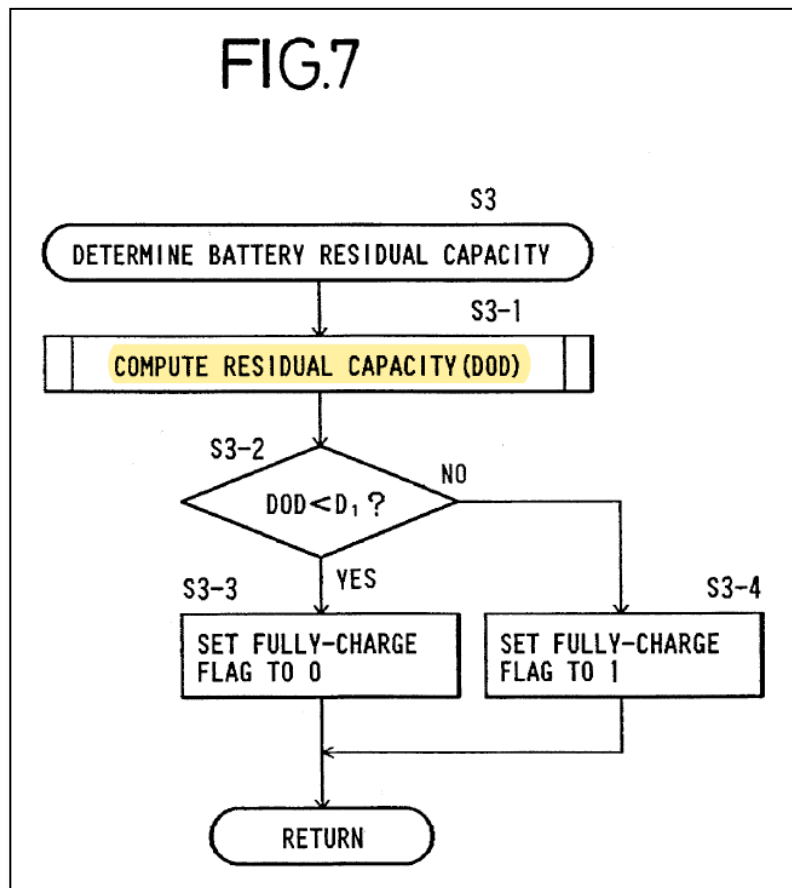
EX1007-Suyama, FIG. 5, 7:43-45. Like the '011 Patent, Suyama's indicator 102 is a bar chart "lighted so as to correspond to the computed residual capacity DOD" (depth-of-discharge), where DOD is commonly represented as a percentage in the art. EX1001, 12:47-51; EX1007-Suyama, 8:4-5, 9:13-15; *see* EX1051-Barsoukov, 4:56-62 (describing DOD as being "expressed as a percentage"). Further, Suyama teaches "the transmission-signal coding ECU 52 reads data indicative of the battery residual capacity DOD outputted from the charge-status determining ECU 48, e.g. data corresponding to 10%, and data determined in Step S4 and outputted from the charge control ECU 38, e.g., data indicative of the on-charge defined by the charge-status display mode A." EX1007-Suyama, 12:13-18. Suyama's FIG. 15A is reproduced below:

FIG.15A

RESIDUAL CAPACITY											
STATUS CODE	RESIDUAL CAPACITY(%)										
	0%	10	20	30	40	50	60	70	80	90	100
OFF	A0	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10
COMPLETION	B0	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10
ON CHARGE	C0	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10
STOP	D0	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10

EX1007-Suyama, FIG. 15A.

197. Suyama further teaches “[a] routine for determining the **residual capacity of the main battery 18** is executed in Step S3”:



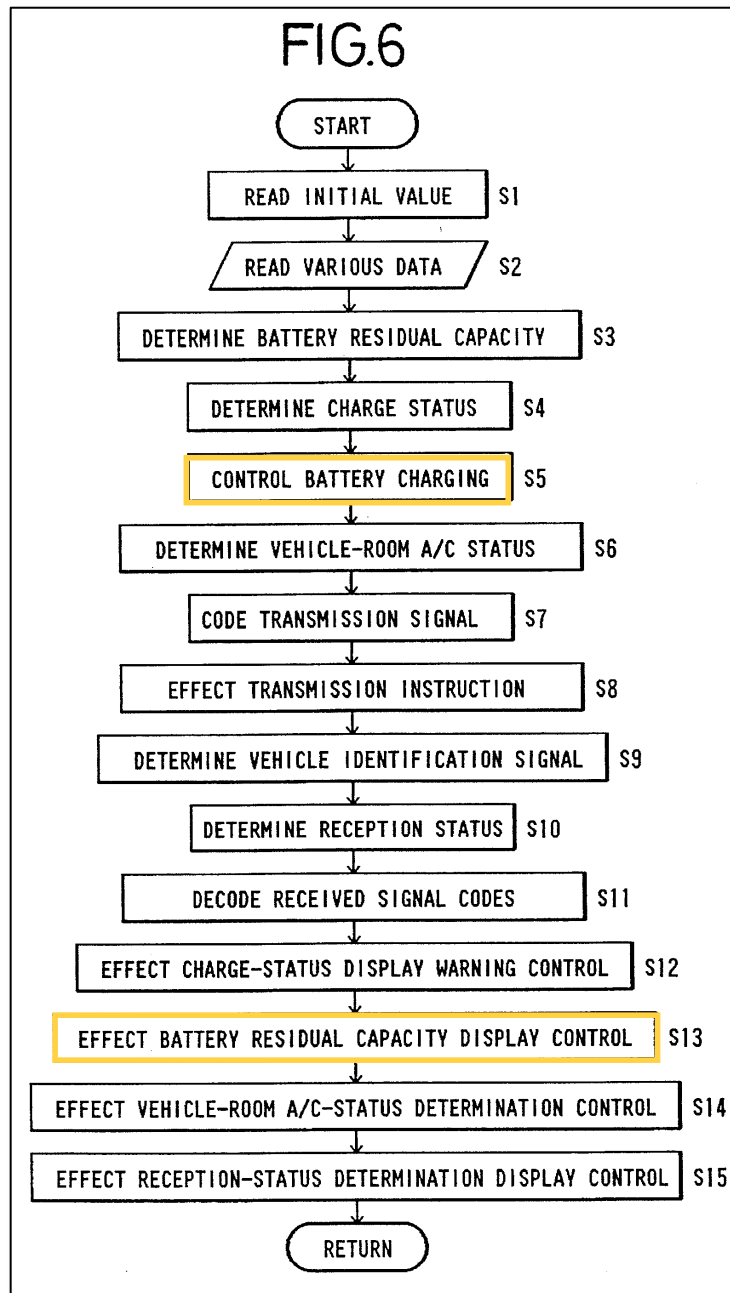
EX1007-Suyama, 8:58-59, FIG. 7, 8:36-45, FIG. 6. A “charge-status determining ECU 48 computes” (Step S3-1) and then “compares the residual capacity DOD with a capacity D1 produced when the main battery 18 is fully charged” (Step S3-2). EX1007-Suyama, 8:59-67. If the battery is fully charged, the residual-capacity indicator 102 lights up, the present time is displayed on “charge-completion expected time indicator 108,” and the charge stop indicator 106 is lighted. EX1007-Suyama, 9:6-12.

When, on the other hand, the fully-charged flag is set to "0", the **battery residual-capacity indicator 102 is lighted so as to correspond to the computed residual capacity DOD**. Further, the charge-completion expected time determined by computation is represented by the charge-completion expected time indicator 108 and the on-charge indicator 104 will light up.

EX1007-Suyama, 9:12-19, FIGS. 3, 7 (Steps S3-2, S3-3). 8:67–9:2; *see also* Claim 1[e] (discussing Suyama’s “signal” teachings).

198. Suyama also expressly teaches the residual capacity is estimated *during charging and repeatedly display[ed] during charging*. Suyama teaches that “display circuit 30 displays the state of charging of the main battery **while being charged**,” such as displaying “the remaining capacity of the main battery 18...on the residual-capacity indicator 102 (Step S13).” EX1007-Suyama, 8:36-37, 8:41-43. “Steps S1

through S15 are **repeatedly** executed,” including the *display* step S13. EX1007-Suyama, 8:50-51.



EX1007-Suyama, FIG. 6.

c) Motivation to Combine

199. *See* Claims 1[e], 1[h].

200. A POSITA would have been motivated and found it obvious to repeatedly display and update Suyama's indicator 102 (depicting the residual capacity of battery 26), on Kelty-078's in-vehicle display 30 in the modified Kelty-078 system. It was well-understood prior to the '011 Patent that a "SOC calculation can be displayed in terms of useful battery capacity" and that "[a]n accurate battery state-of-charge indicator is essential to prevent stranding and to provide economical operation of" devices containing batteries that require recharging. EX1014-Sandeep, 57; EX1018-Aylor, 1. Providing the level of charge during charging on an in-vehicle display allows the user to wait in their car while completing charging and stay repeatedly informed on the time to charge, especially considering the time to charge may fluctuate based on temperature and other power draws (such as A/C running).

201. This would have been similar to a typical fuel (or charge) gauge (whether analog or digital) in a vehicle, because such gauges allow a user to quickly and intuitively understand what the approximate fuel/charge level of the vehicle is without having to interpret data such as "9.5 gallons of gasoline remaining," for example. Indeed, the user may not know what 9.5 gallons of gasoline means in relation to the total fuel capacity of the vehicle (which may be 14 gallons, 18 gallons, etc.). Of course, this same reasoning would also apply to the charge level of an

electric vehicle, but would use different units. On the other hand, a gauge with a bar representation or other indication allows a user to easily see at a glance that the fuel/charge level is “half full” or “three-quarters full,” for example.

202. There are several additional reasons why a POSITA would have valued having charging-related information displayed within view while charging their electric vehicle. First, if the user wishes to remain inside the vehicle during charging due to inclement weather or for safety purposes, for example, the user would have appreciated seeing the updated level of charge to determine when the battery reaches the desired capacity. Providing updated charging information would have been in line with typical user interface updating practices used on a wide variety of devices in the prior art. EX1052-Hwang, [0019]. This would have provided useful information to a user of the vehicle, thus the modification would have been desirable for a POSITA.

203. Second, it was well-understood prior to the '011 that temperature dramatically impacts how fast batteries recharge. I noted this above. *See* Claim 1(e)(c)-(d), 1(f)(b)-(c) where I opined regarding the prior art teaching temperature impacting battery charging rate. Therefore, a POSITA would have appreciated repeated updates regarding the charge level considering the ambient temperature either slows or accelerates recharge rate in real-time. Indeed, charging may take hours to complete, and on a hot or cold day, the temperature may increase or

decrease, leading to changes in how fast the battery recharges. By repeatedly providing updates regarding charge level, the temperature fluctuations are accounted for, and the user is advantageously able to receive more accurate charge level estimates compared to only receiving a single estimate.

204. Third, if a user was drawing power while charging the vehicle by listening to the radio or running the air conditioning or heater, for example, a POSITA would have valued knowing how those choices impact the charge level of the battery. Indeed, a user would have been able to make a more informed choice to turn certain features on or off (e.g., air conditioning, headlights) if the user wishes for charging to complete sooner.

205. Fourth, a POSITA would have understood it is valuable to consistently monitor batteries to ensure they are charging appropriately and detect if the vehicle is not charging as predicted. This would have informed a user of charging abnormalities such as a potential problem with the vehicle or charging station. A user may waste time because charging may be stopped or interrupted due to a problem, and if the user is unaware of such an issue, this would lead to user frustration. Thus, informing the user would have been advantageous. Further, the vehicle itself monitoring the charging process (even if a user is not informed of such) would have been advantageous to detect abnormalities that would best be addressed by stopping charging or taking some other corrective action, for example.

206. Finally, it was well-known that using visuals (e.g., indicator 102) in dashboard displays, like display 30, are useful for drivers to quickly interpret information. *See* §VI.B.3. Indeed, it was known that including “instrument panels on the vehicle dashboard” (e.g., comprising “digital meter displays”) permits the driver to easily “monitor” the vehicle’s systems including the battery. EX1015-Nadal, 5.

207. The modification is a simple combination of known prior art elements (a charge level indicator and a vehicle’s display) according to known methods (displaying calculated information to a display screen) to yield predictable results (providing a driver information about an electric vehicle’s charging status). As discussed above, Kelty-078’s VMS 32 onboard vehicle computer is the *controller configured to* perform Claim 1[i]’s functionality. EX1004-Kelty-078, 7:44-64; *see also* Claim 1[a]. This modification is also the use of a known technique to improve similar devices in the same way.

208. This modification would have had a reasonable expectation of success and been well-within the expertise of a POSITA given the ubiquitousness of using displays to provide users information relevant to a vehicle. *See* EX1006-Fujita, 3:38-40 (describing display means 22 “provided on an instrument panel 38 of the electric vehicle 10.” *See* ¶¶ 58-60. above where I discuss examples of vehicle displays including vehicle displays indicating battery status. Modifying Kelty-078 to utilize

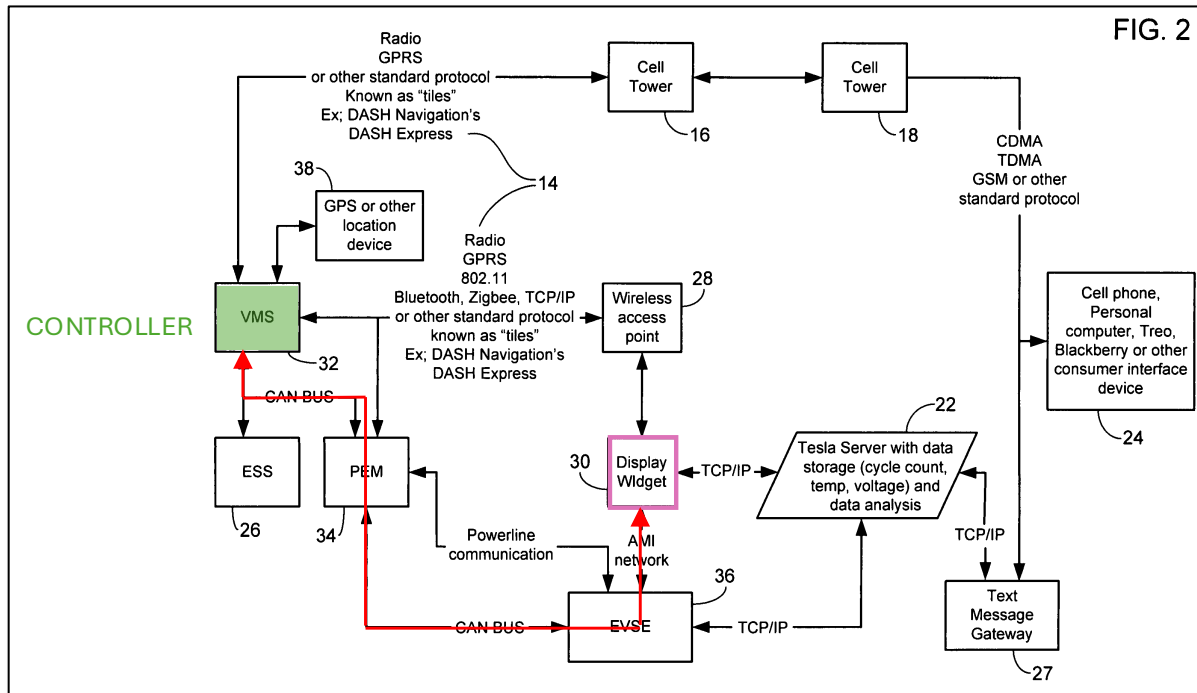
Suyama's known technique would have required only straightforward and routine changes to programming instructions, which would have been within the skillset of a POSITA. Thus, there would have been a reasonable expectation of success when modifying Kelty-078 in view of Suyama.

209. Additionally, using a battery level indicator was well-known prior to the '011 Patent. *See* ¶¶ 58-60. Thus, implementing a battery level indicator in the Kelty-078 combination would have been merely using a known technique requiring only straightforward and routine programming instruction modifications to achieve. Also, Kelty-078 already contemplates displaying information to the user on display 30, such as “charging options” or “messages” like “servicing requirements or tips to increase the efficiency of the vehicle 12, such as checking tire pressure, battery temperature and the like.” EX1004-Kelty-078, 6:40-45, 8:49-52. Because Kelty-078 already has hardware and programming instructions for providing information to a user via a display, the proposed modification would not have required modifying hardware. Therefore, also displaying the level of charge would be straightforward and well within a POSITA's expertise.

B. Claim 2: “The system of claim 1, wherein the display is electrically coupled to the controller.”

210. Kelty-078 teaches Claim 2. As shown in FIG. 2, Kelty-078 teaches VMS 32 (*controller*) is *electrically coupled* to the *display* (display 30) through PEM 34 and electric vehicle service equipment module (EVSE) 36 via CAN BUS and

AMI Network, as shown in FIG. 2 below. EX1004-Kelty-078, 7:59–8:2, FIG. 2; EX1001, 6:29-35 (describing how the terms ‘mounted,’ ‘connected,’ ‘supported,’ and ‘coupled’ and variations thereof are used broadly and encompass both direct and indirect mountings, connections, supports, and couplings.”).



EX1004-Kelty-078, FIG. 2. Such “communication” among “systems” in vehicle 12 (e.g., PEM 36, EVSE 36) “will allow for any messages to be communicated to the user of the vehicle via the display device 30 within the vehicle.” EX1004-Kelty-078, 7:48-59, 7:64–8:4. *See* Claims 1[a]-1[b], 1[g].

C. Claim 3: “The system of claim 1, wherein the controller is further configured to display a time of day at which charging will be completed based at least in part upon the amount of time remaining to charge the battery.”

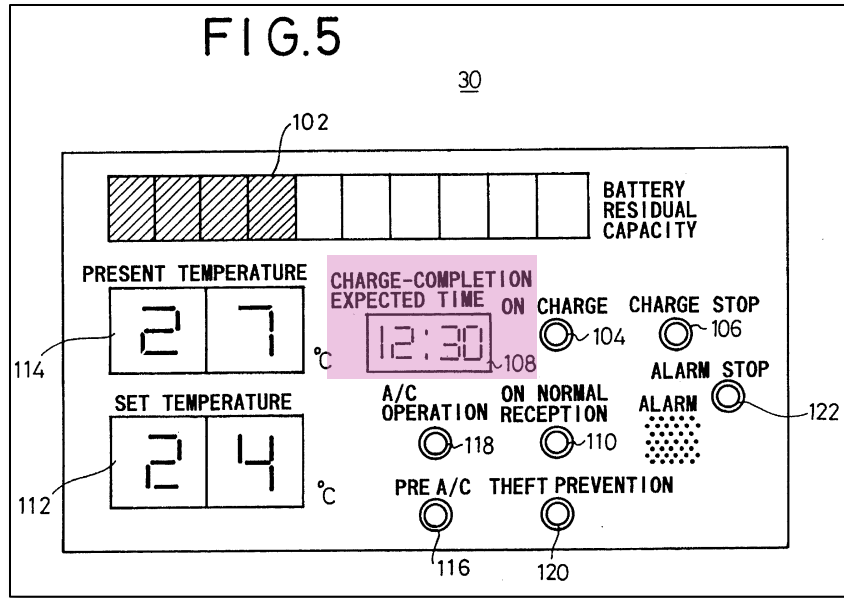
211. Suyama and Fujita combined with Kelty-078 teach Claim 3. *See* Claims 1[f]-[h], mapping estimating and displaying an amount of time remaining to charge.

1. Suyama’s Teachings

212. Suyama teaches a “charge-completion expected time indicator 108” configured to *display a time of day at which charging will be completed*. EX1007-Suyama, 9:16-18, 5:66–6:13, FIG. 5. I note that Suyama provides numerous examples of indicators:

The display circuit 30 includes indicators such as an indicator 102 for indicating the remaining capacity of the main battery 18, an on-charge indicator 104, a charge stop indicator 106, a charge-completion expected time indicator 108, an on-normal-reception indicator 110, a pre-A/C setting temperature indicator 112, a room or interior present-temperature indicator 114, a pre-A/C on-operation indicator 116, a pre-A/C operation completion indicator 118 and a theft-prevention indicator 120 and the like.

EX1007-Suyama, 7:43-51.



EX1007-Suyama, FIG. 5. FIG. 5's displayed "12:30" is a *time of day at which charging will be completed*. EX1007-Suyama, 9:16-18, 5:66-6:13, FIG. 5. Specifically, Suyama teaches "a charge-completion expected time indicator 108" which is depicted in FIG. 5 above and indicates a time of "12:30" in this example. A POSITA would have understood from Suyama that the expected time for charge completion would update according to each charging session, for example.

213. In the combination with Fujita, Suyama's displayed *time of day* is based *at least in part upon* Fujita's calculated time to charge (*the amount of time remaining to charge the battery*, as mapped for Claim 1[f]). See EX1006-Fujita, 4:21-49. Suyama teaches determining the residual capacity (or "depth of discharge" (DOD)) of the battery for comparison with a fully-charged capacity. EX1007-Suyama, 8:4-19, 8:58-9:5. Suyama then states that if the battery is not fully-charged, "the charge-

completion time [is] determined by computation.” EX1007-Suyama, 9:6-19; Suyama’s system is aware of both (1) the “present time” (*see* 8:58–9:5) and (2) if the battery is charging or not (*see* 9:6-19), teaching a flag set to “0” (charging) or “1” (fully-charged; not charging)). EX1007-Suyama, 9:6-19. Thus, if the flag is set to “0,” the battery is charging and the charge completion time is computed. EX1007-Suyama, 9:6-19. In the combination, it would have been obvious to compute the charge completion time, as taught by Suyama, based at least in part on Fujita’s time to charge, as further detailed in the following section.

214. Finally, Kelty-078 teaches VMS 32 is the onboard vehicle computer that controls various vehicle systems, including the ESS 26 (battery) and PEM 34 (responsible for charging battery 26), thus teaching *the controller configured to* perform Claim 3’s functionality. EX1004-Kelty-078, 7:44-64; *see also* Claim 1(a) (discussing Kelty-078’s *controller* teachings). In the combination, VMS 32 performs Claim 3. Specifically, Kelty-078’s controller (VMS 32) *is configured to display the time of day at which charging will be completed* (per Suyama) *based at least in part upon the amount of time remaining to charge the battery* (per Fujita).

2. Motivation to Combine

215. A POSITA would have been motivated and found obvious to determine by computation the charge-completion expected time (e.g., 12:30, per Suyama) by taking the known present time (per Suyama) and adding Fujita’s charge time (e.g.,

1 hour) to the present time (i.e., add one hour of charge time to the present time), to obtain Suyama's charging-completion expected time of 12:30. In the modification, the *time of day at which charging will be completed*, per Suyama's indicator 108 displaying 12:30, is *based on the amount of time remaining to charge the battery*, per Fujita's charge time (t) calculations of 1 hour to charge. EX1007-Suyama, 8:58-9:19; EX1006-Fujita, 4:15-49. Thus, this modification would have been using a known technique of addition to add charge completion time to the present time. Indicator 108 is *display[ed]* on Kelty-078's "in vehicle display 30." EX1004-Kelty-078, 6:33; Claims 1[g]-1[i]. A POSITA would have appreciated the planning convenience of viewing information relevant to charging (such as the predicted time at which charging will finish, e.g., 12:30) within the vehicle itself before exiting and for trip planning purposes while waiting for the charging to finish. Providing this information to a user would have been especially convenient so the user does not have to perform an addition operation to project when the charging will finish. Indeed, allowing the vehicle to perform this calculation and present the result to the user would have allowed the user to simply look at the predicted time at which charging will finish and plan his or her activities accordingly.

216. As another example of this concept being known in the prior art, Hayashi teaches this. EX1055-Hayashi, [0029]-[0030] ("The information displayed in the aspect of the invention described above (Claim 8) may consist solely of direct

information related to the charging status of the charging device, but preferably includes the predicted time until charging is complete, as this allows the user to plan the next scheduled use of the charging device.”).

217. The modification is a simple combination of known prior art elements (calculating the time a vehicle will finish charging by adding the “amount of time remaining to charge the battery” to the known “present time”) according to known methods (summing time values and displaying calculated information to a screen using a controller, VMS 32) to yield predictable results (providing a driver information about an electric vehicle’s charging status). This use of a known technique of calculating a finishing time by adding two quantities would have improved the similar Kelty-078 vehicle in the same way as Suyama and Fujita.

218. The modification would have a reasonable expectation of success given Suyama teaches that “the charge-completion expected time [is] determined by computation” and Fujita provides the implementation for said “computation” of the expected charge time. EX1007-Suyama, 9:16-17; EX1006-Fujita, FIGS. 4-5. I note that using a processor to perform an addition operation was a simple and straightforward task, thus this modification would have required only straightforward and routine changes to programming instructions to implement, which would have yielded a reasonable expectation of success when modifying the Kelty-078 combination.

D. Claim 4: “The system of claim 1, wherein the controller is further configured to receive a second wireless signal from the portable controller and, in response to receiving the second wireless signal, stop charging of the battery of the vehicle.”

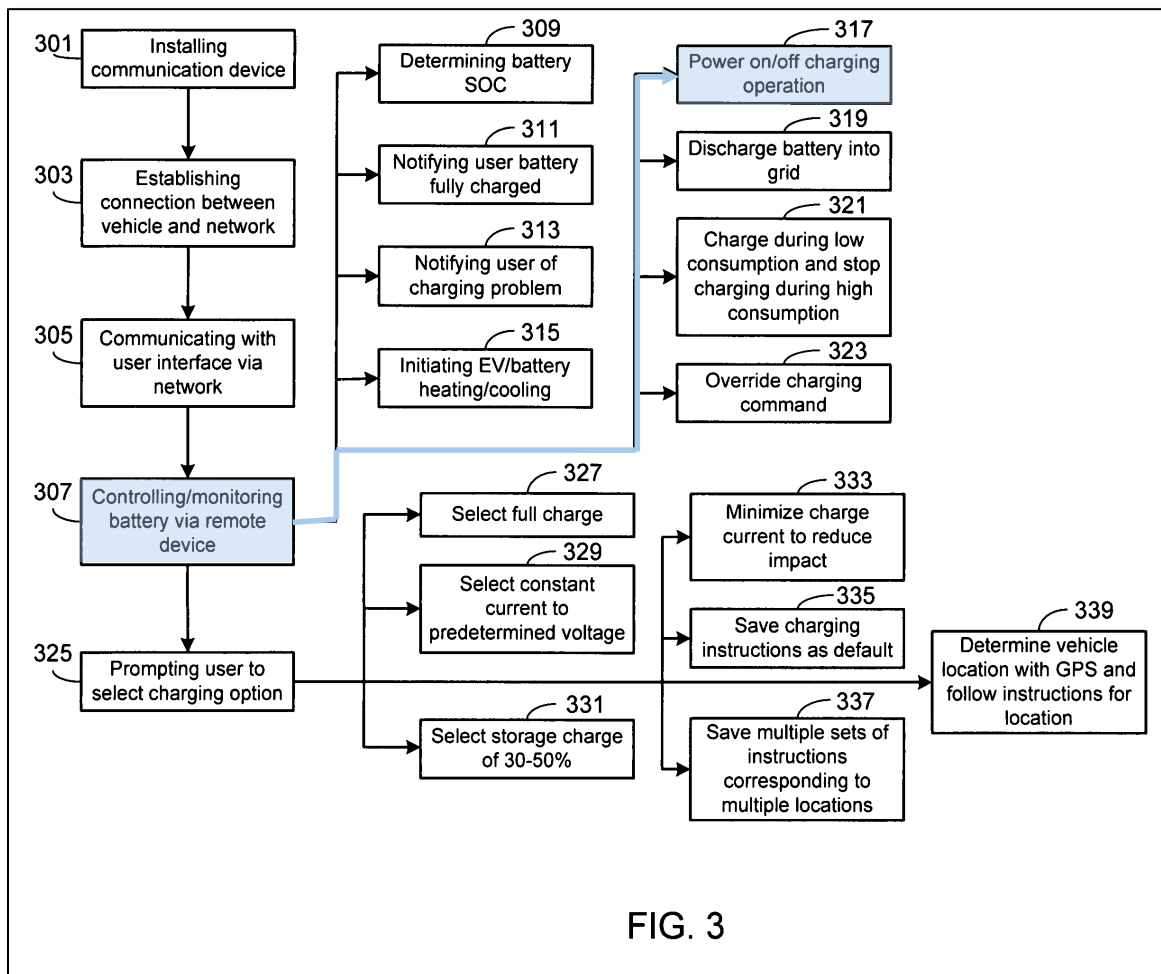
219. Kelty-078 teaches Claim 4.

220. *See* Claims 1[b]-1[c], mapping Kelty-078’s *portable controller* (mobile device 24). Because Kelty-078’s VMS 32 (*controller*) performs all control, monitoring, and coordination of the electric vehicle’s systems, VMS 32 *is configured to* perform Claim 4’s functionality. EX1004-Kelty-078, 7:43-53; *see* Claims 1[a]-1[c].

221. Kelty-078’s interface device 24 (*portable controller*) and *controller* (VMS 32) wirelessly communicate over Bluetooth. VMS 32 is thus configured to receive *wireless signal[s]* from portable device 24. *See* Claims 1[b]-1[c]; EX1001, 22:39-44, 10:38-53.

222. Kelty-078 further teaches the VMS receiving an instruction, i.e., *receiv[ing] a wireless signal*, to power off charging of the battery, i.e., *to stop charging*. EX1004-Kelty-078, 4:66, 5:40-52, FIG. 3 (see steps 317 and 319). Interface 10 is used to perform various steps for “controlling and monitoring a battery in the electric vehicle,” including *charging* battery 26 of electric vehicle 12 and powering on and off the charging operation of said battery. *See* EX1004-Kelty-078, Abstract, 3:49-54, FIG. 3 (Step 317).

223. As extensively discussed for Claim 1[d] and incorporated into this mapping, Kelty-078 teaches “an interface that will allow for communication between the user and the vehicle to enable the user to control certain aspects of charging of the battery....” EX1004-Kelty-078, 2:41-43. Specifically, user 20 powers “off” the “charging operation” from portable device 24 (“such as a cell phone”):



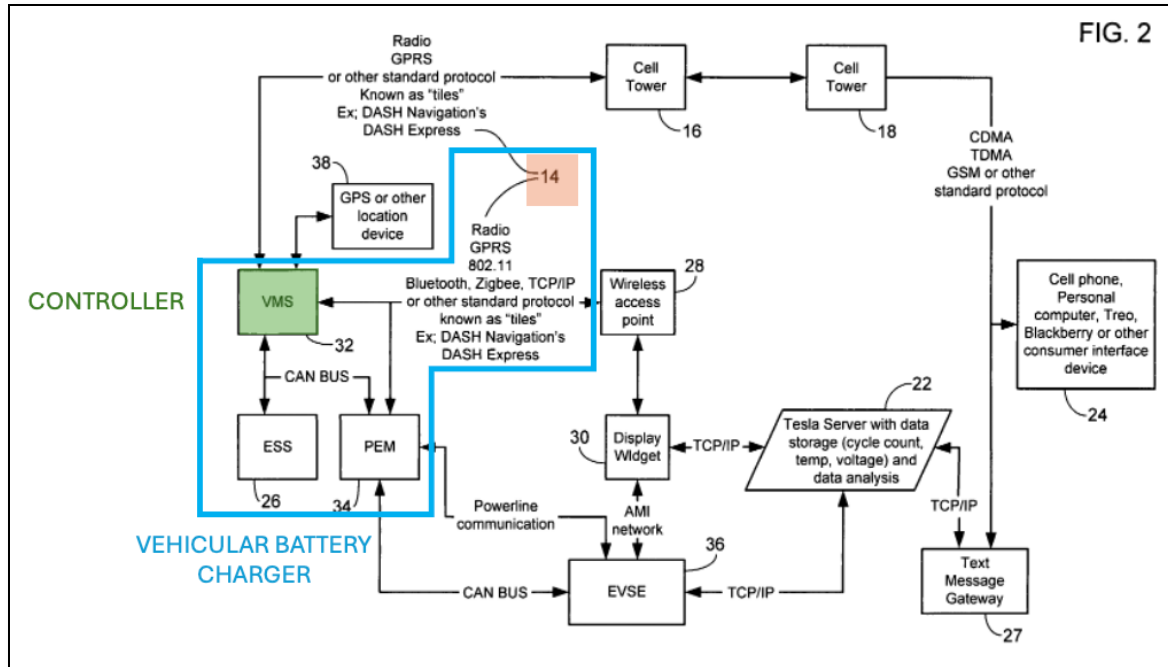
EX1004-Kelty-078, FIG. 3. As discussed and depicted in FIG. 3 above, Step 307 includes controlling/monitoring battery via remote device and Step 317 powers

on/off charging operations. Kelty-078 additionally expressly teaches “**starting and stopping of charging of the battery pack** via the means 25 of keyfob,” where the option of starting/stopping charging “**may also be added to a cell phone connection or other mobile device** to follow the network connections of the first and second network 16, 18 as described above **to allow for choosing of one the charging options and setting any default via any user interface device 24.**” EX1004-Kelty-078, 7:35-43.

224. Therefore, Kelty-078 teaches the VMS (*controller*) configured to receive an instruction from portable device (*receive a second wireless signal*) and in response, *stop charging of the battery*.

E. Claim 6: “The system of claim 1, wherein the controller is included in the vehicular battery charger.”

225. Kelty-078 teaches Claim 6. As discussed above in Claim 1[Pre], *controller VMS 32 is included in the vehicular battery charger* (VMS 32, PEM 34, and ESS 26) as shown in FIG. 2 below:



EX1004-Kelty-078, FIG. 2; *see* Claim 1[Pre]. In particular, the '011 Patent describes “the vehicle battery charger...can be at least partially integrated into the vehicle.” EX1001, Abstract.

F. Claim 10: “The system of claim 1, wherein the portable controller is defined at least in part by a phone.”

226. Kelty-078 teaches Claim 10. Kelty-078 teaches a *portable controller* (processor of interface device 24). *See* Claim 1[b]. Kelty-078 teaches that “user interface devices 24 may include but are not limited to mobile devices, such as **cell phones**” (*controller defined at least in part by a phone*). EX1004-Kelty-078, 4:20-21.

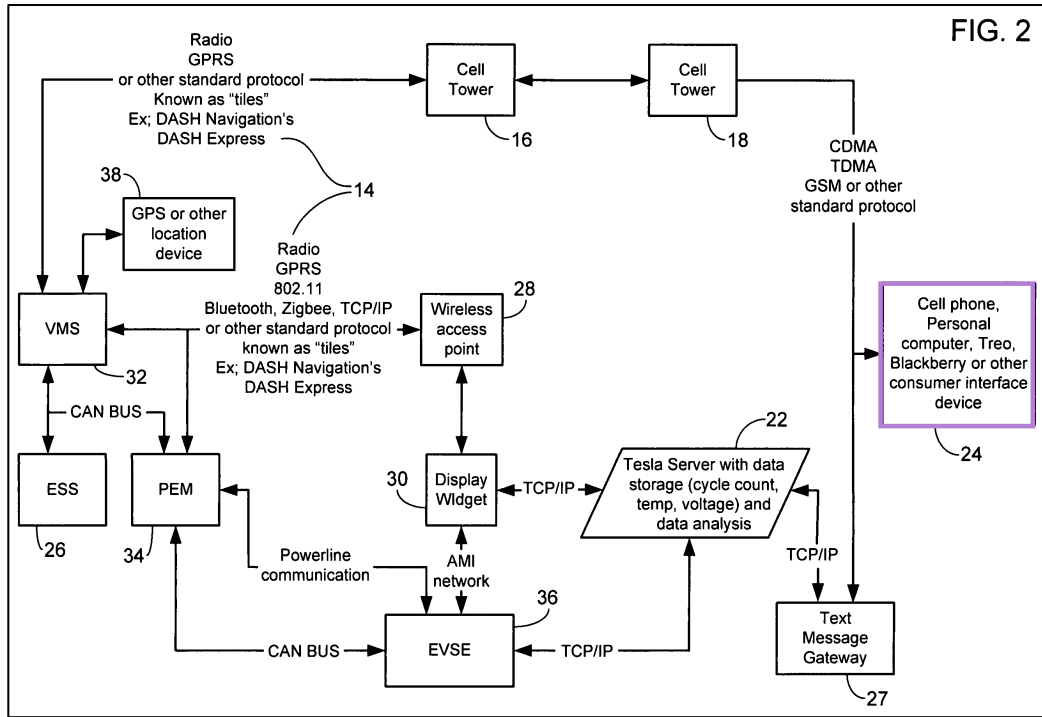
G. Claim 11: “The system of claim 1, wherein the display is a first display, and wherein the controller is further configured to display on a second display, during the charging of the battery, at least one selected from a group consisting of the information indicative of the amount of time remaining to charge the battery and the information indicative of the level of charge of the battery.”

227. The modified Kelty-078 in combination with Suyama teaches Claim 11.

a) Kelty-078’s Teachings

228. Kelty-078 teaches a *first display*, namely Claim 1[g]’s *display mounted within the vehicle in view of a user* (i.e., display device 30).

229. Kelty-078 teaches a *second display* (display of *portable controller* device 24). Kelty-078 teaches interface device 24 may be a “consumer interface device” such as a “cell phone,” “Blackberry,” or “Treo” as discussed above in §IX.A.3.a, and shown in FIG. 2 below:



EX1004-Kelty-078, FIG. 2; *see* Claim 1[b]. Such devices comprised a *display*. For example, the Treo 700p included a display. EX1019-PalmTreo700p, 29 (describing how a user navigates “around the Treo 700P smartphone screen.”), 43 (“The phone and the screen of your smartphone can be turned off and on separately.”) Kelty-078 also expressly teaches user’s “portable device” as “any known **display** device....” EX1004-Kelty-078, 4:60-65. Kelty-078 teaches “contact[ing] the user 20 via the user interface device 24” via “instant messaging” or similar communication methods, such interface devices 24 comprise a *display* for viewing textual information like text messages. EX1004-Kelty-078, 5:53-58. In another example, Kelty-078 teaches “Contemplated user interface devices 24 may include but are not limited to mobile devices, such as cell phones, PDA’s, handheld devices, desktop

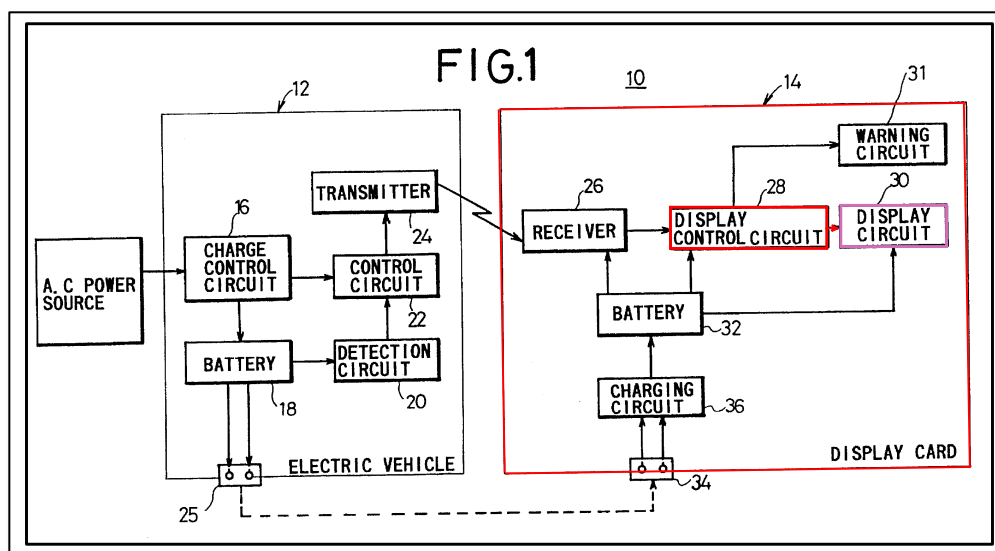
computers, laptop computers or any other communication device that is capable of producing email, IM, or any other communication device that is well known in the art.” EX1004-Kelty-078, 4:19-24. A POSITA would understand that these exemplary user interface devices would have included a display for presenting information to a user the device.

230. As discussed above, Kelty-078 teaches VMS 32 is the onboard vehicle computer that controls various vehicle systems, including the ESS 26 (battery) and PEM 34 (responsible for charging battery 26). Thus, Kelty-078 teaches *the controller configured to perform Claim 11’s functionality*. EX1004-Kelty-078, 7:44-64; *see also* Claims 1[a] (discussing Kelty-078’s *controller* teachings), 1[g]-1[i] (discussing additional information the *controller is configured to* repeatedly display on display 30, per Fujita and Suyama).

b) Suyama’s Teachings

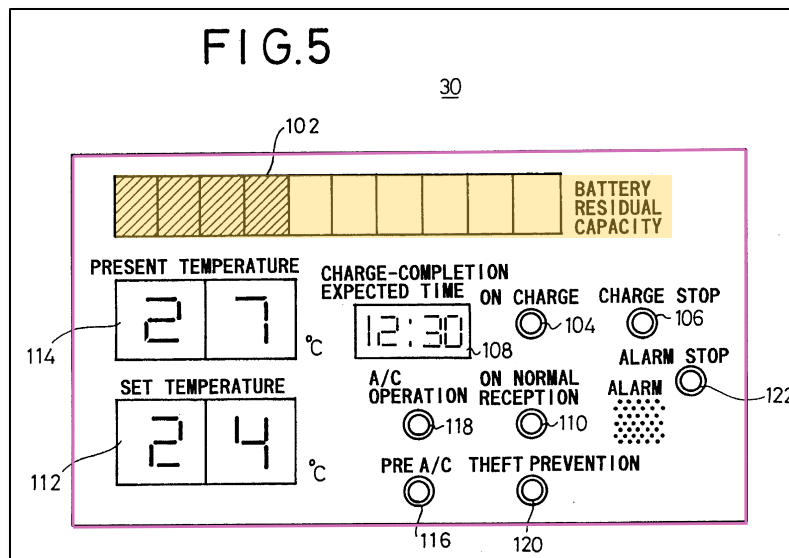
231. Suyama teaches “a charge-status display system” for “monitoring the status of charging of the electric vehicle being charged...at a location remote from the electric vehicle.” EX1007-Suyama, Abstract, 1:10-14, 15:29-32. Specifically, Suyama teaches “detecting” and “determining a status of charging of said main battery,” and “wireless[ly] transmitting” said status to “a display unit separated from said electric vehicle and disposed at a location remote from said electric vehicle” (*the controller (a vehicle controller)...configured to display on a second display*).

EX1007-Suyama, 1:46-65. For example, Suyama teaches “the charge-status display system 10 comprises an electric automobile or vehicle 12 and a portable display card 14 for displaying the state of charging of the electric vehicle 12.” EX1007-Suyama, 5:48-50, 5:66-6:13 (“The display card 14 includes a receiver 26 for receiving therein the signal transmitted from the wireless transmitter 24, a display control circuit 28 for converting the received signal into displayable data, a display circuit 30 for displaying data outputted from the display control circuit 28”), *id.* (“a power reception terminal 34 plugged or fitted into the power transmission terminal 25, a charging circuit 36”), 8:26-28 (“the receiver 26 of the display card 14 receives therein the signals transmitted from the wireless transmitter 24.”). Suyama discloses “a portable display card 14 for displaying the state of charging of the electric vehicle 12”:



EX1007-Suyama, 5:48-50, 5:66–6:13, 8:26-28 (disclosing receiver of portable display card 14 receiving signals transmitted wirelessly from transmitter of vehicle, *see* 5:51-63), FIG. 1.

232. Suyama teaches charging status is presented to the user with “indicators such as an indicator 102 for indicating the remaining capacity of the main battery 18” (*information indicative of the level of charge of the battery*). EX1007-Suyama, 7:43-45, FIG. 5; Claim 1[i]. See below:



Kelty-078, FIG. 5.

233. The charge status is presented on the remote display *during charging of the battery*. Suyama expressly teaches that “[t]he display circuit 30 displays the state of charging of the main battery **while being charged....**” EX1007-Suyama, 8:36-39, 15:29-31, 7:33-45, FIG. 1.

c) Motivation to Combine

234. In the combination, Kelty-078's system is modified to transmit and *display* to the *second display*, i.e., Kelty-078's device 24, Suyama's teachings of an indicator 102 indicating the remaining capacity of the battery, i.e., the *level of charge of the battery*.

235. A POSITA would have found obvious and been motivated to make the modification of Kelty-078's system at least because Suyama expressly suggests the modification. Suyama teaches: "Therefore, the charging operator can monitor the status of charging and the state of the vehicle while the main battery 30 18 is being charged at a location spaced from the electric vehicle 12." EX1007-Suyama, 15:29-31, 15:18-38. Suyama continues: "Thus, the charging operator is no longer required to remain with the vehicle over the long period of time that the main battery is being charged." EX1007-Suyama, 15:23-45. Suyama therefore provides express motivations for the combination with Kelty-078 to allow for remote viewing of the level of charge by a user on a remote, portable device such as Kelty-078's user interface device 24. This would have been a teaching, suggestion, or motivation in the prior art that would have led a POSITA to modify Kelty-078 per Suyama to arrive at the claimed invention.

236. Charging an electric vehicle takes time, up to multiple hours. EX1014-Sandeep, 96 ("Fast charging of an individual battery or a battery pack refers to

charging times in the one-hour range.”); EX1033-Chan, 24-25 (describing how lower charging currents extend the charging time. For example, “EV batteries can be charged by a medium current of 30–60 A and the charging period may last for a few hours” compared to “over six hours” with a 15 A current, or “a short time based on a high charging current of 150-400 A.”). Thus, a POSITA would have appreciated the flexibility and convenience of using a portable device to monitor the vehicle’s charging status “at a location remote from the electric vehicle” since the alternative requires that “the charging operator should often proceed to the garage or the like to confirm the conditions of the electric vehicle being charged, thus inconveniencing the charging operator.” EX1007-Suyama, 1:14, 1:33-36. Indeed, modifying Kelty-078 to include Suyama’s feature of monitoring charging operations via a portable device would have significantly improved convenience and ease-of-use for the user, which would have advantageously led to increased user satisfaction.

237. Thus, a POSITA would have valued that they can “leave his/her electric vehicle” while charging and still remain informed regarding “a situation in which the charging of the battery has been completed.” EX1007-Suyama, 1:26, 1:31-32. In particular, a user receiving a notification on a portable device indicating that charging has completed would have been especially useful to a user to avoid wasting time of having to keep checking on the vehicle while charging is ongoing. Further, a notification such as “charging complete” would have provided assurance that the

charging operation completed successfully. This would have helped reduce user worry that a charging operation may not have completed by providing reassurance that charging did, in fact, complete. In such scenarios where a user thought the vehicle was charging but charging did not complete, the user may end up frustrated and late to an appointment, for example, because additional charging may need to be completed before leaving the charging station.

238. A POSITA would have further appreciated being able to do other tasks while charging their electric vehicle, or merely being able to take a break from being within the electric vehicle if they are charging during a road trip, for example, where they are driving for long periods of time. By including notifications to a portable device, a user would have been free to go for a walk, go shopping at a nearby store, or perform other activities without having to repeatedly check the vehicle itself for the charging status. This would have freed up the user to do whatever other activities the user desired, advantageously leading to increased user satisfaction.

239. The modification is a simple combination of prior art elements (transmitting and displaying information indicative of charge remaining in an electrical vehicle, and the display of a portable device, like a phone) according to known methods to yield predictable results (remote monitoring of an electric vehicle while charging). This modification is also use of Suyama's known technique to improve the similar Kelty-078 and Suyama devices in the same way.

240. A POSITA would have had a reasonable expectation of success without undue experimentation in making such a combination since Kelty-078 already envisions “communication between the electric vehicle 12 and user 20 or user 20 and electric vehicle 12” and teaches that “the user 20 may **check...the charge status**” of vehicle 12 from device 24. EX1004-Kelty-078, 5:1-6. FIG. 3 (see Step 307). Thus, the modification would have been able to take advantage of Kelty-078’s native messaging capabilities and hardware. A POSITA would have needed only to modification programming instructions, which would have been a straightforward and routine modification well-within the skillset of a POSITA. *See also* EX1004-Kelty-078, 1:10-14, 7:38-43 regarding Kelty-078’s native communication capabilities.

H. Claim 12: “The system of claim 11, wherein the second display is electrically coupled to the portable controller.”

241. Kelty-078 teaches Claim 12.

242. Kelty-078 teaches that interface device 24 (*portable controller*) may be a “mobile device” like a “Cell phone,” “Blackberry,” or “Treo” (as shown in FIG. 2) comprising a *second display*. EX1004-Kelty-078, FIG. 2; *see* Claims 1[b], 11. As discussed above, Kelty-078’s interface devices 24 are “processor-based devices” per the meaning of the ’011 Patent, such that a processor of the cellphone is causing display on a display of the cellphone (*second display*).

243. For example, it was known that the Treo 700p included a “312MHz” “Intel XScale® processor” and a “[t]ouch-sensitive LCD screen” which a POSITA would have understood requires the controller be *electrically coupled* to the screen (*second display*) in order for the user to select elements and view information on the screen, such as navigating web pages or “viewing the pictures [] capture[d] with the built-in camera.” EX1019-PalmTreo700, 7 (describing the Treo 700p as a “smartphone”), 103 (“The Blazer® web browser on your smartphone provides quick and easy access to web pages.”) 123 (“In addition to viewing the pictures you capture with the built-in camera, you can view pictures captured on many popular digital cameras or downloaded from the Internet.”) 247 (describing the Treo 700p specifications, including the processor and camera). Thus, the *portable controller* (processor) of interface device 24 is *electrically coupled to the second display* of device 24 so that “the user 20 may check or change the charge status and settings or other vehicle parameters.” EX1004-Kelty-078, 5:3-5. FIG. 3 (*see* Step 307). Additionally, Kelty-078 teaches choosing such charging options. Kelty-078, 7:38-43 (“Furthermore, the options may also be added to a cell phone connection or other mobile device to follow the network connections of the first and second network 16, 18 as described above to allow for choosing of one the charging options and setting any default via any user interface device 24.”).

X. OPINIONS REGARDING GROUND 2: CLAIMS 7-8 ARE OBVIOUS OVER KELTY-078, FUJITA, SUYAMA, AND SUTARDJA

A. Claim 7: “The system of claim 1, wherein the wireless signal includes a time of day and wherein the controller is configured to supply electricity from the source of power to the battery based on the time of day.”

244. The modified Kelty-078 in view of Sutardja teaches Claim 7.

a) Kelty-078’s Teachings

245. Kelty-078’s *controller* (VMS) *is configured to supply electricity* (“starting and stopping of charging of the battery pack”) *from the source of power* (a utility company controlling an electricity grid) *responsive to a wireless signal* (an instruction sent via Bluetooth, per Kelty-078; *see* Claims 1[c]-1[d]) communicated from the *portable controller* (interface device 24). EX1004-Kelty-078, 5:40-44, 7:35-43, FIG. 3; *see* Claim 1[c].

b) Sutardja’s Teachings

246. Sutardja (EX1010) is similarly directed to “charging batteries in vehicles.” EX1010-Sutardja, [0002]. Sutardja teaches that “users may use the user interface modules to generate default and/or custom charging parameters.” EX1010-Sutardja, [0235]. “The charging parameters may specify **a time of the day** to charge the batteries, a charge **completion time**,” etc. (*time of day to supply electricity*). EX1010-Sutardja, [0235]. For example, “the user may request a full charge daily between 9 pm and 6 am.” EX1010-Sutardja, [0262]. “Utility companies may supply

power to the batteries...according to the charging parameters generated by the users.” EX1010-Sutardja, [0233].

247. Therefore, Sutardja teaches *supply[ing] electricity from the source of power* (utility company supplying electricity) *to the battery* (battery 14) *based on the time of day* (charging parameters, such as charge start time).

c) Motivation to Combine

248. A POSITA would have been motivated and found it obvious to further modify EX1004-Kelty-078’s *wireless signal* (instruction from device 24 to VMS 32, such as powering on/off) to include a *time of day*, per Sutardja’s charging parameters. Kelty-078 already contemplates charging “at a different time of day” “to reduce [the user’s] cost of charging the battery pack of the electric vehicle 12.” EX1004-Kelty-078, 8:65–9:3. A POSITA would have been motivated to modify Kelty-078 per Sutardja to advantageously reduce costs by allowing a user to specify a time of day for charging. It was well known in the prior art that electricity prices can fluctuate throughout the day such as during times of peak demand; thus, some users may prefer the option to save money by charging during periods when electricity demand is lower. EX1048-Hafner, [0080] (describing how user “preferences may indicate that charging when the price per kilowatt hour is less than thirteen cents is to be maximized and charging when prices are higher than thirteen cents per kilowatt hour is to be minimized or prohibited all together.”); EX1026-

Sims, 4:22-24 (“FIG.3c illustrates charging at a lower power during the high cost energy rate and then increasing the charging power to a higher current during the period of lower cost.”), FIGS. 3B-3C. Modifying Kelty-078 in this way would have thus provided an option for users to advantageously lower charging costs, which would have been highly desirable.

249. It was well-known prior to the '011 Patent that charging electric vehicles may require lengthy charging time; thus, it would have been desirable for the user to schedule charging at night when the vehicle would likely not be used, or at a time when the cost of electricity is less expensive, per Kelty-078's express desires. EX1014-Sandeep, 96 (“Fast charging of an individual battery or a battery pack refers to charging times in the one-hour range.”); EX1033-Chan, 24-25 (describing how lower charging currents extend the charging time. For example, “EV batteries can be charged by a medium current of 30–60 A and the charging period may last for a few hours” compared to “over six hours” with a 15 A current, or “a short time based on a high charging current of 150-400 A.”).

250. A POSITA would have also appreciated scheduling the charge time for the added convenience of not having to remember to manually charge the electric vehicle, thus ensuring that the user neither forgets to charge their vehicle nor needs walk to their car to start the charging process themselves. Automating tasks, such as charging an electric vehicle on a schedule, was a well understood concept in the prior

art, with Sutardja as merely one example. As another example, Ross describes “providing fully automated garaging features that permit the onboard EMB’s [(electromechanical battery)] (and/or other storage elements) to be intelligently charged when the vehicle is parked overnight or at other times in a specially equipped garage....” EX1023-Ross, 7:6-10; *see also*, EX1023-Ross, Abstract. In a further example unrelated to vehicles that illustrates this point, automating a routine and mundane task such as watering a lawn by utilizing an automated sprinkler system readily illustrates how automating tasks was known in many areas of technology and was highly desirable for users. Further, a consumer would appreciate “**custom** charging parameters” that are tailored to their specific needs and circumstances, per Sutardja. These custom charging parameters would have advantageously allowed a user to make selections to best fit one’s needs or desires. Implementing Sutardja’s known technique would have thus enhanced usability and user satisfaction of the modified Kelty-078’s system.

251. Additionally, utilizing Kelty-078’s device 24 to input charging parameters, such as time of day to charge, provides added convenience of setting the charging schedule using the portable controller and thus, not requiring the user to be in the vehicle to set the charging parameters. A POSITA would have recognized that this would have been highly advantageous for a user to set charging parameters from whatever location the user desires, including while away from the vehicle. Thus, the

user may be in their office at work or home and able to set the charging parameters instead of having to leave to go to the vehicle itself. This added convenience would have been desirable to improve the user experience, and a POSITA would have been motivated to implement such.

252. The modification is a simple combination of prior art elements (wireless signal comprising time of day information, per Sutardja, and a vehicle charging system, per Kelty-078) according to known methods to yield predictable results (customizable, e.g., scheduled, electric vehicle charging). This modification would also have been use of Sutardja's known technique to improve the similar Kelty-078 and Sutardja devices in the same way.

253. The combination would have had reasonable expectation of success since, in the modification, the *wireless signal* is sent from Kelty-078's portable device 24. Similarly, Sutardja teaches embodiments in which "a user of the vehicle 102-1 may use the user interface module 108 to set charging parameters for charging the battery 14 and for returning charge from the battery 14." EX1010-Sutardja, [0243]. Further, Kelty-078 already contemplates scheduling charging to benefit the user by reducing cost. EX1004-Kelty-078, 2:6-11. Therefore, the only modification needed would have been straightforward changes to programming instructions, which would have been well-within the skillset of a POSITA. No additional hardware would have been necessary for implementing this modification.

B. Claim 8: “The system of claim 7, wherein the time of day includes at least one selected from a group consisting of a time of day to start charging and a time of day to complete charging.”

254. The modified Kelty-078 system in view of Sutardja teaches Claim 8. Sutardja expressly teaches that “charging parameters may specify...a charge completion time...” (*time of day includes a time of day to complete charging*). EX1010-Sutardja, [0235]; Claim 7.

XI. OPINIONS REGARDING GROUND 3: CLAIM 9 IS OBVIOUS OVER KELTY-078, FUJITA, SUYAMA, AND KELTY-218

A. Claim 9: “The system of claim 1, wherein the wireless signal includes a cost threshold and wherein the controller is configured to supply electricity from the source of power to the battery based on the cost threshold.”

255. The modified Kelty-078 system further modified by Kelty-218’s cost thresholds teach Claim 9.

256. The modified Kelty-078 teaches *a controller (VMS 32) configured to supply electricity* to the battery of the vehicle responsive to a wireless signal from a portable controller, which “enables the user to control certain aspects of **charging of the battery.**” *See* Claim 1[d] (*signal*) and *citing* EX1004-Kelty-078, 2:41-43 Kelty-078 states an object of its invention is to “provide an electric vehicle communication interface that will allow the user...to control the timing of charging of the vehicle such that charging occurs **during low power consumption times at a lower cost** to the vehicle user.” EX1004-Kelty-078, 2:6-11.

257. Kelty-218 (EX1008) teaches a charging cost circuit 212 associated with a computer, such as a vehicle computer or home computer, operable to control electric vehicle charging automatically based on a cost of power. EX1008-Kelty-218, [0024]-[0027], [0030], [0048], FIG. 2; Claim 13. In embodiments, charging cost circuit 212 is part of a computing device outside the vehicle (e.g., in a computing device of the user), operable to control the charging of the vehicle, including turning charging on or off. EX1008-Kelty-218, [0025]-[0026], [0048]. Specifically, the charging cost circuit 212 may include a user controllable interface “such that the user can input a **threshold** for what is a less expensive charging cost rate and what is a more expensive charging cost rate.” EX1008-Kelty-218, [0030].

258. For example, a user may specify via their vehicle or home computer “to charge **only** when below a certain threshold.” EX1008-Kelty-218, [0030], [0047]-[0048], FIG. 8. As noted above in my opinions for Claim 7, allowing a user to set a custom charging parameter such as time of day would have been beneficial. Here, modifying Kelty-078 to include a cost threshold for charging **only** when cost is below a certain threshold would have been a similar use of a known technique that would have been highly desirable and advantageous. I discuss a motivation to modify Kelty-078 in the section below. Therefore, Kelty-218 teaches a *wireless signal* (instruction entered by user on a portable device) *includes a cost threshold* (the user-specific threshold at which charge can occur, per Kelty-218) and *wherein*

the controller is configured to supply electricity from the source of power to the battery based on the cost threshold (in the combination with the modified Kelty-078, the VMS 32 controls supply of power to the battery based on the cost threshold entered by the user).

1. Motivation to Combine

259. A POSITA would have been motivated and found it obvious to modify Kelty-078's system to receive a user's desired cost of power threshold, thereby providing the user with convenient control of the vehicle charging and associated costs. Here, a POSITA would have been motivated to modify Kelty-078 to advantageously allow for charging **only when** cost is below a certain threshold per Kelty-218's teachings. This would have been highly desirable for a user to save money on charging by charging **only** during periods when electricity costs are below a threshold (e.g., during time periods of lower electricity demand compared to peak demand hours). Reducing costs associated with charging would have been a highly advantageous and desirable goal that would have been a strong motivation for a POSITA to implement this modification. Doing so would have furthered Kelty-078's express objective of allowing the user to "control the timing of charging of the vehicle such that charging occurs **during low power consumption times at a lower cost** to the vehicle user," motivating the combination. EX1004-Kelty-078, 2:6-11.

260. Similar to the motivation to combine for Claim 7, utilizing Kelty-078's device 24 to input charging parameters, such as cost of power threshold, provides added convenience for the user by allowing inputting charge parameters from any location with the user's phone. A POSITA would have recognized that this would have been highly advantageous for a user to set charging parameters from whatever location the user desires, including while away from the vehicle. Thus, the user may be in their office at work or home and able to set the charging parameters instead of having to leave to go to the vehicle itself. This added convenience would have been desirable to improve the user experience, and a POSITA would have been motivated to implement such.

261. Additionally, Kelty-218 provides express motivation for the combination, teaching its system may be particularly "helpful in areas in which municipal power grid pricing fluctuates frequently, such as in areas where wind turbines produce excess power at windy times, and a shortage of power during times in which is it not windy." EX1008-Kelty-218, [0048]. Therefore, a POSITA would have recognized that Kelty-218 includes an express teaching, suggestion, or motivation that would have been achieved by modifying Kelty-078 to control charging timing to occur **only** when power consumption is low and prices are below a user desired threshold, per Kelty-218.

262. A POSITA would have recognized the combination constitutes applying a known technique (receiving the user's cost threshold, per Kelty-218) to a known system ready for improvement (Kelty-078's vehicle charging system) to the yield predictable result of stopping the charging of the vehicle when the cost of power exceeds the user's selected cost of power threshold, leading to a reasonable expectation of success. Indeed, this modification would have had a reasonable expectation of success because only straightforward and routine changes to programming instructions would have been required, which would have been well-within the skillset of a POSITA.

XII. OPINIONS REGARDING GROUND 4: CLAIMS 13-14, 5 ARE OBVIOUS OVER KELTY-078, FUJITA, SUYAMA, KELTY-218, AND SUTARDJA

A. Claim 13: "The system of claim 1, wherein the controller is a first controller and the portable controller is a second controller, and wherein the first controller is configured to receive data indicative of a cost of power from a third controller remote from the vehicle and the vehicular battery charger."

263. I have been instructed to apply the claim construction for *cost of power* as "monetary price of power." §III.C.

264. Sutardja teaches a processor associated with a utility company (*third controller*) sending information indicative of a cost of power to a vehicle battery charger. Kelty-218 provides further specificity that the cost of power is a monetary price of power.

1. '011 Specification Regarding “third controller”

265. The '011 Patent describes a “*third controller*” by stating “another controller can be...one or more processors of a **server** or other computer associated with a power utility providing power to the vehicle charging cord 22, and the like.” EX1001, 9:5-13, 9:13-16 (explaining that in embodiments “the other controller is a remote computer of a power utility”).

2. Kelty-078's Teachings

266. Kelty-078 teaches a *first controller* (controller VMS 32) and a *second controller* (portable controller interface device 24). See Claims 1[a]-1[b].

267. Kelty-078 teaches “an electric vehicle communication interface that will allow the user to pre-register with **local utility companies** and energy providers to control the timing of charging of the vehicle such that charging occurs during low power consumption times **at a lower cost to the vehicle user.**” EX1004-Kelty-078, 2:7-11, 2:55-59 (disclosing an “advantage of the present invention” is allowing “the user to pre-register with a local utility company or energy provider to allow for charging of the vehicle at periods of low power consumption, thus reducing the overall cost of operating the electric vehicle”), 8:65–9:3 (disclosing the invention “methodology” is “capable of determining that if the cost of electricity may be higher at the second location that the user 20 of the vehicle 12 may want to charge at a

different time of day at that second location to reduce their cost of charging the battery pack”); Claim 1[d] (describing the utility company supplying electricity).

268. Kelty-078 teaches a *third controller*, namely the server of the utility company supplying electricity. EX1004-Kelty-078, 5:47-52 (“the electric vehicle 12 is either charged or stored via a vehicle to grid application that will allow for communication between **a local utility company server** and the electric vehicle 12, thus allowing for certain operations to be performed by the utility company and the user 20 on the electric vehicle 12.”). Cf. EX1001, 44:8-10 (’011 Patent describing “the controller 50 of the power utility 48” “can be defined by one or more servers and associated computer equipment”).

269. VMS 32 *is configured to receive data from a third controller*, i.e., the utility server because (1) VMS 32 is the onboard vehicle computer that controls various vehicle systems, including the ESS 26 (battery) and PEM 34 (responsible for charging battery 26); and (2) Kelty-078 teaches “communication between” vehicle 12 and the utility company “for charging the vehicle 12 during periods of low power consumption....” EX1004-Kelty-078, 5:48-49, 6:1-2. Indeed, “certain operations” are performed by the “utility company” during such communications, including the utility company “turn[ing] the charging of the electric vehicle 12” on or off to thus “reduc[e] the overall cost of operating the electric vehicle 12,”

confirming the VMS 32, which controls charging of the vehicle, *receive[s] data* from the *third controller*. EX1004-Kelty-078, 5:48-49, 6:1-2, 7:47-61.

270. The utility server (*third controller*) is remote from vehicle 12 and the vehicular battery charger (VMS 32, PEM 34, ESS 26) (*remote from the vehicle and the vehicular battery charger*) because vehicle 12 may be charged from multiple locations, indicating that the utility company is not at a single, shared location with the *vehicle* and *vehicular battery charger*. For example, Kelty-078 teaches the electric vehicle being charged at a “second location,” indicating the utility company is at least at two different locations, and thus is not at a shared location with the *vehicle* and the *vehicular battery charger*. EX1004-Kelty-078, 8:65–9:3.

3. *Sutardja’s Teachings and Motivations To Combine*

271. Sutardja teaches *receiv[ing] information indicative of the cost of power* (cost of and discounts for electricity) *from a third controller* (a server LMM at utility company 23) *remote from the vehicle and the vehicular battery charger*.

272. Sutardja teaches negotiating parameters for charging between a control module 112 (inside the vehicle) and a utility company 23. EX1010-Sutardja, [0267], FIG. 3B, [0243] (disclosing interface module 110-1 within the vehicle enabling “communication between the utility company 23 and the CMM 104-1” of control module 112). Sutardja states, “the control module 112 may receive charging parameters input by the user and/or alternate **charging parameters transmitted by**

the utility company 23.” *Id.* Such “alternate charging parameters” are exemplified by Sutardja as including “additional costs” for charging, expressly teaching receiving data indicative of a monetary price (cost) of power. EX1010-Sutardja, [0235-0236]. Sutardja also teaches “charging parameters” as including “costs the users may pay if batteries are charged at higher than normal priority” and “users and utility companies may create alternate charging parameters by interactively negotiating costs,” such as utility companies offering “discounts to users when the users are willing to accept receiving power at other times,” further indicating the alternate charging parameters transmitted from the utility company include a monetary price (cost) of power received by the control module 112. EX1010-Sutardja, [0235]-[0236], [0264-0265] (disclosing “the utility company 23 may inform the user of any extra cost the user may incur if the utility company 32 supplies power at the requested time or a discount the user may receive if the user accepts power at a different time”). Sutardja’s cost of power is a “monetary price of power,” per the applied claim construction, at least because Sutardja teaches the “costs the users may pay” may be less/more, as well as the utility company sending “additional costs” or discounts to the user. EX1010-Sutardja, [0236].

273. A POSITA would have been motivated and found obvious to modify Kelty-078’s VMS 32 (*first controller*) to *receive data indicative of a cost of power* (monetary price of power) *from the utility company server (third controller) remote*

from the vehicle and the vehicular battery charger, recognizing that the utility company would have been the most-straightforward, expected source of the cost of power information. Indeed, the utility company was commonly known to set the cost of power, and thus would have accurate knowledge on costs incurred to the user. EX1032-Kempton, Section 4 (describing the cost of electricity being “controlled in real-time” by an “integrated electric utility”). The monetary price of power would have been valuable information for the vehicle to achieve Kelty-078’s express objective of allowing the user to “control the timing of charging of the vehicle such that charging occurs **during low power consumption times at a lower cost** to the vehicle user,” motivating the combination. EX1004-Kelty-078, 2:6-11, 6:4-7 (teaching charging of the vehicle during periods of low power consumption which may result in **lower kilowatts charges** to the user of the electric vehicle 12 (step 321)” by the utility company). Indeed, a user would want to know the cost of power from the utility company to be able to charge at such “low power consumptions times at a lower cost.”) *Id.*

274. A POSITA would have recognized the combination constitutes applying a known technique (receiving the monetary price of power, per Sutardja) to a known system ready for improvement (Kelty-078’s vehicle charging system) to the yield predictable result of providing up-to-date price information to the vehicle,

leading to a reasonable expectation of success, so that user is accurately informed in controlling charging to reduce costs incurred.

275. The combination would have had a reasonable expectation of success and been well-within the expertise of a POSITA given that Kelty-078 already contemplates “pre-register with a local utility company or energy provider to allow for charging of the vehicle at periods of low power consumption, thus reducing the overall cost of operating the electric vehicle.” EX1004-Kelty-078, 2:55-59; *see also id.*, 8:65–9:3. Thus, all that would be required is programming the utility server (*third controller*) to send cost of power information to the VMS 32 (*first controller*) so a user can use the cost of power when charging the vehicle.

4. Kelty-218’s Teachings and Motivations to Combine

276. Kelty-218 provides additional specificity that a transmitted cost of power is a “monetary price of power,” per the applied claim construction. Kelty-218 teaches charging an electric vehicle based on a “charging cost rate [that] is the instantaneous cost of energy transfer. Cost rate is in cost per energy transferred over time (e.g., \$0.06 United States Dollar per kilowatt hour.”). EX1008-Kelty-218, [0024]. Meaning, the “\$0.06 United States Dollar per kilowatt hour” is a “monetary price of power” per energy transferred over time. *Id.* Kelty-218 also teaches estimating that it will cost “\$5.00 to charge an electric vehicle based on measured conditions and optionally learned conditions.” EX1008-Kelty-218, [0028].

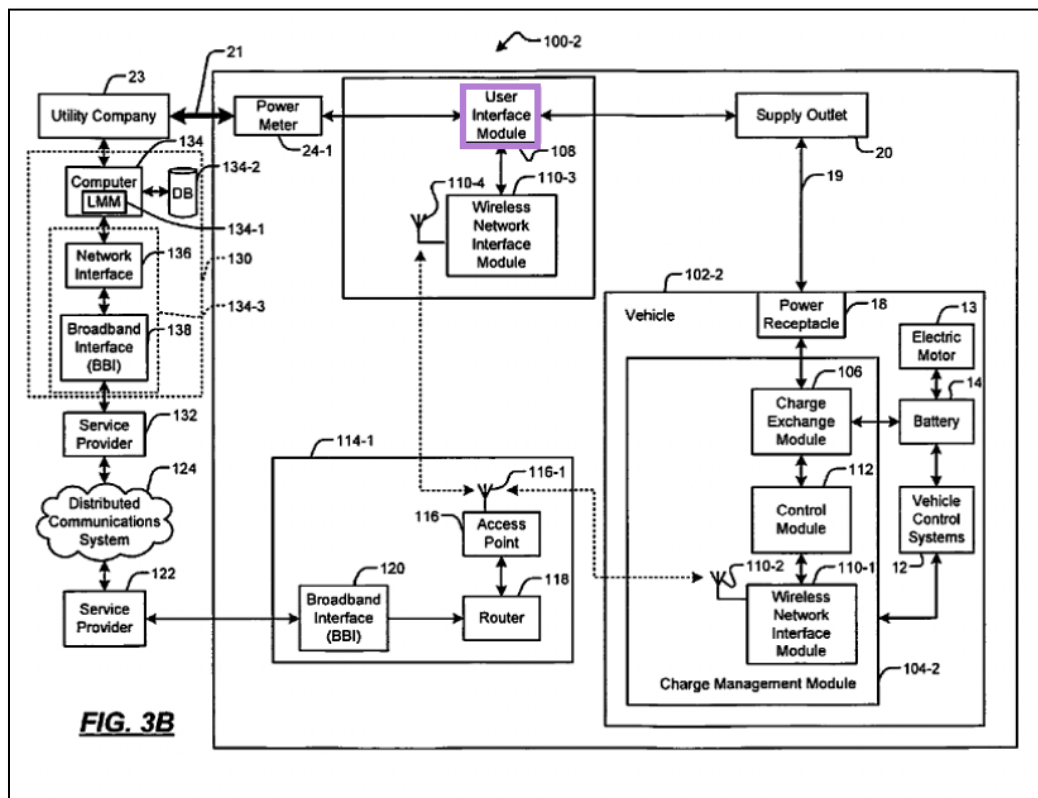
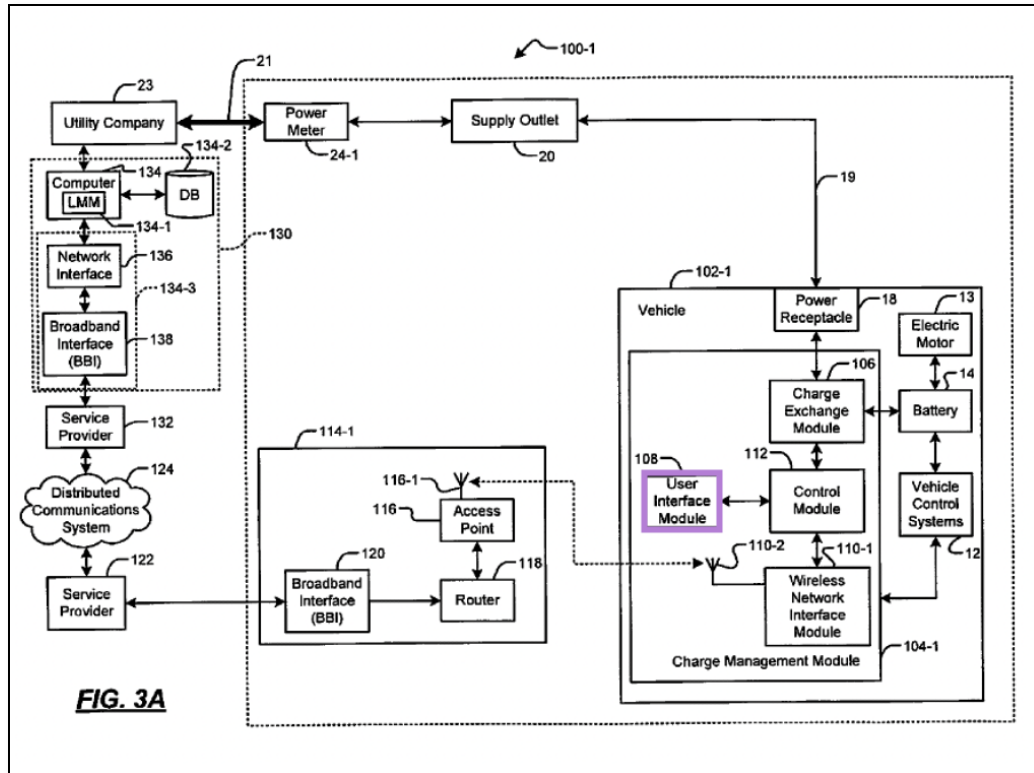
Therefore, Kelty-218 express teaches a *cost of power* that is a “monetary price of power,” applying the claim construction.

277. A POSITA would have been motivated and found obvious to use monetary value (e.g., \$0.06, per Kelty-218) as the costs the user may pay in the Sutardja-modified Kelty-078 system. A monetary price based in U.S. dollars per common units of energy, e.g., kilowatt per hour, is a well-recognized, commonly-understood, and well-accepted method of exchanging services (e.g., supplying power) for payment (e.g., U.S. dollars). *See e.g.*, EX1017-Nor, 10:30-33 (discussing indicators of its system that provide a “running indication of the amount of energy being delivered in kWh **or its cost in local currency, such as dollars.**”). The end user would have easily recognized the cost of power in terms of U.S. dollars, given the ubiquity of payment for services render in U.S. dollars. There would have been a reasonable expectation of success, at least because of payment in money is well accepted. A POSITA would have readily recognized that this modification would have been simple and straightforward as the VMS 32 would be programmed to receive a monetary value (e.g., dollar amount) from the utility server and the utility server would be programmed to send the monetary value to the VMS 32.

B. Claim 14: “The system of claim 13, wherein the first controller is configured to receive the information indicative of the cost of power from the third controller through the second controller.”

278. I have been instructed to apply Claim 14’s *information* as the recited *data* of Claim 13.

279. Sutardja teaches Claim 14. As brief background, Sutardja discloses FIGS. 3A-3B but notes that the components of charge management system (CMS) 100 shown in FIG. 3A are applicable to the corresponding components in FIG. 3B. In FIG. 3B, the “user interface module 108 [is]...arranged outside a vehicle 102-2,” versus inside the vehicle in FIG. 3A. EX1010-Sutardja, [0239], [0247] (“Otherwise, the CMS 100-2 of FIG. 3B may be substantially similar to the CMS 100-1 of FIG. 3A.”); EX1010-Sutardja, [0261] (disclosing “CMSs 100-1, 100-2” being “collectively referred to as CMS 100”). Thus, when I refer to descriptions and functionality of FIG. 3A while discussing the architecture of FIG. 3B, this is not intended as a combination of embodiments, as Sutardja expressly teaches both CMSs 100 being substantially similar and each being a CMS 100. EX1010-Sutardja, [0247] (“Additionally, the wireless network interface module 110-3 may enable the user interface module 108 to communicate with a CMM 104-2 in the vehicle 102-2 via the user LAN 114-1. Otherwise, the CMS 100-2 of FIG. 3B may be substantially similar to the CMS 100-1 of FIG. 3A.”).



EX1010-Sutardja, FIGS. 3A (top), 3B (bottom); both annotated to show the similarity of CMS 100 between the two figures apart from the location of user interface module 108.

280. In FIG. 3B, Sutardja provides an embodiment in which an interface **outside the vehicle** acts as a middleman between a utility company 23 and the vehicle; namely, the wireless network interface module 110-3 that is outside the vehicle enabling communications between user interface module 108 and utility company 23. EX1010-Sutardja, [0247], [0243], FIG. 3B. Specifically, Sutardja teaches “wireless network interface module 110-3” (outside the vehicle) “may enable the user interface module 108 to communicate with the utility company 23.” EX1010-Sutardja, [0247]. Additionally, the same “wireless network interface module 110-3 may enable the user interface module 108 to communicate with a CMM [charge management module] 104-2 **in the vehicle** 102-2 via the user LAN 114-1.” *Id.* Thus, Sutardja teaches that a computer 134 at utility company 23 connects wirelessly with interface 108, which connects with the Charge Management Module of the vehicle that “manage[s] the amount of charge in the battery 14.” EX1010-Sutardja, [0239].

281. As discussed above regarding Claim 13, information transmitted from Sutardja’s utility company 23 to the vehicle specifically includes data indicative of

a monetary price of power (cost of power) such as “additional costs” for charging.

Claim 13, *citing* EX1010-Sutardja, [0264], [0267].

282. Thus, in the combination, the modified Kelty-078 vehicle controller (VMS 32 of Kelty-078; *first controller*) *is configured* (as in Sutardja, FIG. 3B) *to receive the information indicative of the cost of power* (e.g., “additional costs” for charging with specificity of monetary price per Kelty-218) *from the third controller* (Sutardja’s computer 134 at utility company 23) *through the second controller* (the processor of Kelty-078’s device 24, modified to serve as a middleman like wireless network interface module 110-3 of Sutardja’s FIG. 3B). The modified Kelty-078 system already has the VMS 32 configured to receive cost information from the utility company. *See* Claim 13. Accordingly, as discussed below the system is further modified to route the cost information *from the third controller* (utility company) to the *second controller* (processor of Kelty-078’s device 24).

1. Motivation to Combine

283. A POSITA would have been motivated and found obvious to further modify the modified Kelty-078 system; namely to route the cost information from the utility server through the user interface device 24 to the VMS 32. A POSITA would have appreciated the convenience and ease of monitoring the cost of power through their personal device and being able to monitor charging of their electric vehicle remote from the vehicle itself. This would allow a user to schedule and/or

control charging while away from the vehicle, providing the user with higher charge control flexibility. Because it was well-understood that “municipal power grid pricing fluctuates frequently,” a POSITA would have further valued up-to-date pricing information delivered through their mobile device, and charging their vehicle dynamically in response to the changing cost of electricity. EX1008-Kelty-218, [0048]. Indeed, using updated charging information, such as price, was known to be advantageous by dynamically updating charging such that, for example, charging may be changed to occur “when electricity rates are lower.” EX1056-Ferro, [0097-0098]. Further, routing utility pricing information through Kelty-078’s device 24 would allow the user to approve cost-based charging decisions. Indeed, Kelty-078 expressly contemplates that user 20 may “automatically reject or accept” the utility company’s control of vehicle charging, such as user 20 overriding the utility company turning off charging (e.g., to save cost, lower demand on the electrical grid) if the user “needs the battery 26 charged at the current time in order to use the vehicle in the near future.” EX1004-Kelty-078, 5:62-67, 6:7-16, FIG. 3 (Step 323). Indeed, a user would benefit from easy access to such cost-based charging decisions to ensure the decisions work within their budget. EX1056-Ferro, [0099] (describing a charging system as allowing a user to dynamically update cost information that “specifies that the electric vehicle should be charged if the rate for purchasing electricity is lower than a given amount, such as ‘\$0.XX’”). Additionally, a POSITA

would have valued the portability of a mobile device and being able to monitor charging of their electric vehicle without needing to be in the exact same location as their vehicle. *See* ¶¶ 61-63 (generally describing it was desirable to communicate charging information remotely from a phone to a vehicle).

284. A POSITA would have recognized the combination constitutes applying a known technique (routing information regarding cost of power from a utility company through a user's phone to an electric vehicle's controller, per Sutardja) to a known system ready for improvement (Kelty-078's vehicle charging system 10) to the yield predictable result of dynamically charging the electric vehicle based on cost and allowing a user to review cost changes on-the-fly, leading to a reasonable expectation of success.

285. Doing so would have furthered Kelty-078's express objective of allowing the user to "control the timing of charging of the vehicle such that charging occurs **during low power consumption times at a lower cost** to the vehicle user," motivating the combination, as a user would be provided further control over cost fluctuations affecting vehicle charging. EX1004-Kelty-078, 2:6-11. Kelty-078's vehicle 12 is already equipped to perform wireless communications, and the user is already capable of starting/stopping charging using device 24, per Claims 1[b]-1[d]. Additionally, Kelty-078 already teaches the utility server notifying the "user" about certain electricity rate-related options, such as "if they want to delay the charge until

the electricity rates are reduced.” EX1004-Kelty-078, 9:13-17. Accordingly, the modification would simply require implementing communication between the utility server and the user interface device 24, programming the utility server to send cost information to the user interface device 24, and programming device 24 to relay cost information to VMS 32, which would not have been challenging given wirelessly communicating information during charging was well-known. EX1056-Ferro, [0083]; EX1046-Ambroziak, 11 (describing an electric charging station sending pricing information to a user via “a message sent to a cell phone”).

C. Claim 5: “The system of claim 1, wherein the controller is further configured to receive data indicative of a cost of power and, based on the received data indicative of the cost of power, stop charging of the battery of the vehicle.”

286. I have been instructed to apply the claim construction for *cost of power* as “monetary price of power.” §III.C.

287. Kelty-078 teaches *controller (VMS 32) is configured to receive data* from a utility company, describing “a vehicle to grid application that will allow for **communication between a local utility company server and the electric vehicle 12.**” EX1004-Kelty-078, 5:47-52; Claim 13. Further, Kelty-078’s *controller (VMS 32) is configured to start and stop charging of the battery of the vehicle* in response to an instruction from device 24. *See* Claim 1[d] (*citing* EX1004-Kelty-078, 5:40-44, 7:34-38, FIG. 3, Step 317). Specifically, Kelty-078 teaches VMS 32 “monitors, **controls**, and coordinates” various systems in the vehicle including the power

electronics module and energy storage system, such that VMS 32 is configured to *stop charging*, when appropriate. EX1004-Kelty-078, 7:44-51. As I opined above for Claim 4, Interface 10 is used to perform various steps for “controlling and monitoring a battery in the electric vehicle,” including *charging* battery 26 of electric vehicle 12 and powering on and off the charging operation of said battery. *See* EX1004-Kelty-078, Abstract, 3:49-54, FIG. 3 (Step 317), Claim 4.

288. Per Claim 13, Sutardja teaches receiving data indicative of a cost of power from the utility company 23. Claim 13, *citing* EX1010-Sutardja, [0264], [0267], FIG. 3B. Kelty-218 provides specificity that the cost of power is a “monetary price of power.” *Id.* Per Claim 9, Kelty-218 teaches a user-specified “**threshold** for what is a less expensive charging cost rate and what is a more expensive charging cost rate” by which a user may specify to charge the vehicle **only** when the cost of power is below a certain threshold. EX1008-Kelty-218, [0030], [0047]-[0048], FIG. 8. This would have been highly desirable for a user to save money on charging by charging **only** during periods when electricity costs are below a threshold (e.g., during time periods of lower electricity demand compared to peak demand hours). Reducing costs associated with charging would have been a highly advantageous and desirable goal that would have been a strong motivation for a POSITA to implement this modification. *See* Claim 9. Thus, Kelty-218 teaches *stop[ping]*

charging of the battery of the vehicle based on data indicative of the cost of power (a monetary price of power).

289. In the combination, the modified Kelty-078 vehicle is further modified pursuant to Sutardja and Kelty-218, such that VMS 32 receives the monetary price of power (cost of power) from utility company 23 (Claim 13, discussing Sutardja) and *stop charging of the battery of the vehicle* when the cost of power rises above a user-specified threshold (Claim 9, discussing Kelty-218).

1. Motivation to Combine

290. Motivations to combine receiving data indicative of a cost of power (the “monetary price of power,” per Sutardja) and *stop[ping] charging of the battery of the vehicle* when the monetary price of power exceeds the threshold (per Kelty-218) are provided above for Claims 13 and 9, respectively and are incorporated herein.

XIII. OPINIONS REGARDING GROUND 5: CLAIMS 15-16 ARE OBVIOUS OVER KELTY-078, FUJITA, SUYAMA, AND JOHNSON

291. I have been instructed to apply the claim construction for *cost of power* as “monetary price of power.” §III.C.

A. Claim 15: “The system of claim 1, wherein the controller is further configured to display information indicative of a cost of power on the display.”

1. Kelty-078’s Teachings

292. Kelty-078 teaches *the display*, namely in-vehicle display 30 displaying charging information. Claim 1[g]. Kelty-078 teaches VMS 32 is the onboard vehicle

computer that controls various vehicle systems, including the ESS 26 (battery) and PEM 34 (responsible for charging battery 26). As shown in FIG. 2, VMS 32 controls display 30 via “CAN BUS” through PEM 34 and electric vehicle service equipment module (EVSE) 36. EX1004-Kelty-078, 7:64–8:2, FIG. 2. Thus, Kelty-078 teaches *the controller configured to perform Claim 15’s functionality, namely VMS 32 displaying charging information.* EX1004-Kelty-078, 7:44-64; Claims 1[a], 1[g]-1[i] (discussing additional information the *controller is configured to repeatedly display on display 30, per Fujita and Suyama).*

2. Johnson’s Teachings

293. Johnson (EX1011) teaches a system for charging electric automobiles that displays the price per kwh (kilowatt-hour) on a display screen 35, teaching *display[ing] information indicative of a cost of power.* EX1011-Johnson, Abstract (system for charging), [0056] (display screen), [0092] (“Price per KWH”), FIGS. 1, 5-6. Namely, the charging system includes a “display screen 35” and CPU 32, and the CPU 32 displays “sales price ‘Price per KWH’” on the “display screen.” EX1011-Johnson, [0056], [0060], [0092]. The displayed cost of power is a “monetary price of power,” applying the claim construction, because the displayed cost is provided in cents per kilowatt hour: “Price per KWH is ¢____ per kwh.” EX1011-Johnson, [0092]. The displayed cents per kilowatt hour is a monetary price of power because it is a price per energy transferred over time.

294. Johnson teaches displaying cost of power is useful to the user. EX1011-Johnson, [0092-0093] (describing how the user may use this displayed cost of power information useful to determine if the current price is “acceptable.”). Johnson further teaches displaying the total power cost after charging. EX1011-Johnson, [0116].

3. *Motivation to Combine*

295. A POSITA would have been motivated and found obvious to modify Kelty-078’s in-vehicle display 30 to further display *information indicative of a cost of power*, such as the “Price per KWH” per Johnson, desirably enabling the user to determine if the current cost of power is “acceptable” to increase user convenience and ensure the price fits within the user’s budget. EX1011-Johnson, [0092-0093].

296. Doing so would have furthered Kelty-078’s express objective of allowing the user to “control the timing of charging of the vehicle such that charging occurs **during low power consumption times at a lower cost** to the vehicle user,” motivating the combination, as a user would be provided further control over cost fluctuations affecting vehicle charging. EX1004-Kelty-078, 2:6-11. Additionally, other charging information is already presented on the in-vehicle display 30 of Kelty-078, so a POSITA would appreciate displaying other charging information, such as cost, on the same display would increase ease of use as a user would only have to view one screen to gather information about charging of the vehicle. A POSITA would have recognized the combination constitutes applying a known

technique (displaying the cost of power information, per Johnson) to a known system ready for improvement (Kelty-078's vehicle charging system) to the yield predictable result of informing the user of the current charging price, leading to a reasonable expectation of success, as Kelty-078 already displays charging information on the in-vehicle display 30 and displaying a price to a consumer was well-known and common. EX1046-Ambroziak, 11 (describing an electric charging station sending a message to a user regarding "the cost of electricity" and the message being displays "on a dashboard display device").

B. Claim 16: "The system of claim 15, wherein the information indicative of the cost of power includes a cost of power per unit of power."

297. The modified Kelty-078 system in further view of Johnson teaches displaying *information indicative of the cost of power includ[ing] a cost of power per unit of power* (Monetary price in cents per KWH). See Claim 15, citing EX1011-Johnson, [0092].

XIV. OPINIONS REGARDING GROUND 6: CLAIM 17 IS OBVIOUS OVER KELTY-078, FUJITA, SUYAMA, AND POLLACK

A. Claim 17: "The system of claim 1, wherein the wireless signal includes a signal to start a manual charge of the battery."

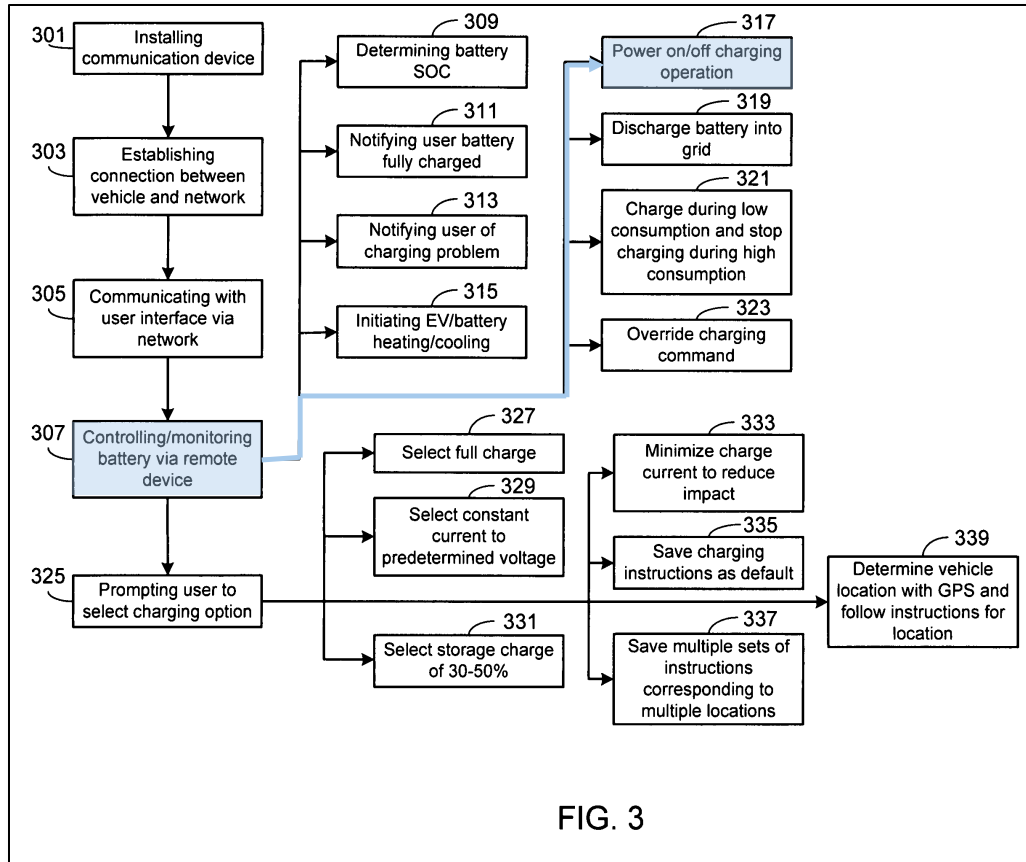
298. The modified Kelty-078 in view of Pollack teaches Claim 17.

1. '011 Specification Regarding "signal" and "manual charge"

299. Claim 1[c] (*signal*). The '011 Patent describes “the process of charging a vehicle battery in ‘manual’ mode (i.e., not based upon a time of day).” EX1001, 11:30-32, 20:64-66 (describing the charger “operating in a manual charge mode (e.g., not based upon a time of day as selected using buttons 86 and 100)”).

2. *Kelty-078's Teachings*

300. Kelty-078 teaches “that the user or driver 20 of the vehicle is [] capable of communicating with the electric vehicle 12 from their portable device such as a **cell phone**...to program and send specific **instructions** to the electric vehicle 12 for **controlling and monitoring the battery system 26** arranged within the electric vehicle 12 (step 307).” EX1004-Kelty-078, 4:58–5:1, FIG. 3, 4:16-19 (disclosing the user communicating “directly with the vehicle 12 via any user interface device 24,” with such user interface devices being, e.g., “cell phones”); Claims 1[b]-1[d]. Examples of such “instructions” are illustrated in FIG. 3 and include user 20 “powering on and off” charging of battery 26. EX1004-Kelty-078, 4:66, 5:40-52, FIG. 3 (Step 317). Namely, step 317 depicts the user being capable of “powering on and off in predetermined cycles and at predetermined times the charging of the battery 26 **from a user interface device 24** (step 317).” EX1004-Kelty-078, 5:40-44.



EX1004-Kelty-078, 6:16-21, FIG. 3 (Steps 307, 317).

301. VMS 32 (*controller*) “monitors, controls and coordinates various systems in the electric vehicle 12 including” ESS 26 (the electric vehicle battery). EX1004-Kelty-078, 7:44-51; Claim 1[a]. Therefore, wirelessly communicating using Bluetooth to “send...instructions” from device 24 to VMS 32 includes VMS 32 *receiv[ing] a wireless signal and configured to do so*. EX1004-Kelty-078, 4:53-58, 8-5:18, 8:44-48.

3. Pollack’s Teachings

302. Pollack teaches a user interface “associated with an electric resource...such as an electric vehicle that includes an energy storage system.” EX1013-Pollack, [0227]. Pollack’s “user interface may be displayed on a device associated with the owner of the electric resource, such as a cell phone or portable computer.” *Id.*, Claim 6 (“user interface comprises an in-vehicle user interface...a web-based user interface, or a cell phone user interface”). Pollack allows the user to “input[] user-selected power aggregation constraints and...preferences via the user interface” and “display[s] parameters of the power aggregation system.” EX1013-Pollack, Claims 1-4. The parameters displayed on Pollack’s user interface include “user-selectable manual charging overrides.” EX1013-Pollack, Claim 4.

303. Pollack teaches *start[ing] a manual charge of the battery*. Namely, Pollack teaches that the user interface may include “an override for requesting immediate charging of the electric vehicle.” EX1013-Pollack, Claims 4, 15, [0100], [0202]. Pollack teaches a power aggregation system 100 that monitors the electrical resources during charging. EX1013-Pollack, [0100]. The system includes “[e]xemplary User Experience Options,” such as the “vehicle owner 408 can override and request immediate charge if desired.” EX1013-Pollack, [0199], [0202].

304. In the combination, Kelty-078’s *portable controller* (processor of device 24) sends Pollack’s override signal (“override for requesting immediate charging of the electric vehicle”) to Kelty-078’s *controller* (VMS 32) to *start a*

manual charge of the battery (immediately start charging vehicle 12 and do not start charging the vehicle battery based on time). EX1013-Pollack, Claims 4, 15, [0100], [0202].

4. Motivation to Combine

305. A POSITA would have been motivated and found obvious to transmit Pollack's manual charge command as a "signal" in the modified Kelty-078 system. A POSITA would have appreciated being able to immediately start charging their electric vehicle whenever desired to improve user convenience in using the charger and increase the flexibility of the charging schedule. A POSITA would have recognized the benefit of enabling a user of Kelty-078's system to directly initiate charging via a user interface device, rather than relying solely on scheduled triggered charging. For example, in emergency situations where the user unexpectedly needs to drive their car, a POSITA would have appreciated being able to manually initiate charging via the user interface instead of waiting for the scheduled time to charge. Thus, a POSITA would have appreciated that user schedules would change in certain circumstances and understand the benefit of allowing a user to manually start charging in these circumstances. Such a modification would have resulted in greater system flexibility to address a user's immediate charging needs (for example, if they needed additional charge immediately in an emergency or on a long trip, or if the user was likely to lose access to a shared charger). For example, another situation

benefitting from manual charging would be if a user knew they were going to be driving where chargers may not be provided, and thus would appreciate the ability to manually charge on-the-fly should they end up in an area with no charging capability. Immediate charging allows a user to take advantage of low power rates, or to charge their vehicle up to a minimum desired amount of charge to provide peace of mind. Much like a driver choosing to unexpectedly top off their gas when prices are low, a driver of an electric vehicle would appreciate being able to manually charge when prices are lower.

306. Transmitting a manual battery charge as a signal would have been the use of a known technique (charging command in the form of signal) to improve similar devices (EV charging systems) in the same way. A POSITA would have had a reasonable expectation of success because the combination would implement the wireless Bluetooth communications expressly taught by Kelty-078 to send a manual charge command signal, a feature well within the skill set of a POSITA. EX1005-Bluetooth Specification, 1 (describing Bluetooth as making wireless connections “easy”); EX1046-Ambroziak, 11 (describing an “iphone” communicating “via Bluetooth” with an “automobile to make and/or change” charging parameter selections). Further, EV charging systems commonly provided users with the ability to manually initiate charging when desired, including through charging overrides and immediate charging requests. EX1039-Izuno, [0022] (describing a charging

system that includes a user selection of “start charging,” that, when selected, “transmits a charging instructions to the charging station”).

307. Kelty-078 already teaches device 24 that allows users “to control certain aspects of charging of the battery” “and discharging of the battery to an electric grid if necessary.” EX1004-Kelty-078, 2:42-45. Similarly, Pollack teaches a user interface for a user to select charging preferences and “user-selectable manual charging overrides,” including “an override for requesting immediate charging of the electric vehicle.” EX1013-Pollack, Claims 4, 12, 15, [0202]. Therefore, a POSITA would have had a reasonable expectation of success applying Pollack’s teachings to the Kelty-078 system given their similarities (such as comprising interface devices like cellphones), and given the ubiquity of communicating charging information (including instructions) between a phone and a vehicle. *See* § VI.E.

XV. OPINIONS REGARDING GROUND 7: CLAIM 18 IS OBVIOUS OVER KELTY-078, FUJITA, SUYAMA, KELTY-218, AND HOTTA

A. Claim 18

308. The combination of Kelty-218 and Hotta (EX1009) teaches Claim 18. Kelty-218 teaches almost all of Claim 18’s limitations. Hotta provides specificity on the implementation detail of the mathematical calculations for beginning charging of the battery, based on Kelty-218’s predicted charge stop time.

1. Claim 18[a]: “The system of claim 1, wherein the controller is further configured to: estimate a latest time of day to begin charging of the battery;”

309. Kelty-218 teaches methods of charging based on at least three factors, including the charging cost (i.e., the cost of power in cents per kilowatt hour; KWH), the time of day (i.e., first period, second period), and a predicted time of day when the user will want to use their vehicle. EX1008-Kelty-218, [0024], [0047], FIG. 8, [0027]. Kelty-218 recognizes that “municipal power grid pricing fluctuates frequently.” EX1008-Kelty-218, [0048]. To accommodate the frequent fluctuations while keeping the cost of charging as low as possible, Kelty-218 teaches various methods of setting a cost threshold for charging, e.g., charge/do not charge if below/above threshold, such that charging is performed during different time periods based on different charging costs. EX1008-Kelty-218, [0027]. Yet further, Kelty-218 predicts charging stop times, i.e., a time by which the charging needs to be completed, to ensure the desired charging occurs, even if subjected to a higher charge cost. EX1008-Kelty-218, [0027].

310. Kelty-218 teaches:

a trend circuit to record a plurality of charging stop times over a period of days, and to **predict a predicted charging stop time** based on the plurality of charging stop times. A **charging stop time**, in various embodiments, **is the time of day when a user usually unplugs their electric vehicle**. In many cases, **this is right before the user engages their electric vehicle for a drive**.

EX1008-Kelty-218, [0027]. Kelty-218 thus teaches predicting the time of day when the user will need their vehicle to be charged to the desired charge level. This predicted time of day is *a latest time of day* by which charging of the battery should be complete, because it is the time of day “right before the user engages their electric vehicle for a drive.” *Id.* Thus, the predicted time of day is *a latest time of day*.

311. Hotta provides specificity on a latest time of day *to begin* charging of the battery, as recited in Claim 18. Hotta (EX1009) teaches a vehicle battery charging system “**calculating a charging start time to finish the charging of the storage battery**” based on (a) “the time the driver intends to next board and drive the vehicle” and (b) the total time required to charge the battery. EX1009-Hotta, Abstract, 2:15-19, 6:25-27. Hotta’s charging start time calculation is an *estimat[ion]* of *a latest time of day to begin charging of the battery* because the battery is not charged (held in “holding mode ‘a’”) “until a calculated charging start time in order to finish the charging of the storage battery 22 at the scheduled boarding time” when the driver will next use the vehicle. EX1009-Hotta, 6:25-27. Namely, because the estimated start time is based on finishing the charging “at” when the driver boards the vehicle to use the vehicle, the estimated start time is *a latest time of day to being charging*. Any later start time would not allow the vehicle to be charged fully before the user has to “board[] the vehicle,” thus making the estimated start time the latest time. Hotta’s controller 21 “executes” a standby mode (“holding mode ‘a’”) to

prevent battery charging until reaching the calculated charging start time T_s . EX1009-Hotta, 9:26-30.

312. Regarding the start time estimation, Hotta's "FIGS. 3 and 4 show a subroutine [within the FIG. 2. Main operation routine]...for setting a charging start time in the constant-current/constant-current charging mode." EX1009-Hotta, 3:1-5. Hotta teaches that controller 21 of the electric vehicle calculates individual "necessary charging periods" (e.g., T_{c1} , T_{c2} , T_{c3} ; "hours (H) necessary to charge a portion of the amount of discharged electric energy") and adds the individual periods together to determine the total time required to recharge battery 22. EX1009-Hotta, 7:23-28. The calculated recharge time is subtracted from the scheduled boarding time (T_{ob}) desired by the driver to determine the "charging start time T_s " (" $T_s = T_{ob} - (T_{c1} + T_{c2} + T_{c3})$ "). EX1009-Hotta, 8:19. The "necessary charging periods" T_{c1} and T_{c2} are calculated based on "storage capacity of the storage battery 22" (C), "amount of discharged electric energy D(AH)" from battery 22, and charging "current" (C/H; battery capacity per hour). EX1009-Hotta, 7:15-35. The "necessary charging period" T_{c3} is calculated based on the nighttime (T_n ; "ranging from 23:00 to 7:00 in the next morning") or daytime (T_d) "rate" of supplying electricity. EX1009-Hotta, 7:50-54, 8:1-6.

313. In the combination, Kelty-218's teaching of predicting when the user will want to drive their vehicle (and therefore, for the charging to be complete) is

combined with Hotta's teaching of calculating a charging start time to finish prior to when the user will want to drive their vehicle. A POSITA would have been motivated and found obvious to modify the Kelty-078 system, as modified, such that Kelty-078's *controller* (VMS 32) *is configured to* calculate the latest time to start charging vehicle 12, per Kelty-218 and Hotta, to ensure the vehicle is sufficiently charged when the user needs to drive and to further perform the steps of Claims 18[b]-[c], discussed below.

314. Users commonly prefer to charge an electric vehicle when the monetary price of power is low to reduce cost. Kelty-078, 2:55-59; *see* § VI.F. However, the car eventually needs recharging, regardless of the cost of electricity, to ensure there is enough charge to reach the user's destination at the desired driving time, thus motivating the combination to start charging the battery based on when the user will need to drive the vehicle. Thus, a POSITA would have appreciated a charging system that utilizes the time they plan to next use the vehicle in determining when the start charging the battery. Additionally, a POSITA would have appreciated there are certain situations where waiting until the latest time to charge would be beneficial, based on lower electricity costs. For example, electricity often has lower cost during the night time, as homes are using less electricity (e.g., for lights, TV, etc.) while people are sleeping. Thus, for a morning commute trip, a POSITA would appreciate the charging system determining a charge start time based on the next time they have

to drive so that the charge would start later in the evening during lower costs. A POSITA would have further valued the vehicle **automatically** charging by a calculated time without requiring user intervention to do so. This would increase ease of use of the charging system, as the user would not have to remember to start charging in order to have the necessary amount of charge for their next trip, especially when charging at odd times where the user may not be awake.

315. A POSITA would have recognized the combination constitutes applying a known technique (calculating a charging start time, per Hotta) to a known system ready for improvement (Kelty-078's vehicle charging system 10) to the yield predictable result of determining a time by which to start charging of the vehicle leading to a reasonable expectation of success, given the only modification required is programming Kelty-078's VMS 32 to determine the latest time of day at which to start charging (per Kelty-218 and Hotta), via Hotta's estimated start time calculation.

316. Kelty-218 provides express motivation for the combination, teaching its system may be particularly "helpful in areas in which municipal power grid pricing fluctuates frequently, such as in areas where wind turbines produce excess power at windy times, and a shortage of power during times in which is it not windy." EX1008-Kelty-218, [0048]. Thus, waiting to charge the battery at an estimated start time would provide assurance to the user that their vehicle would be charged and ready for their next trip, regardless of pricing fluctuation. Accordingly,

a POSITA would have appreciated that their electric vehicle will still reliably charge by a calculated time (an *estimate[d] latest time of day to begin charging*) independent of other factors that may “fluctuate[] frequently” like cost. EX1008-Kelty-218, [0048]. In other words, regardless of other factors that affect the charge schedule, a POSITA would appreciate the peace of mind that their vehicle will be charged by the time they next have to use their vehicle.

2. Claim 18[b]: “determine whether a cost of power satisfies a cost threshold; and”

3. Claim 18[c]: “in response to the cost of power not satisfying the cost threshold, automatically start charging the battery based on at least the estimated latest time of day.”

317. Kelty-218 teaches a *cost of power*, applying the claim construction of a “monetary cost of power.” Claim 13; §III.C. Additionally, Kelty-218 teaches a *cost threshold*. Claim 9.

318. Kelty-218 expressly teaches Claim 18[b]’s *determin[ing] whether a cost of power satisfies a cost threshold*, namely “the charging cost circuit 212 is to turn on the charging circuit 208 during a first time period in which the charging cost rate is **below** a first threshold.” EX1008-Kelty-218, [0027], [0030] (a user may specify via their vehicle or home computer “to charge **only** when below a certain threshold). In Kelty-218, a first threshold (*cost threshold*) is set by the user: “the user can input a **threshold** for what is a less expensive charging cost rate and what is a more expensive charging cost rate.” EX1008-Kelty-218, [0030]. When it is

determined the cost of power is below the first threshold (*determine whether a cost of power satisfies a cost threshold*), the battery is charged. EX1008-Kelty-218, [0027], [0047], FIG. 8 (806, 810). For example, Kelty-218 teaches a “charging cost circuit 212” turns on charging when the “charging cost rate is below a first threshold.” EX1008-Kelty-218, [0027], [0047] (disclosing only charging “when the charging cost rate is within the first charging cost rate range 806”).

319. Regarding Claim 18[c], Kelty-218 additionally teaches that in some optional embodiments, a time by which the user will need the charge to be completed is predicted, and charging during a second, more costly time period will occur to ensure charging is complete:

In some optional embodiments, the charging cost circuit 212 **turns on the charging circuit 208 during a second time period in which the charging cost rate is above the first threshold.** This might be during the morning, **after a power supplier has switched to a higher cost rate, but before a user begins to drive their electric vehicle.**

EX1008-Kelty-218, [0027-0028], [0047], FIG. 8.

320. Thus, Kelty-218 teaches a second time period during which the charging cost is “above the first threshold” and thus is at a higher cost rate than the first period (*the cost of power not satisfying the cost threshold*). Kelty-218 teaches the system *automatically start[s] charging the battery*, even though the cost of power does not satisfy the cost threshold (i.e., is above the threshold), because the

vehicle's battery still needs to be charged "before a user begins to drive their electric vehicle" at the predicted charge stop time. *Id.* Therefore, Kelty-218 teaches *in response to the cost of power not satisfying the cost threshold* (being above the first threshold), the systems still *automatically start[s] charging the battery based on at least the estimated time of day* (the latest time of day to begin charging the battery, per both Kelty-218 and Hotta) in order to finish the charging of the battery at the time when the driver will next use the vehicle (e.g., "during the morning...before a user begins to drive their electric vehicle"). EX1008-Kelty-218, [0027].

321. In the combined system, if *the cost of power* ("monetary price of power" in dollars/cents per KWH) does not *satisfy the cost threshold* (per Kelty-218), the vehicle will not begin charging until reaching *the estimated latest time of day* (Hotta's charging start time T_s), at which point the combined system *automatically starts charging the battery* in order to finish the charging of the storage battery" at the time when the driver will next use the vehicle. The Motivations to Combine provided for Claim 18[a] is incorporated for Claims 18[b]-18[c]. This modification would have had a reasonable expectation of success, as the modified Kelty-078 system already estimates the start time for charging and automatically starts charging the vehicle at that estimated latest time. *See* claim 18[a]. Thus, all that is required is programming the VMS 32 to compare costs to cost

thresholds and start charging the vehicle at the latest start time when none of the cost thresholds are met.

XVI. OPINIONS REGARDING GROUND 8: CLAIMS 19-20 ARE OBVIOUS OVER KELTY-078, FUJITA, SUYAMA, KELTY-218, AND HOBBS

A. Claim 19: “The system of claim 1, wherein the wireless signal is a first wireless signal and wherein the controller is further configured to transmit a second wireless signal to the portable controller, the second wireless signal including a power interruption notification.”

322. The modified Kelty-078 system in view of Hobbs teaches Claim 19.

1. '011 Specification Regarding “power interruption notification” and “signal”

323. The '011 Patent states envisioning “if the supply of power has been interrupted, the controller 44 can send a power interrupt fault message to the user” as shown by reference numeral 129 in FIG. 27. EX1001, 43:2-6, FIG. 27. The '011 Specification further describes “power interruption” as “stopping battery charging.” EX1001, 4:10-20, 43:7-17.

324. Regarding *signal*, see Claim 1[c].

2. Kelty-078's Teachings

325. Kelty-078 teaches “an electric vehicle communication interface that allows for the vehicle **to notify the user** when the battery is fully charged or if a problem has occurred during charging thus affecting the operability of the electric vehicle.” EX1004-Kelty-078, 2:46-50; 5:5-9 (describing “**communication between**

the electric vehicle 12 and user 20 or user 20 and electric vehicle 12....”). Specifically, Kelty-078 teaches “vehicle 12 notifying the user or driver 20 that a problem occurred during charging of the battery 26 (step 313)....” EX1004-Kelty-078, 5:21-26, FIG. 3.

3. *Hobb’s Teachings*

326. Hobbs (EX1012) discloses an electric-vehicle charger 100 “configured to charge batteries (e.g., batteries 152) that are located on electric or hybrid electric vehicles (e.g., vehicle 150).” EX1012-Hobbs, [0029]. Charger 100 includes “screen 107 and key pad 104” configured to “provide diagnostics and manual control.” EX1012-Hobbs, [0037], FIG. 1. Hobbs explicitly states a function of its system is to provide an indication of “charging equipment or **utility supply fault.**” EX1012-Hobbs, [0036].

327. Hobbs teaches if the voltage of the vehicle battery is not within a defined range after a certain number of charge additions, its charger 100 may **stop charging and provide a fault indication** via screen 107. EX1012-Hobbs, [0084]; In this way, Hobbs teaches transmitting a signal indicating a fault to the user, where the fault is related to interruption of charging. Additionally, Hobbs teaches that “when a certain amount of charging has been completed or the charge of battery 152 reaches a certain level, **charger 100 may indicate that charging** is complete...or **substantially complete.**” EX1012-Hobbs, [0111]. Hobbs additionally explains that

“charger 100 may **indicate that charging is complete at one current threshold...and stop charging at a lower current threshold.**” *Id.* In each of these descriptions, Hobbs teaches *transmitting a signal including a power interruption notification*. EX1012-Hobbs, [0084], [0111]. Indeed, Hobbs provides teachings of transmitting a signal to indicate that a power interruption has occurred, where the power interruption may be the result of a fault or charging is complete at one current threshold, for example.

328. Hobbs further teaches that the user is notified via a display or screen. Hobbs teaches that “the voltage, current, or power level at which charging is taking place...may be indicated, for example, in real time, via an LED or screen 107.” EX1012-Hobbs, [0109]. “When the charging current ... drops below the threshold ... charger 100 may stop charging ... may indicate that charging is complete (...e.g., via indicator lights 108, screen 107, or both), or both.” *Id.*

4. Motivation to Combine

329. Kelty-078 provides device 24 connected to VMS 32 for wirelessly initiating battery charging. Claims 1[b]-1[d]. Device 24 is configured and intended for bi-directional communication with the vehicle, including “allow[ing] the vehicle 12 to contact the user” and “**monitoring** a battery in the electric vehicle” via device 24. EX1004-Kelty-078, 4:53-58, 2:28-30. Thus, in the combination, Hobbs’s power interruption notification is wirelessly provided via Kelty-078’s device 24 to allow

the user to **monitor** the battery conveniently and remotely, motivating the combination. A POSITA would have been motivated to modify Kelty-078 to utilize Hobb's notification to advantageously inform a user of situations where a charging fault has occurred or charging has completed, as this information would have been useful for the user. For example, if a user is waiting on charging to complete before heading out to drive, the user would have appreciated receiving notification that charging had completed. Similarly, if power were interrupted and charging were interrupted, a POSITA would have appreciated that informing a user to check on the charging system would have been advantageous to try to resolve the issue.

330. Hobbs provides express motivation for the combination, teaching its power interruption notification feature "may facilitate minimizing the charging time if the user is waiting for the charge to be completed, but maximizing the amount of charging that takes place if the user is not ready to use [the] vehicle." EX1012-Hobbs, [0111]. A POSITA would have been motivated by this express teaching, suggestion, or motivation in Hobbs to modify Kelty-078 to capture Hobbs's advantages. Thus, in the combination, Kelty-078's VMS 32 (*controller*) is *configured to transmit a second wireless signal including a power interruption notification* (the instruction comprising the Hobb's charging complete indication) to device 24. EX1012-Hobbs, [0111]. This would have been use of Hobb's known

technique that would have improved the similar Kelty-078 and Hobbs devices in the same way.

331. Hobbs explains that “[t]his feature may facilitate minimizing the charging time if the user is waiting for the charge to be completed, but maximizing the amount of charging that takes place if the user is not ready to use... vehicle 150.” *Id.* A POSITA would have been motivated and found obvious to combine Hobbs’ notification teachings to Kelty-078’s device 24 to provide information to the user regarding vehicle charging. This would have advantageously informed the user of how charging is progressing and would have allowed a user to make decisions on whether to stop charging to drive the vehicle or allow charging to continue. A POSITA would have recognized the combination constitutes applying a known technique (transmitting a power interruption notification, per Hobbs) to a known system ready for improvement (Kelty-078’s vehicle charging system) to yield the predictable result of notifying the user quickly and conveniently when charging has stopped, leading to a reasonable expectation of success. This modification would have required only straightforward and routine changes to programming instructions, which would have been well-within the skillset of a POSITA. Therefore, a POSITA would have had a reasonable expectation of success for making the modification.

B. Claim 20: “The system of claim 19, wherein the power interruption notification indicates at least one selected from a group consisting of an interruption based on a cost of power, an interruption based on a demand surge, and an interruption based on a time of day.”

332. The modified Kelty-078 system teaches *transmitting a second wireless signal including a power interruption notification*. See Claim 19. Further, as discussed for Claims 9, 18, the modified Kelty-078 system teaches charging a vehicle battery **only** while the cost of power is below a threshold set by the user. See Claims 9, 18 *citing* EX1008-Kelty-218, [0027-0028], [0030], [0047]. Thus, the modified Kelty-078 system experiences a *power interruption based on a cost of power*, namely when the cost of power rises above the user-selected threshold, because the system only charges while the cost of power is below the cost threshold.

333. Motivations to combine charging only while a cost of power (the “monetary price of power,” per Kelty-218) is below a threshold and *transmitting a power interruption notification* (per Hobbs) are provided above for Claims 9 and 18-19.

XVII.CONCLUSION

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

Dated: 16 June 2026

By:



Scott Andrews

Scott Andrews

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Petaluma, CA

Summary

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

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

Experience

12/2001-Present Cogenia Partners, LLC

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

Current Engagements:

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

Prior Engagements/Projects:

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

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

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

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

4/2000 to 12/2001 Cogenia, Inc.

President and Chief Executive Officer, Founder

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

1996 to 4/2000 Toyota Motor Corporation, Japan

Project General Manager, R&D Management Division

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

1983 to 1996 TRW, Inc.

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

1993 to 1996 TRW Automotive Electronics Group

Director, Advanced Product Planning/Development

Specific responsibilities included leadership and overall management of advanced

Scott Andrews

Page 3

IPR2026-00382

Tesla EX1003 Page 207

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

1983 to 1993 TRW Space & Electronics Group

Manager, MMIC Products Organization

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

1979-1983 Teledyne Microwave

Developed high reliability microwave components. Developed CAD tools.

1977-1979 Ford Aerospace, Advanced Development Operation

Designed, tested and delivered microwave radar receiver systems

Education

MSEE Stanford University, 1982

BSEE University of CA, Irvine 1977

TRW Senior Leadership Program 1992

Publications

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

- Briefing Presented to the Future Generation Software Architectures in the Automotive Domain Conference, San Diego, CA, January 2004
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 21. Connected Vehicle Performance Requirements; Presented at the 22nd World Congress on Intelligent Transportation Systems, October, 2015, Bordeaux, France

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4. Communication System For Controlling Data Processing According To A State Of A Communication Terminal Device; Patent Number: US 6,122,682 3/23/1998
5. Method And Apparatus For Controlling An Adjustable Device; Patent Number: US 5,864,105; 01/26/1999
6. Automatic Brake Device; Patent Number: JP2000108866; 4/18/2000
7. Visual Field Base Display System; Patent Number: JP2000029618; 01/28/2000
8. Intersection Warning System; Patent Number: US 5,926,114; 07/20/1999
9. Security For Anonymous Vehicular Broadcast Messages; Patent Number: US 7,742,603 3/27/2006
10. Digital Certificate Pool; Patent Number: US7,734,050 3/27/2006
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