US 20100211340A1

(19) United States

(12) Patent Application Publication

Lowenthal et al.

(10) Pub. No.: US 2010/0211340 A1

(43) Pub. Date: Aug. 19, 2010

(54) SYSTEM AND METHOD FOR MANAGING ELECTRIC VEHICLES

(76) Inventors: **Richard Lowenthal**, Cupertino, CA (US); **Milton Tormey**, Los Altos, CA (US); **James Solomon**, Saratoga, CA (US)

Correspondence Address:
BLAKELY SOKOLOFF TAYLOR & ZAFMAN LLP
1279 OAKMEAD PARKWAY
SUNNYVALE, CA 94085-4040 (US)

(21) Appl. No.: **12/372,721**

(22) Filed: **Feb. 17, 2009**

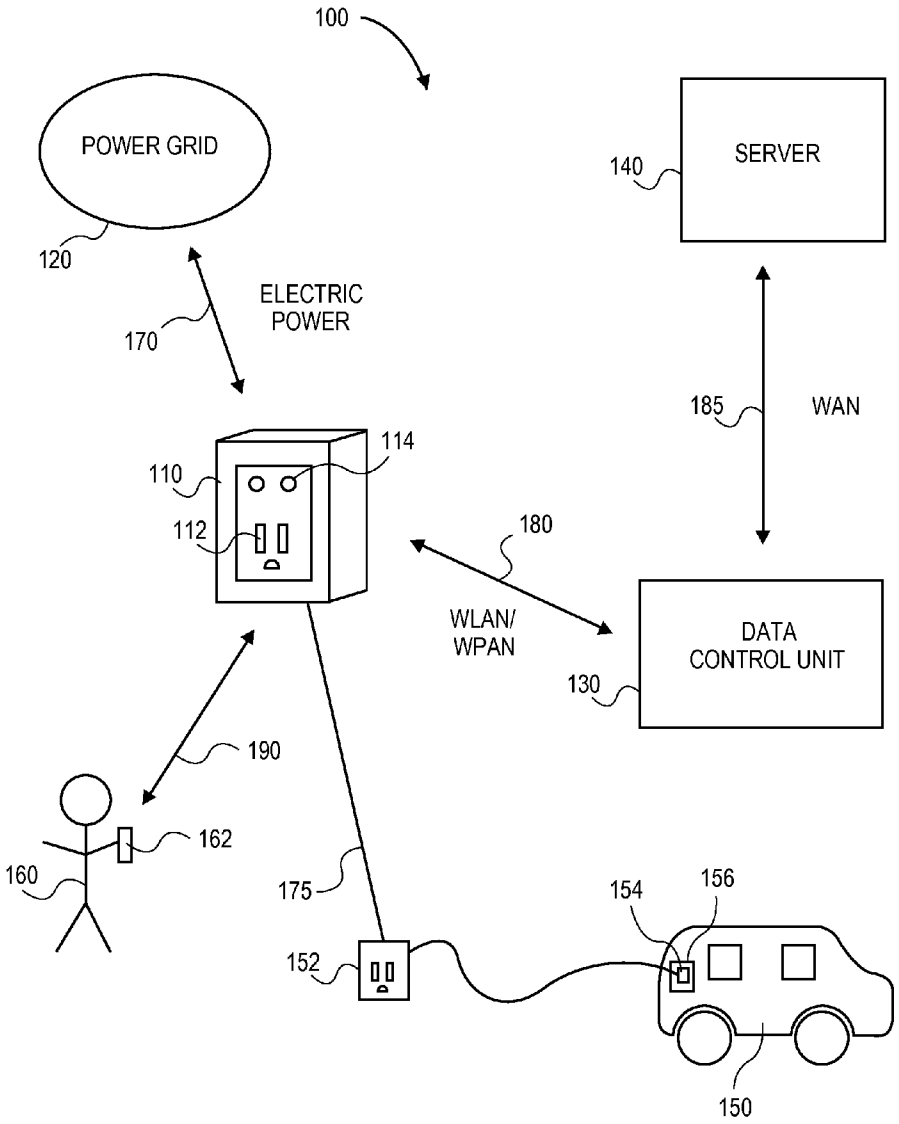
Publication Classification

(51) **Int. Cl.**
G01R 31/36 (2006.01)

(52) **U.S. Cl.** **702/63**; 903/907

(57) **ABSTRACT**

A system and method for managing a plurality of electric vehicles with a fleet management portal is described herein. In one embodiment, a machine implemented method for managing one or more fleets of electric vehicles includes monitoring one or more fleets of electric vehicles using a fleet management portal associated with a server. Next, the method includes monitoring a plurality of charge transfer devices using the fleet management portal. Next, the method includes receiving charging information from the charge transfer devices. Next, the method includes determining a charging status for each electric vehicle based on the charging information. Next, the method includes generating one or more reports having the charging status for each electric vehicle.



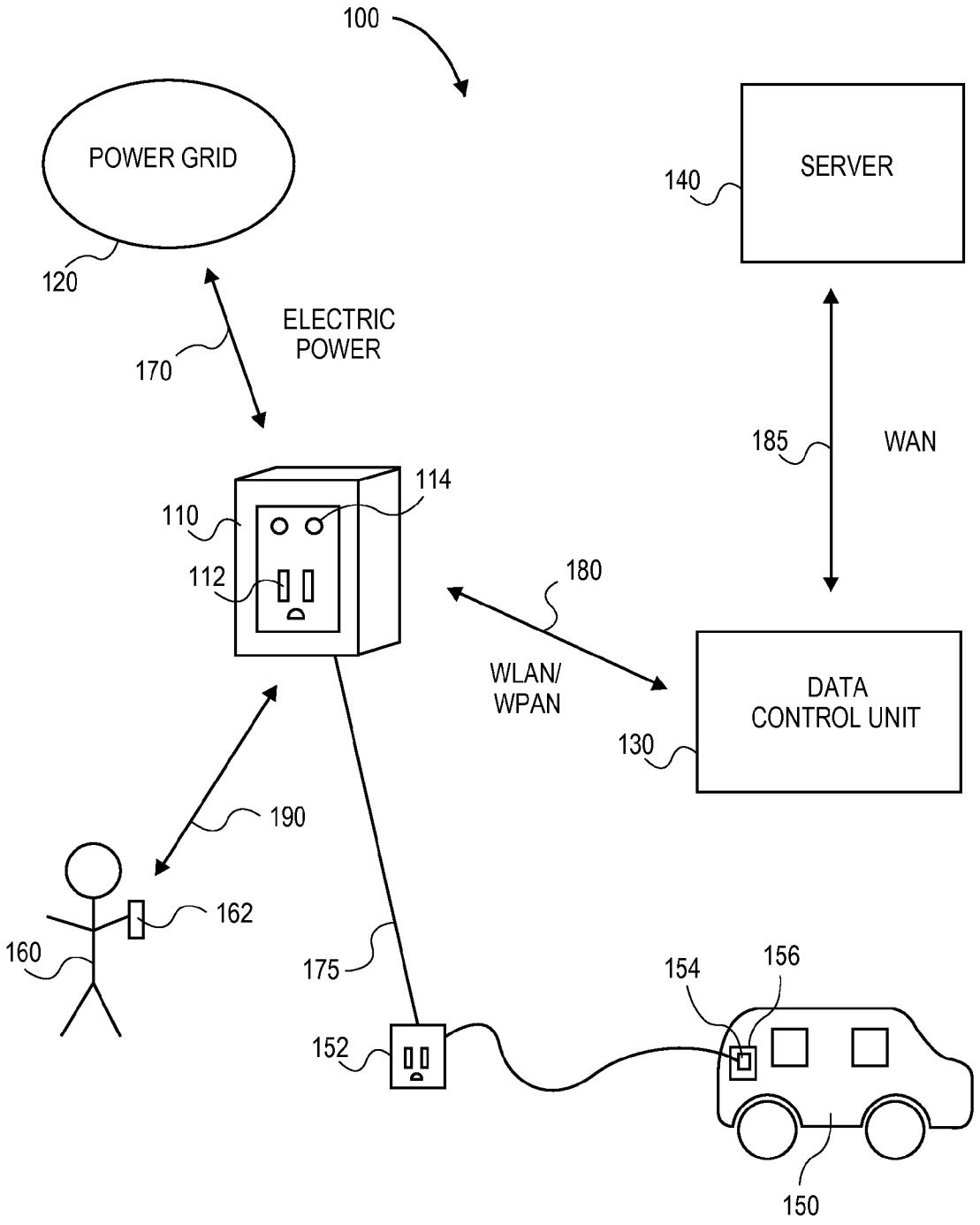

100
POWER GRID
120
ELECTRIC
POWER
170
SERVER
140
185
WAN
110
114
112
180
WLAN/
WPAN
DATA
CONTROL UNIT
130
190
162
160
175
154
156
152
150

FIG. 1A

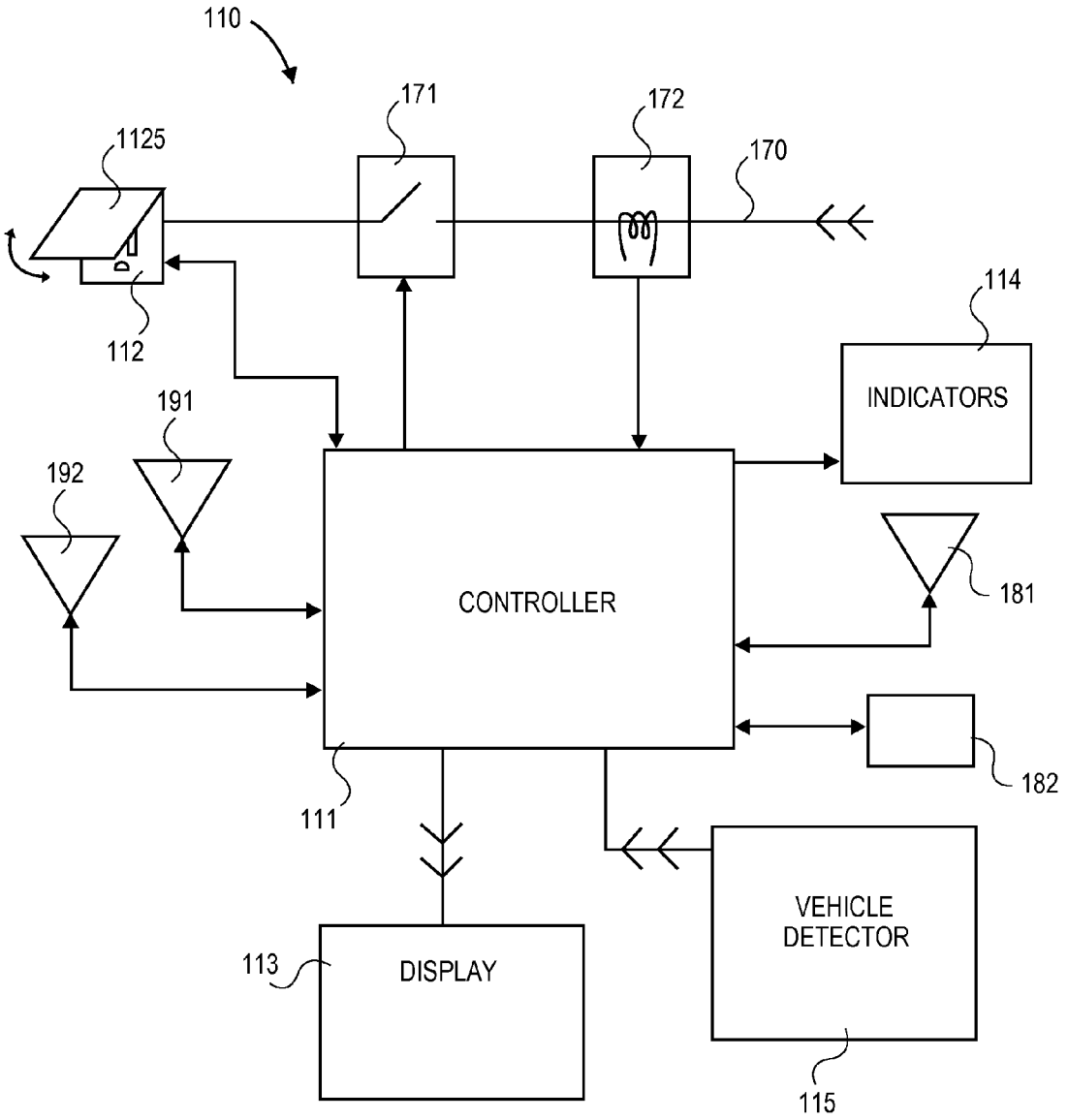

110
171
172
1125
170
112
114
INDICATORS
191
192
CONTROLLER
181
182
111
VEHICLE
DETECTOR
113
DISPLAY
115

FIG. 1B

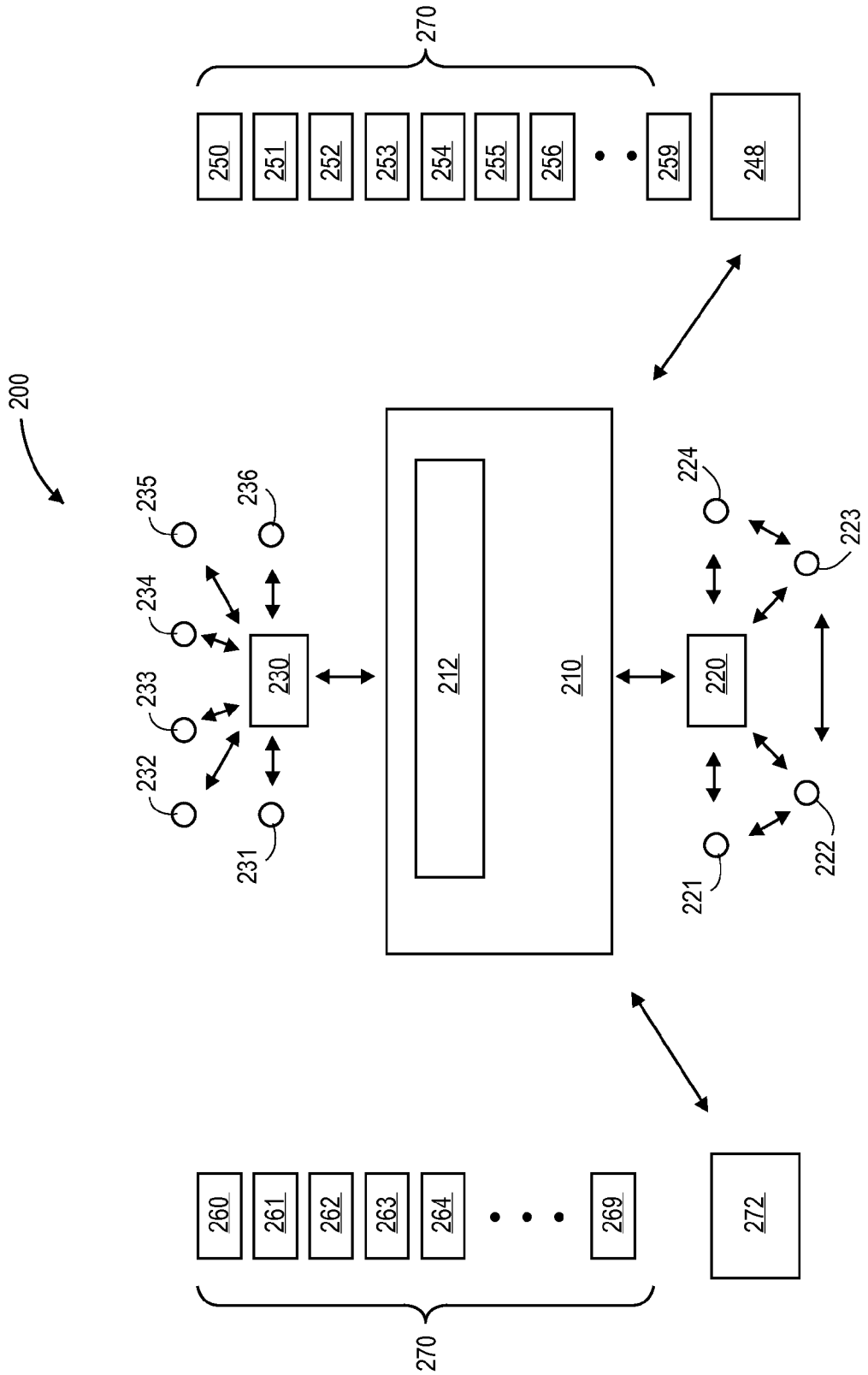

200
270
250
251
252
253
254
255
256
259
248
235
236
234
233
232
231
230
212
210
220
224
223
221
222
260
261
262
263
264
269
272
270

FIG. 2

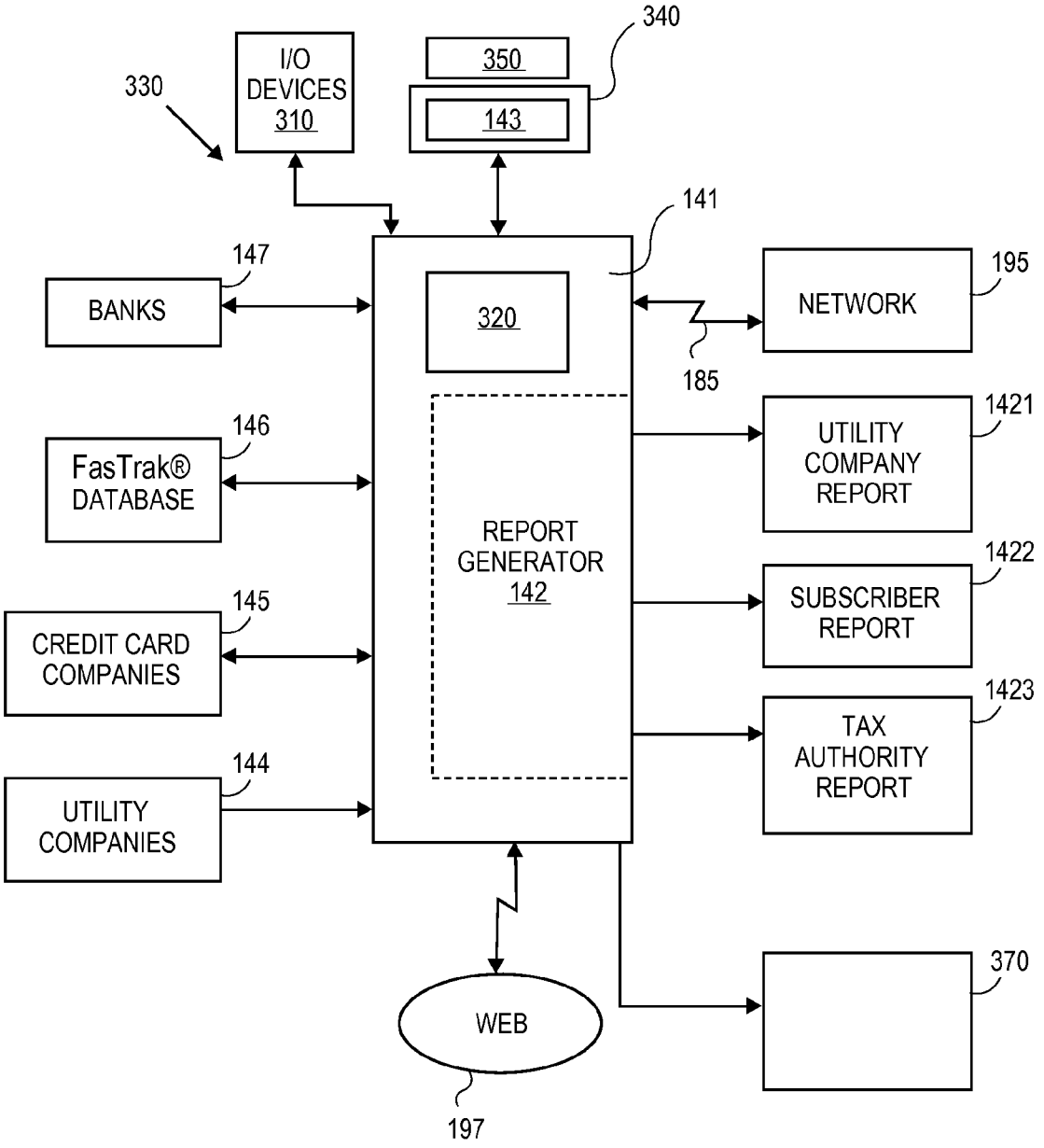

340
350
143
330
I/O
DEVICES
310
141
147
BANKS
320
195
NETWORK
185
146
FasTrak®
DATABASE
REPORT
GENERATOR
142
1421
UTILITY
COMPANY
REPORT
1422
SUBSCRIBER
REPORT
145
CREDIT CARD
COMPANIES
1423
TAX
AUTHORITY
REPORT
144
UTILITY
COMPANIES
370
WEB
197

FIG. 3

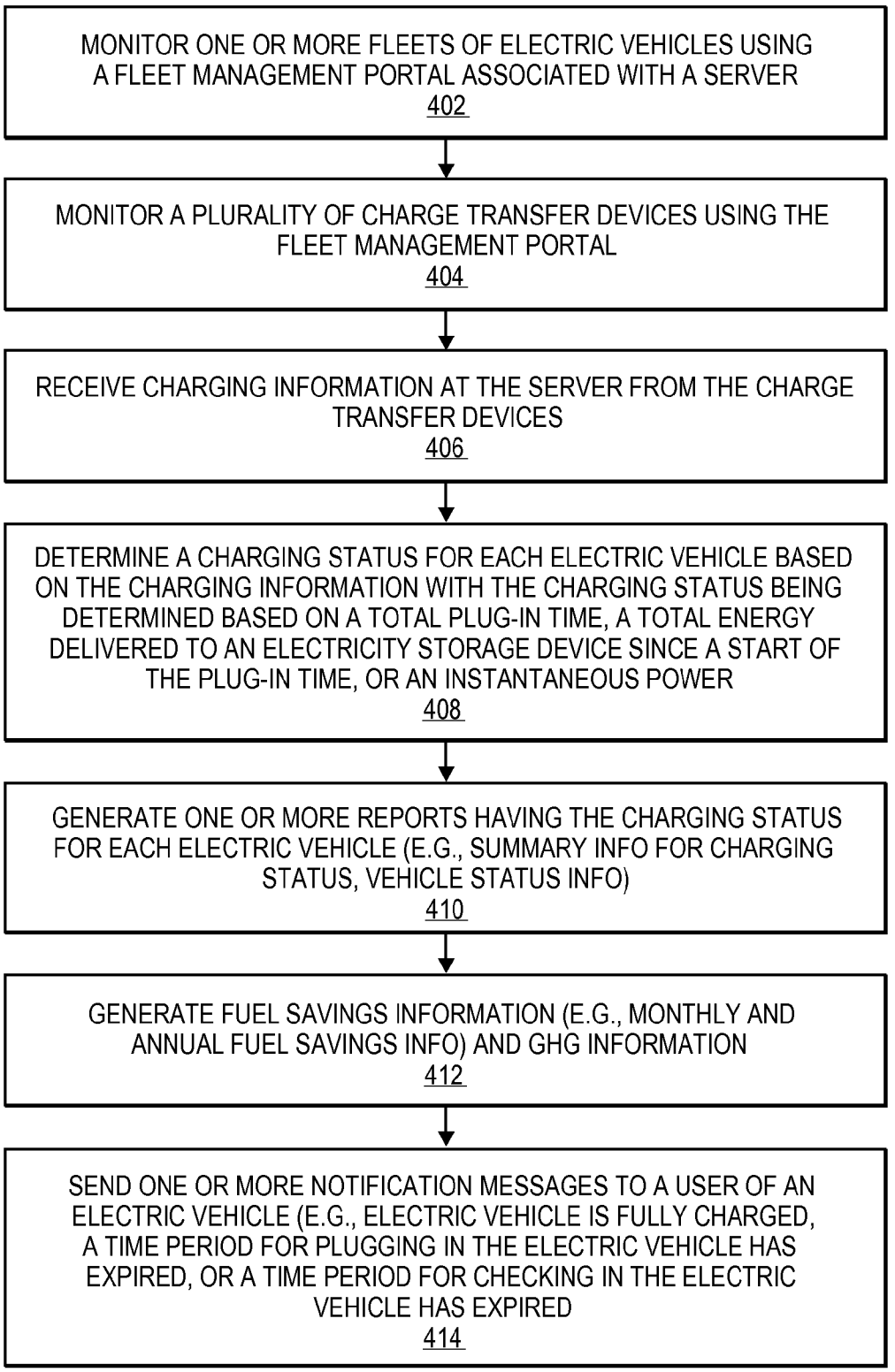

MONITOR ONE OR MORE FLEETS OF ELECTRIC VEHICLES USING A FLEET MANAGEMENT PORTAL ASSOCIATED WITH A SERVER
402
MONITOR A PLURALITY OF CHARGE TRANSFER DEVICES USING THE FLEET MANAGEMENT PORTAL
404
RECEIVE CHARGING INFORMATION AT THE SERVER FROM THE CHARGE TRANSFER DEVICES
406
DETERMINE A CHARGING STATUS FOR EACH ELECTRIC VEHICLE BASED ON THE CHARGING INFORMATION WITH THE CHARGING STATUS BEING DETERMINED BASED ON A TOTAL PLUG-IN TIME, A TOTAL ENERGY DELIVERED TO AN ELECTRICITY STORAGE DEVICE SINCE A START OF THE PLUG-IN TIME, OR AN INSTANTANEOUS POWER
408
GENERATE ONE OR MORE REPORTS HAVING THE CHARGING STATUS FOR EACH ELECTRIC VEHICLE (E.G., SUMMARY INFO FOR CHARGING STATUS, VEHICLE STATUS INFO)
410
GENERATE FUEL SAVINGS INFORMATION (E.G., MONTHLY AND ANNUAL FUEL SAVINGS INFO) AND GHG INFORMATION
412
SEND ONE OR MORE NOTIFICATION MESSAGES TO A USER OF AN ELECTRIC VEHICLE (E.G., ELECTRIC VEHICLE IS FULLY CHARGED, A TIME PERIOD FOR PLUGGING IN THE ELECTRIC VEHICLE HAS EXPIRED, OR A TIME PERIOD FOR CHECKING IN THE ELECTRIC VEHICLE HAS EXPIRED
414

FIG. 4

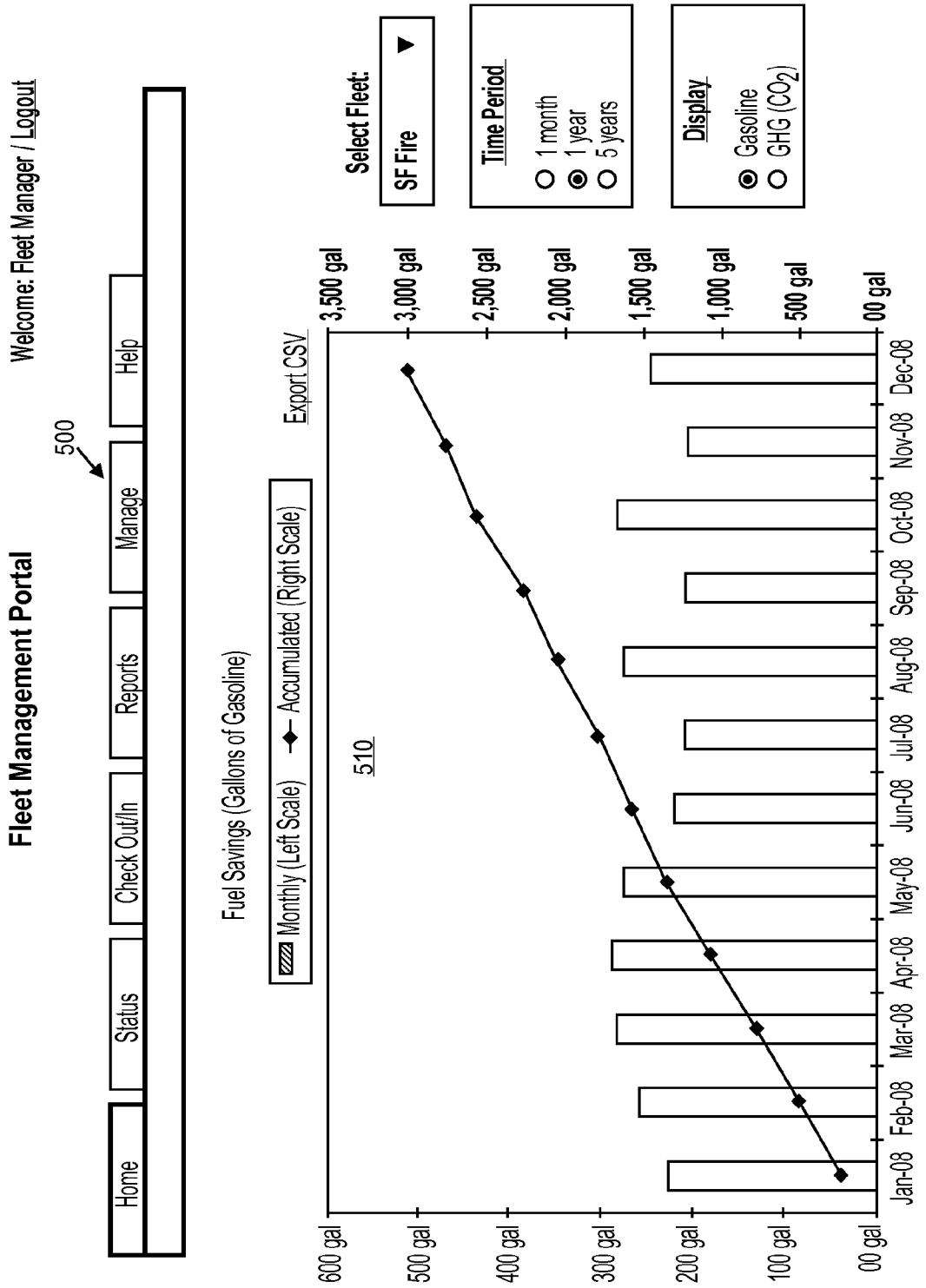

Fleet Management Portal
Welcome: Fleet Manager / Logout
500
Home
Status
Check Out/In
Reports
Manage
Help
Fuel Savings (Gallons of Gasoline)
Monthly (Left Scale)
Accumulated (Right Scale)
Export CSV
510
Select Fleet:
SF Fire
Time Period
1 month
1 year
5 years
Display
Gasoline
GHG (CO_2)
600 gal
500 gal
400 gal
300 gal
200 gal
100 gal
00 gal
3,500 gal
3,000 gal
2,500 gal
2,000 gal
1,500 gal
1,000 gal
500 gal
00 gal
Jan-08
Feb-08
Mar-08
Apr-08
May-08
Jun-08
Jul-08
Aug-08
Sep-08
Oct-08
Nov-08
Dec-08

FIG. 5

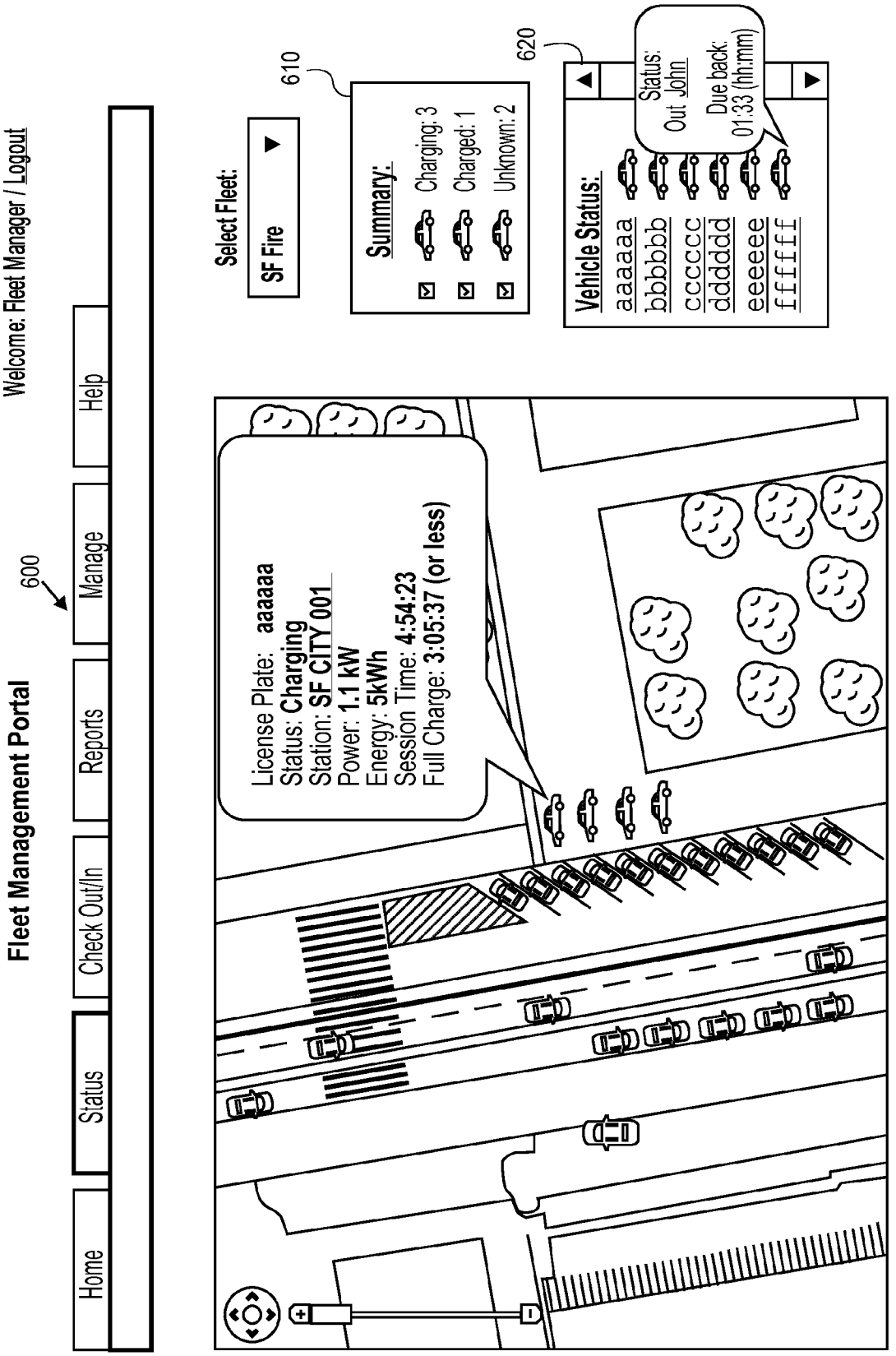

Fleet Management Portal
600
Welcome: Fleet Manager / Logout
Home
Status
Check Out/In
Reports
Manage
Help
Select Fleet:
SF Fire
610
Summary:
Charging: 3
Charged: 1
Unknown: 2
620
Vehicle Status:
aaaaaa
bbbbbb
cccccc
dddddd
eeeeee
ffffff
Status:
Out John
Due back:
01:33 (hh:mm)
License Plate: aaaaaa
Status: Charging
Station: SF CITY 001
Power: 1.1 kW
Energy: 5kWh
Session Time: 4:54:23
Full Charge: 3:05:37 (or less)

FIG. 6

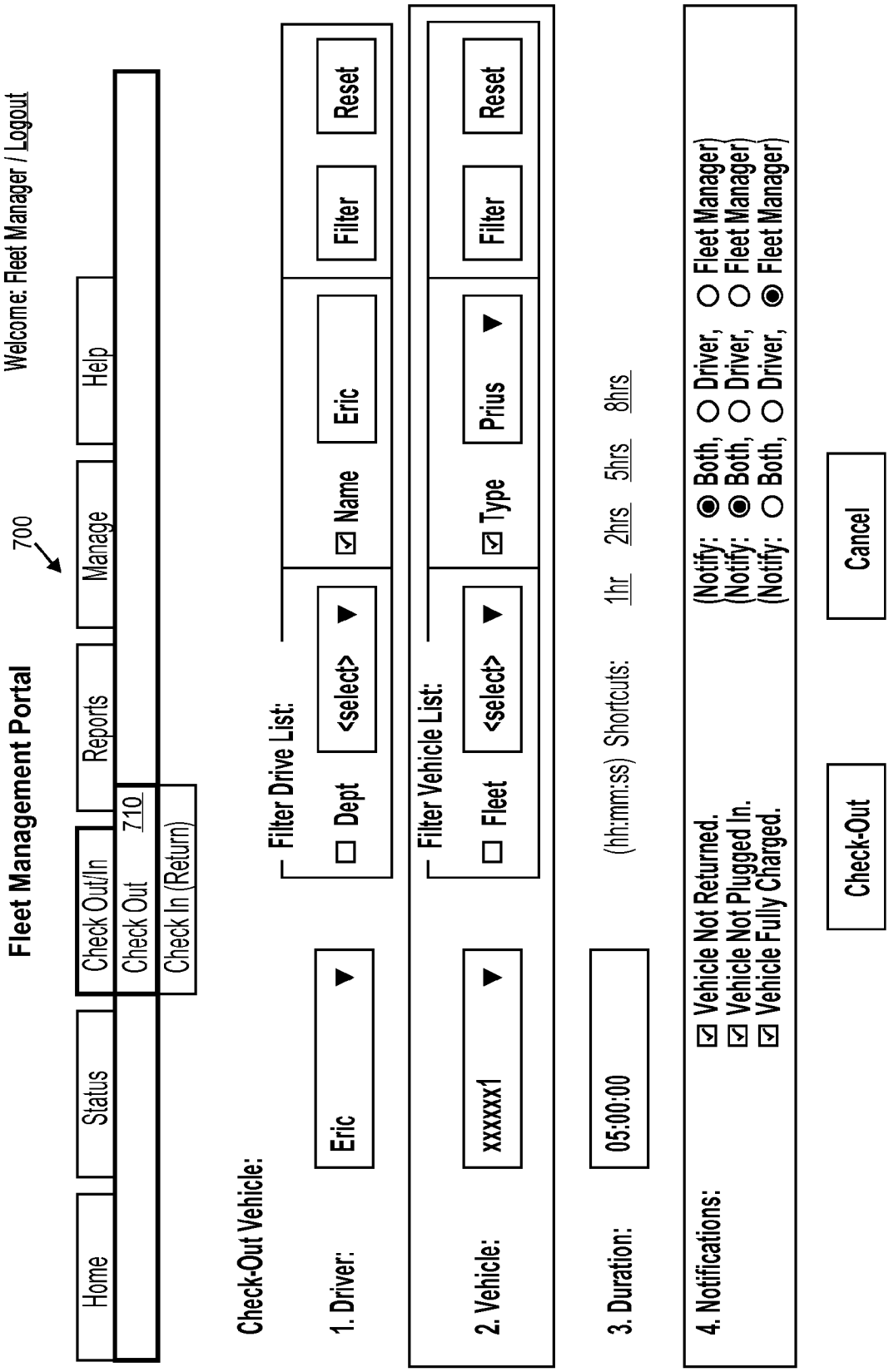

Fleet Management Portal
700
Welcome: Fleet Manager / Logout
Home
Status
Check Out/In
Reports
Manage
Help
Check Out
710
Check In (Return)
Check-Out Vehicle:
1. Driver:
Eric
Filter Drive List:
Dept
<select>
Name
Eric
Filter
Reset
2. Vehicle:
xxxxxx1
Filter Vehicle List:
Fleet
<select>
Type
Prius
Filter
Reset
3. Duration:
05:00:00
(hh:mm:ss) Shortcuts:
1hr
2hrs
5hrs
8hrs
4. Notifications:
Vehicle Not Returned.
Vehicle Not Plugged In.
Vehicle Fully Charged.
(Notify: Both, Driver, Fleet Manager)
(Notify: Both, Driver, Fleet Manager)
(Notify: Both, Driver, Fleet Manager)
Check-Out
Cancel

FIG. 7

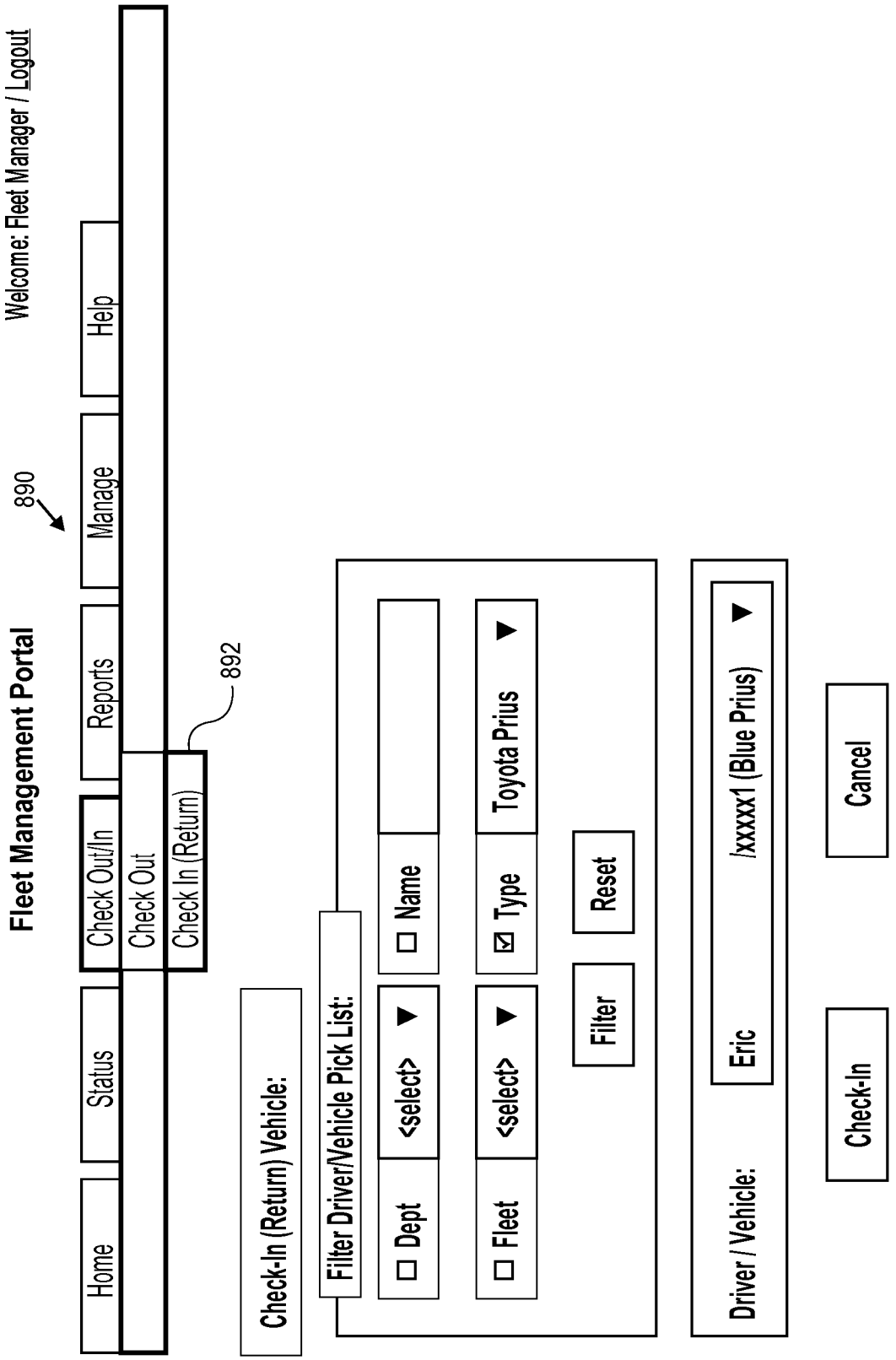

Welcome: Fleet Manager / Logout
Fleet Management Portal
890
Home
Status
Check Out/In
Check Out
Check In (Return)
Reports
Manage
Help
892
Check-In (Return) Vehicle:
Filter Driver/Vehicle Pick List:
Dept
<select>
Name
Fleet
<select>
Type
Toyota Prius
Filter
Reset
Driver / Vehicle:
Eric
/xxxxx1 (Blue Prius)
Check-In
Cancel

FIG. 8

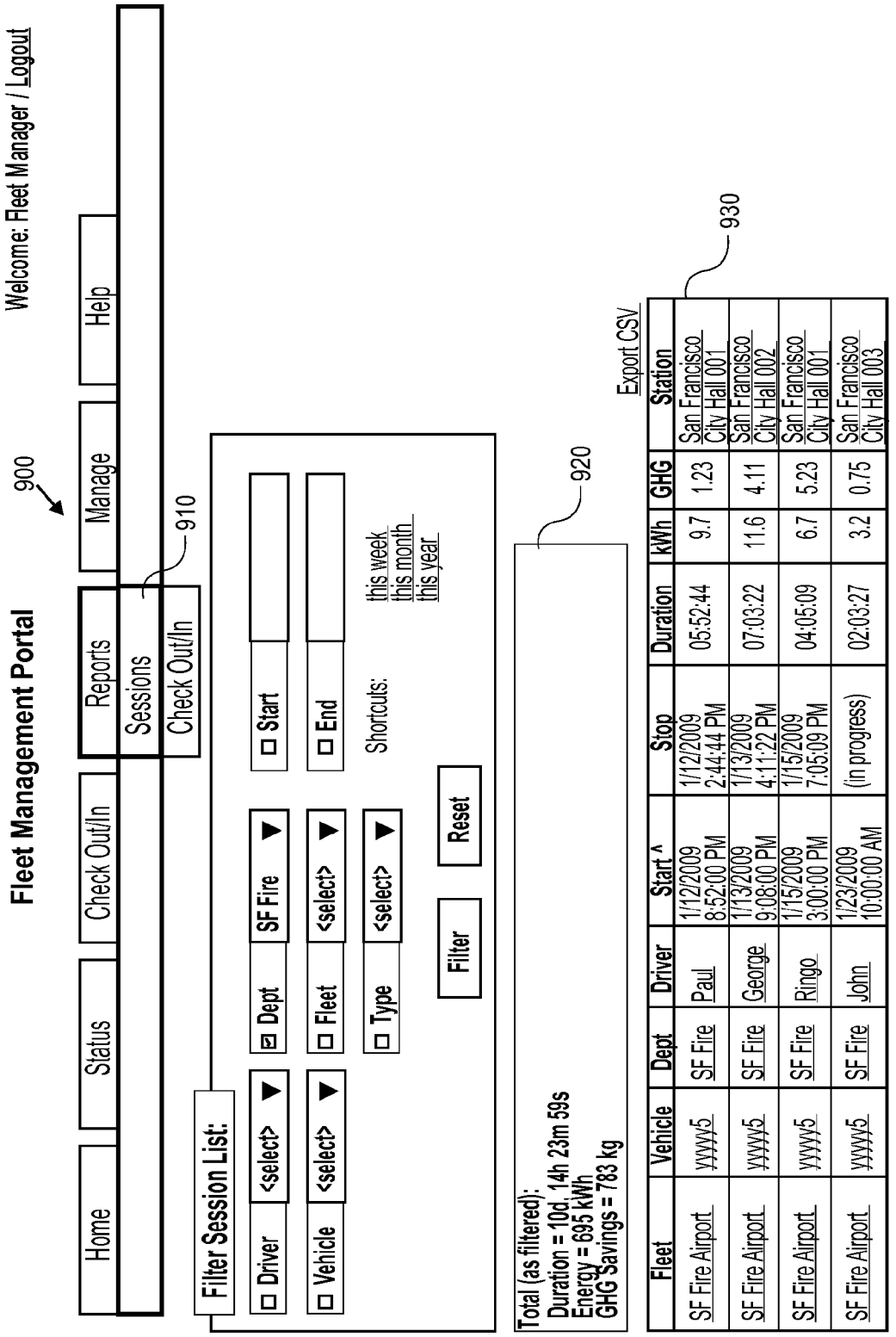

Fleet Management Portal
900
Welcome: Fleet Manager / Logout
Home
Status
Check Out/In
Reports
Manage
Help
Sessions
Check Out/In
910
Filter Session List:
Driver
<select>
Vehicle
<select>
Dept
SF Fire
Fleet
<select>
Type
<select>
Start
End
Shortcuts:
this week
this month
this year
Filter
Reset
920
Total (as filtered):
Duration = 10d. 14h 23m 59s
Energy = 695 kWh
GHG Savings = 783 kg
Export CSV
930
Fleet
Vehicle
Dept
Driver
Start ^
Stop
Duration
kWh
GHG
Station
SF Fire Airport
yyyyy5
SF Fire
Paul
1/12/2009 8:52:00 PM
1/12/2009 2:44:44 PM
05:52:44
9.7
1.23
San Francisco City Hall 001
SF Fire Airport
yyyyy5
SF Fire
George
1/13/2009 9:08:00 PM
1/13/2009 4:11:22 PM
07:03:22
11.6
4.11
San Francisco City Hall 002
SF Fire Airport
yyyyy5
SF Fire
Ringo
1/15/2009 3:00:00 PM
1/15/2009 7:05:09 PM
04:05:09
6.7
5.23
San Francisco City Hall 001
SF Fire Airport
yyyyy5
SF Fire
John
1/23/2009 10:00:00 AM
(in progress)
02:03:27
3.2
0.75
San Francisco City Hall 003
First Prev 1 2 3 ... 9 Next Last

FIG. 9

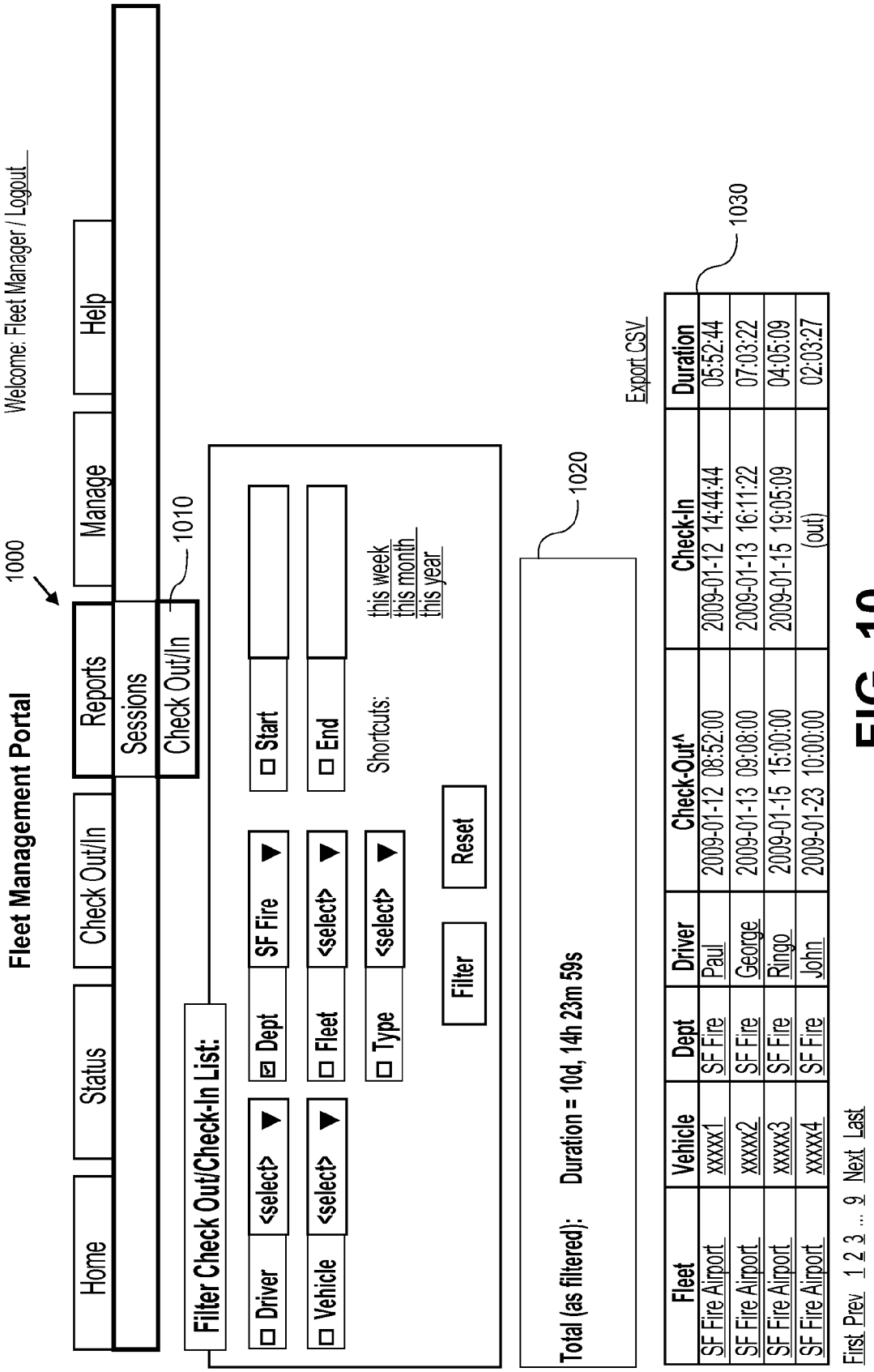

Fleet Management Portal
1000
Welcome: Fleet Manager / Logout
Home
Status
Check Out/In
Reports
Manage
Help
Sessions
Check Out/In
1010
Filter Check Out/Check-In List:
Driver
<select>
Vehicle
<select>
Dept
SF Fire
Fleet
<select>
Type
<select>
Start
End
Shortcuts:
this week
this month
this year
Filter
Reset
1020
Total (as filtered): Duration = 10d, 14h 23m 59s
Export CSV
1030
Fleet
Vehicle
Dept
Driver
Check-Out^
Check-In
Duration
SF Fire Airport
xxxxx1
SF Fire
Paul
2009-01-12 08:52:00
2009-01-12 14:44:44
05:52:44
SF Fire Airport
xxxxx2
SF Fire
George
2009-01-13 09:08:00
2009-01-13 16:11:22
07:03:22
SF Fire Airport
xxxxx3
SF Fire
Ringo
2009-01-15 15:00:00
2009-01-15 19:05:09
04:05:09
SF Fire Airport
xxxxx4
SF Fire
John
2009-01-23 10:00:00
(out)
02:03:27
First Prev 1 2 3 ... 9 Next Last

FIG. 10

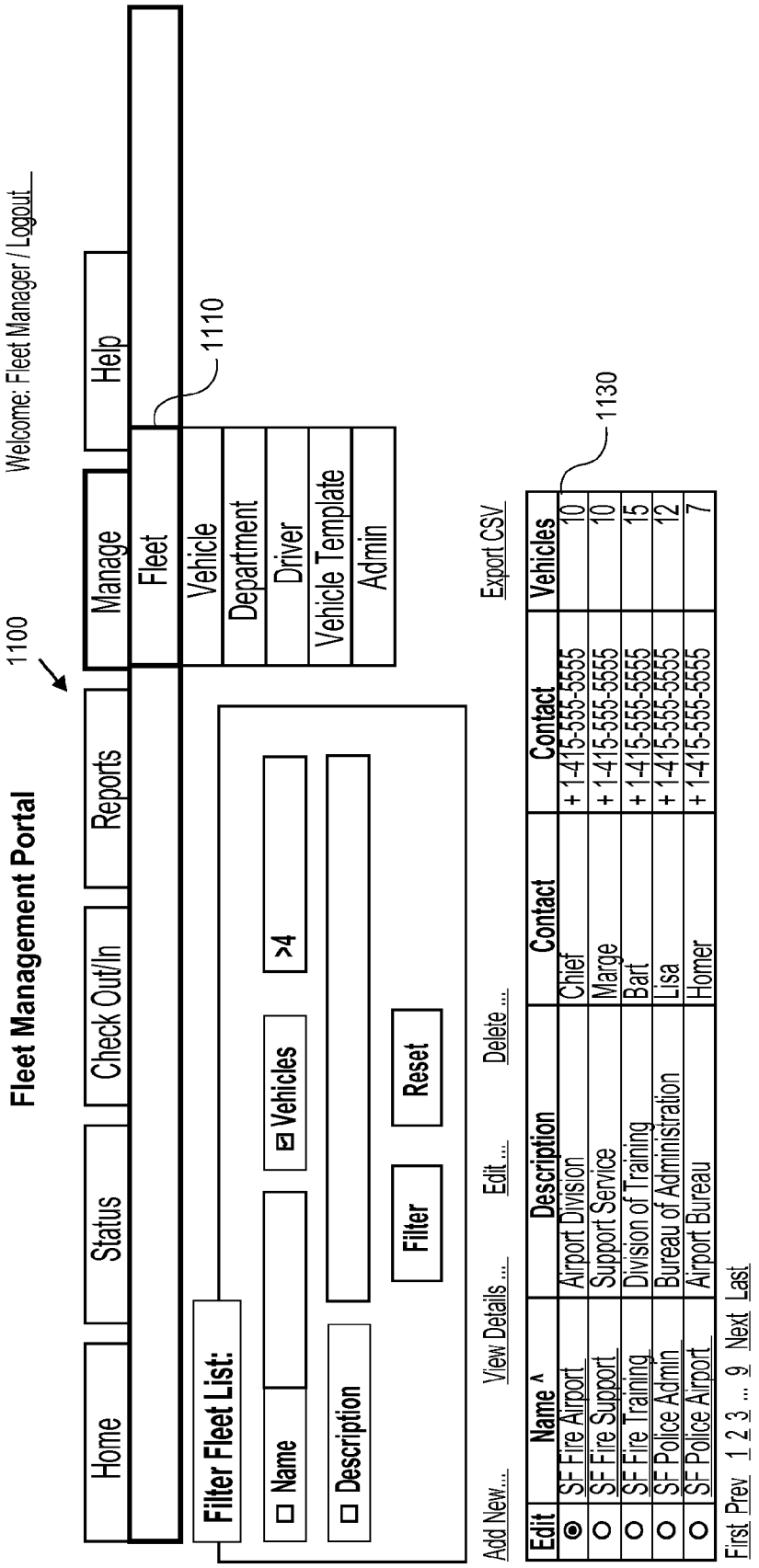

Fleet Management Portal
1100
Welcome: Fleet Manager / Logout
Home
Status
Check Out/In
Reports
Manage
Help
Fleet
Vehicle
Department
Driver
Vehicle Template
Admin
1110
Filter Fleet List:
Name
Description
Vehicles
>4
Filter
Reset
Add New...
View Details ...
Edit ...
Delete ...
Export CSV
1130
Edit
Name
Description
Contact
Contact
Vehicles
SF Fire Airport
Airport Division
Chief
+ 1-415-555-5555
10
SF Fire Support
Support Service
Marge
+ 1-415-555-5555
10
SF Fire Training
Division of Training
Bart
+ 1-415-555-5555
15
SF Police Admin
Bureau of Administration
Lisa
+ 1-415-555-5555
12
SF Police Airport
Airport Bureau
Homer
+ 1-415-555-5555
7
First Prev 1 2 3 ... 9 Next Last

FIG. 11

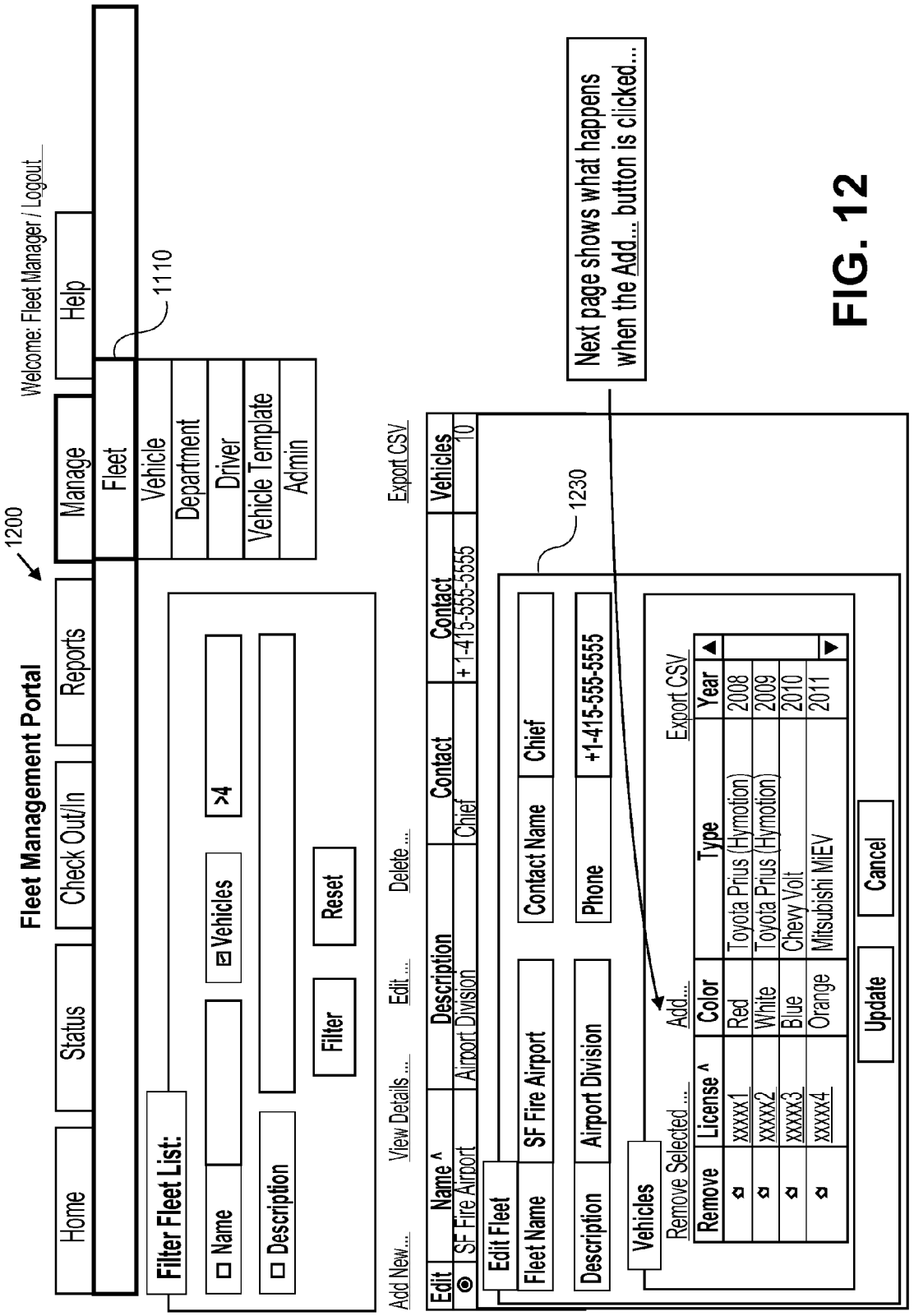

1200
Fleet Management Portal
Welcome: Fleet Manager / Logout
Home
Status
Check Out/In
Reports
Manage
Help
Fleet
Vehicle
Department
Driver
Vehicle Template
Admin
1110
Filter Fleet List:
Name
Vehicles
>4
Description
Filter
Reset
Add New...
View Details ...
Edit ...
Delete ...
Export CSV
Edit
Name ^
Description
Contact
Contact
Vehicles
SF Fire Airport
Airport Division
Chief
+ 1-415-555-5555
10
Edit Fleet
Fleet Name
SF Fire Airport
Contact Name
Chief
Description
Airport Division
Phone
+1-415-555-5555
1230
Vehicles
Remove Selected ...
Add...
Export CSV
Remove
License ^
Color
Type
Year
xxxxx1
Red
Toyota Prius (Hymotion)
2008
xxxxx2
White
Toyota Prius (Hymotion)
2009
xxxxx3
Blue
Chevy Volt
2010
xxxxx4
Orange
Mitsubishi MiEV
2011
Update
Cancel
Next page shows what happens when the Add... button is clicked...

FIG. 12

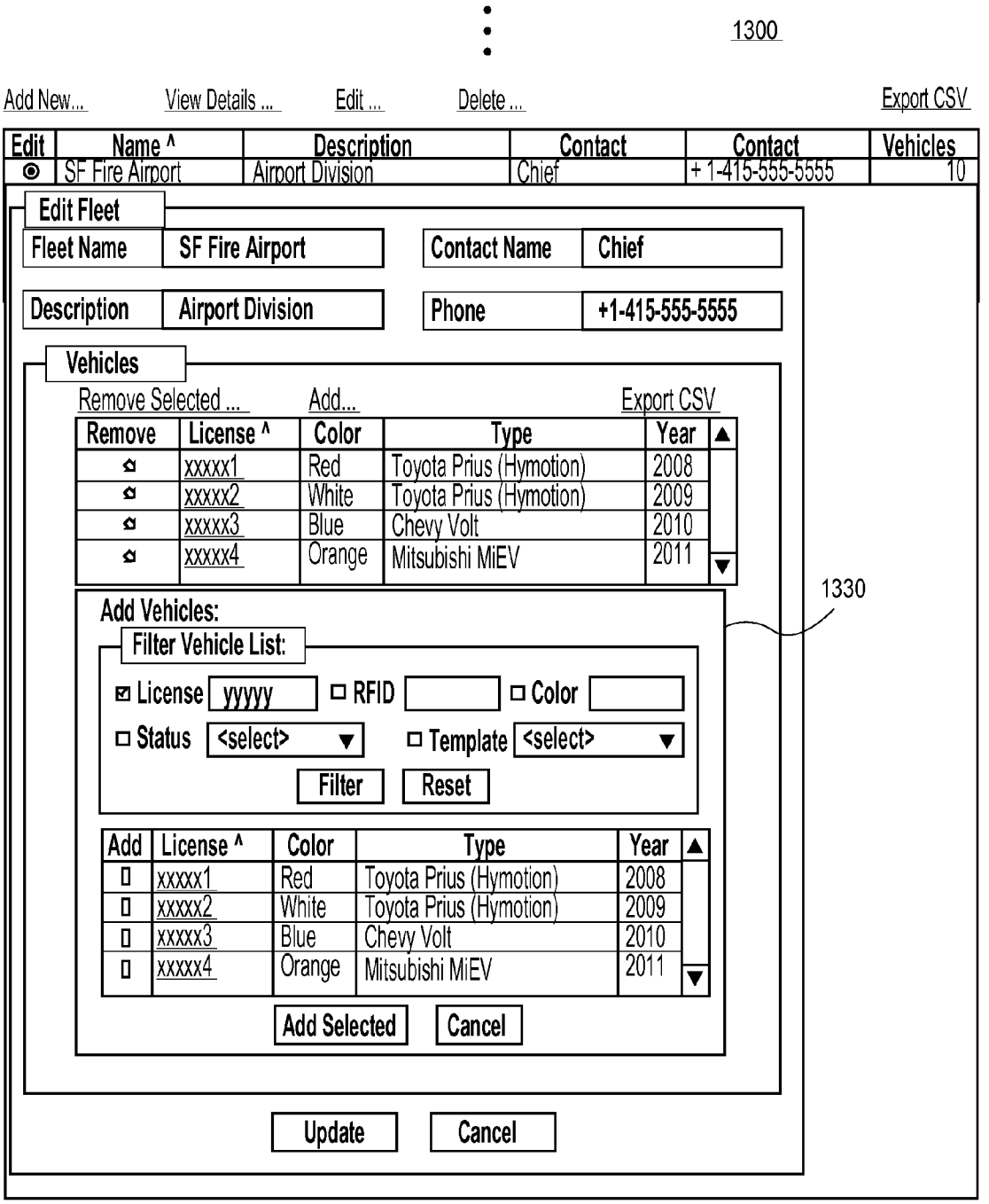

1300
Add New...
View Details ...
Edit ...
Delete ...
Export CSV
Edit
Name ^
Description
Contact
Contact
Vehicles
SF Fire Airport
Airport Division
Chief
+ 1-415-555-5555
10
Edit Fleet
Fleet Name
SF Fire Airport
Contact Name
Chief
Description
Airport Division
Phone
+1-415-555-5555
Vehicles
Remove Selected ...
Add...
Export CSV
Remove
License ^
Color
Type
Year
xxxxx1
Red
Toyota Prius (Hymotion)
2008
xxxxx2
White
Toyota Prius (Hymotion)
2009
xxxxx3
Blue
Chevy Volt
2010
xxxxx4
Orange
Mitsubishi MiEV
2011
1330
Add Vehicles:
Filter Vehicle List:
License
yyyyy
RFID
Color
Status
<select>
Template
<select>
Filter
Reset
Add
License ^
Color
Type
Year
xxxxx1
Red
Toyota Prius (Hymotion)
2008
xxxxx2
White
Toyota Prius (Hymotion)
2009
xxxxx3
Blue
Chevy Volt
2010
xxxxx4
Orange
Mitsubishi MiEV
2011
Add Selected
Cancel
Update
Cancel

FIG. 13

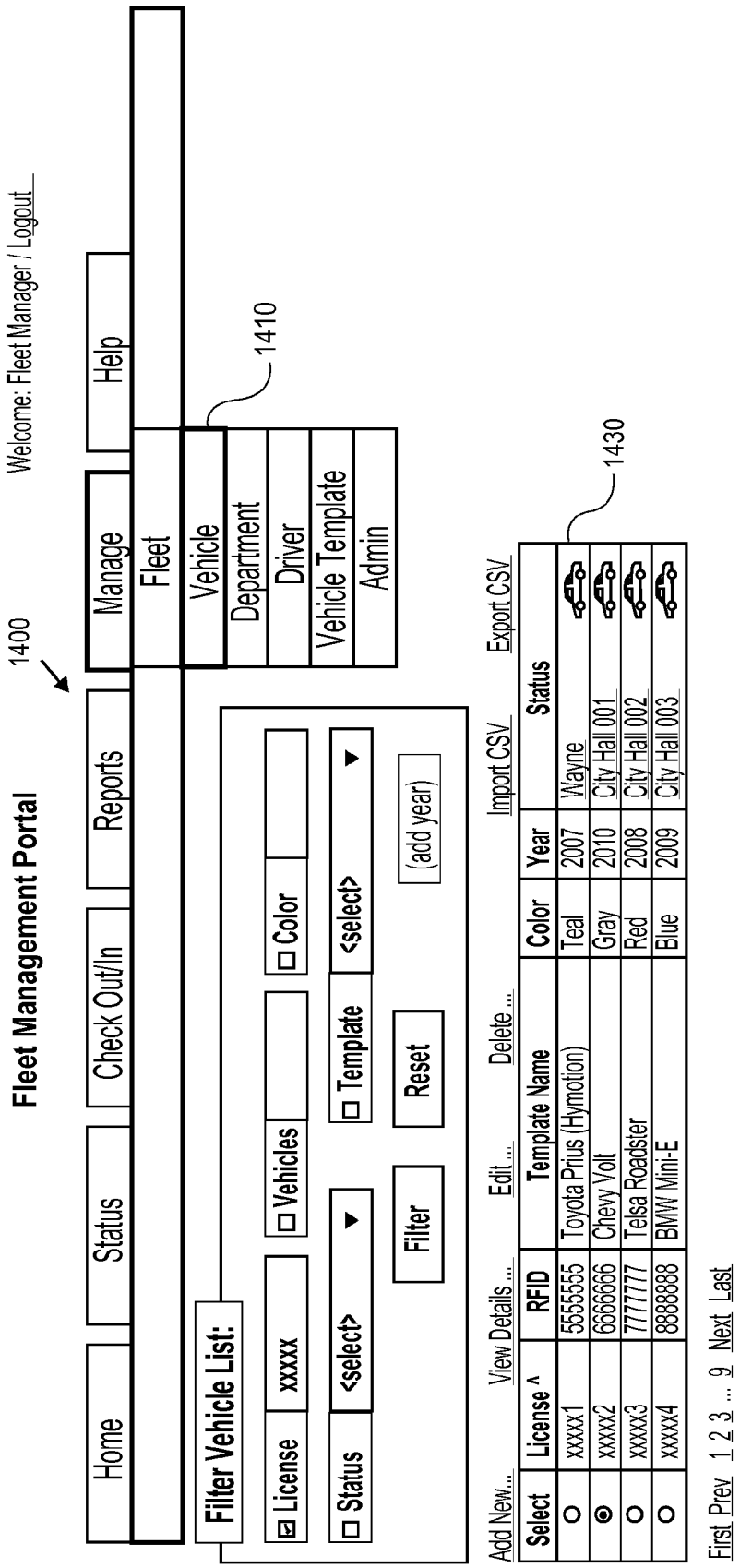

1400
Fleet Management Portal
Welcome: Fleet Manager / Logout
Home
Status
Check Out/In
Reports
Manage
Help
Fleet
Vehicle
Department
Driver
Vehicle Template
Admin
1410
Filter Vehicle List:
License
xxxxx
Vehicles
Color
Status
<select>
Template
<select>
(add year)
Filter
Reset
Add New...
View Details ...
Edit ...
Delete ...
Import CSV
Export CSV
1430
Select
License ^
RFID
Template Name
Color
Year
Status
xxxxx1
5555555
Toyota Prius (Hymotion)
Teal
2007
Wayne
xxxxx2
6666666
Chevy Volt
Gray
2010
City Hall 001
xxxxx3
7777777
Telsa Roadster
Red
2008
City Hall 002
xxxxx4
8888888
BMW Mini-E
Blue
2009
City Hall 003
First Prev 1 2 3 ... 9 Next Last

FIG. 14

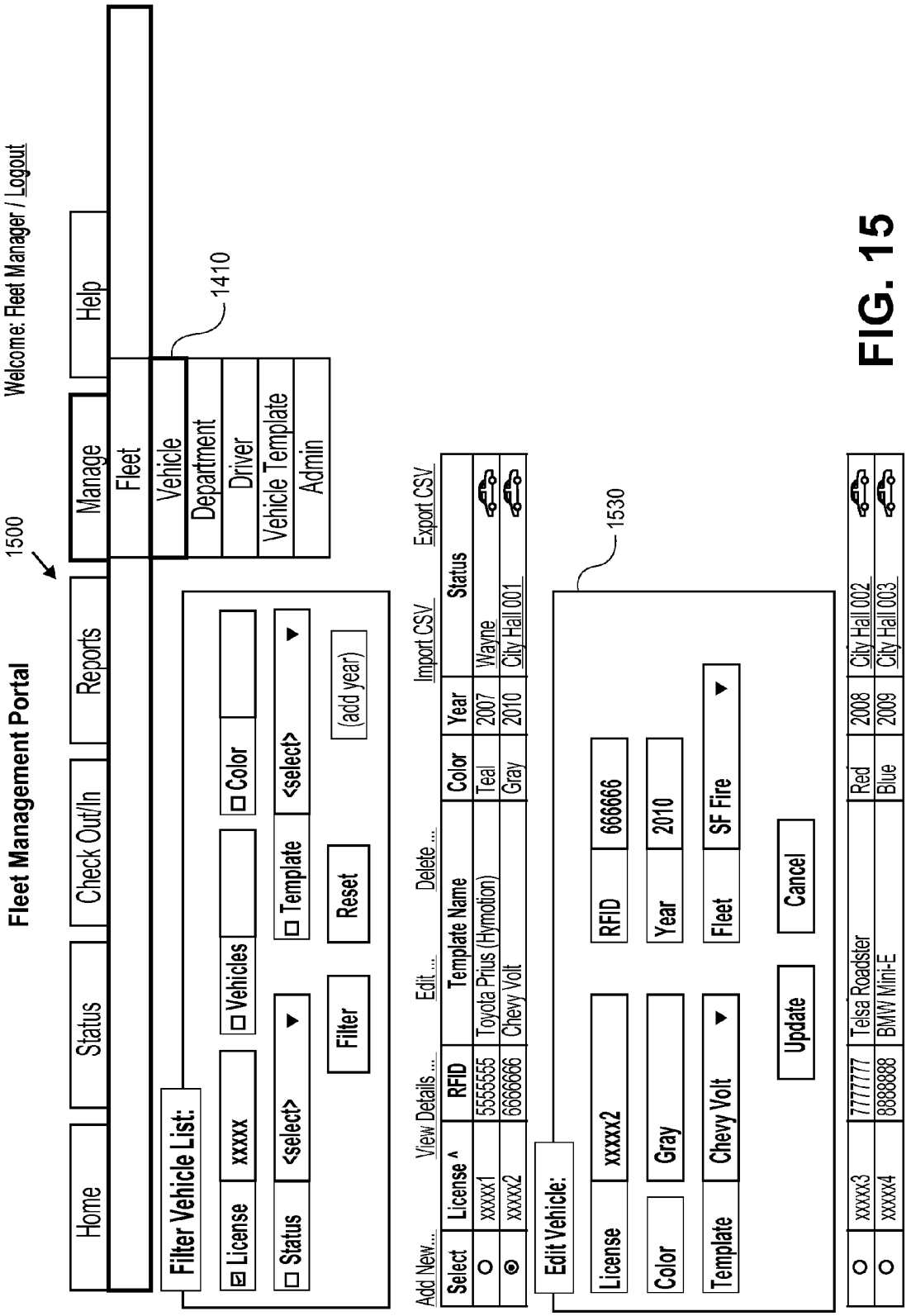

Fleet Management Portal
1500
Welcome: Fleet Manager / Logout
Home
Status
Check Out/In
Reports
Manage
Help
Fleet
Vehicle
Department
Driver
Vehicle Template
Admin
1410
Filter Vehicle List:
License
xxxxx
Vehicles
Color
Status
<select>
Template
<select>
(add year)
Filter
Reset
Add New...
View Details...
Edit...
Delete...
Import CSV
Export CSV
Select
License
RFID
Template Name
Color
Year
Status
xxxxx1
5555555
Toyota Prius (Hymotion)
Teal
2007
Wayne
xxxxx2
6666666
Chevy Volt
Gray
2010
City Hall 001
1530
Edit Vehicle:
License
xxxxx2
RFID
666666
Color
Gray
Year
2010
Template
Chevy Volt
Fleet
SF Fire
Update
Cancel
xxxxx3
7777777
Telsa Roadster
Red
2008
City Hall 002
xxxxx4
8888888
BMW Mini-E
Blue
2009
City Hall 003

FIG. 15

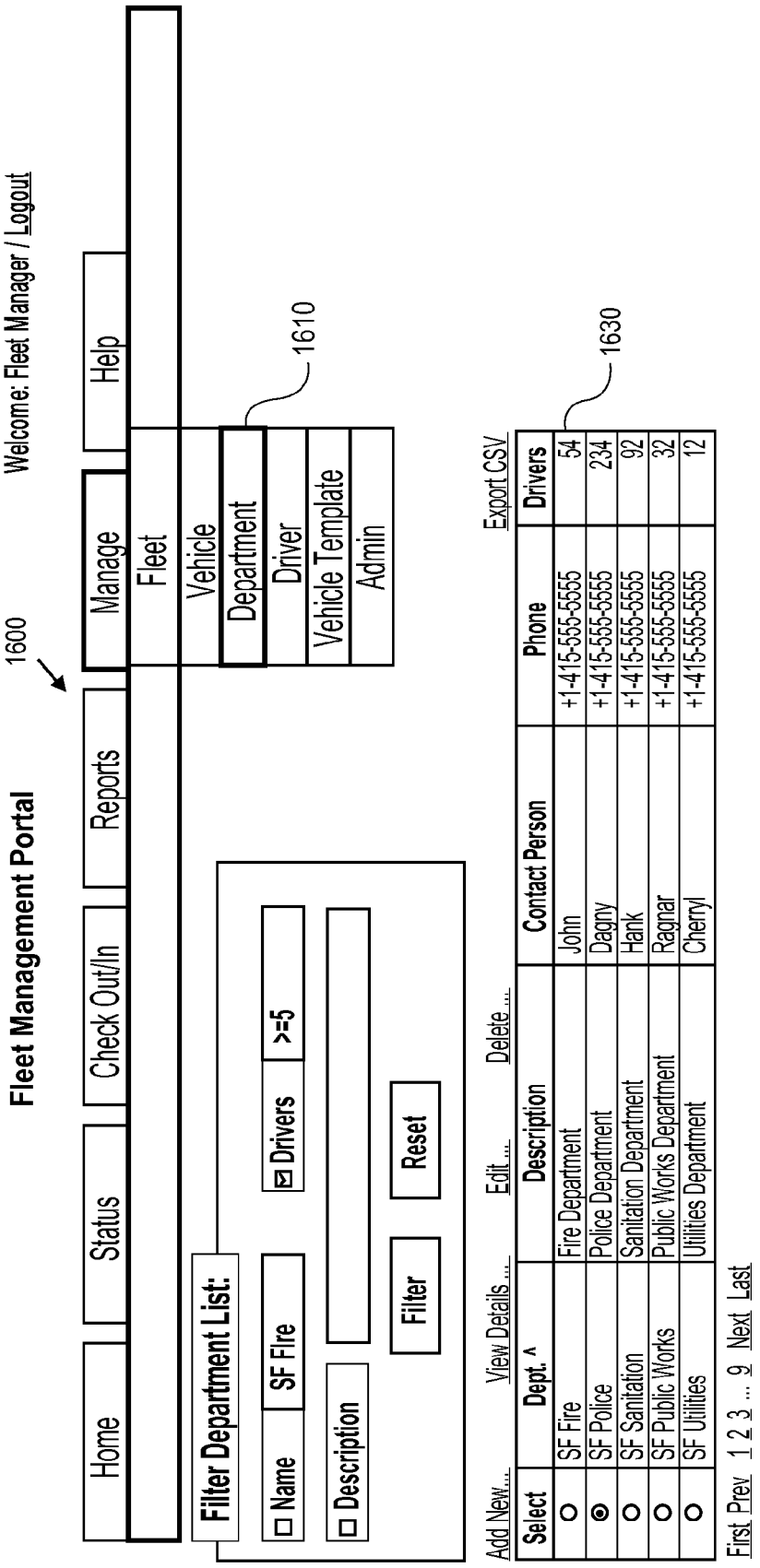

Fleet Management Portal
1600
Welcome: Fleet Manager / Logout
Home
Status
Check Out/In
Reports
Manage
Help
Fleet
Vehicle
Department
Driver
Vehicle Template
Admin
1610
Filter Department List:
Name
SF Fire
Drivers
>=5
Description
Filter
Reset
Add New...
View Details ...
Edit ...
Delete ...
Export CSV
1630
Select
Dept. ^
Description
Contact Person
Phone
Drivers
SF Fire
Fire Department
John
+1-415-555-5555
54
SF Police
Police Department
Dagny
+1-415-555-5555
234
SF Sanitation
Sanitation Department
Hank
+1-415-555-5555
92
SF Public Works
Public Works Department
Ragnar
+1-415-555-5555
32
SF Utilities
Utilities Department
Cherryl
+1-415-555-5555
12
First Prev 1 2 3 ... 9 Next Last

FIG. 16

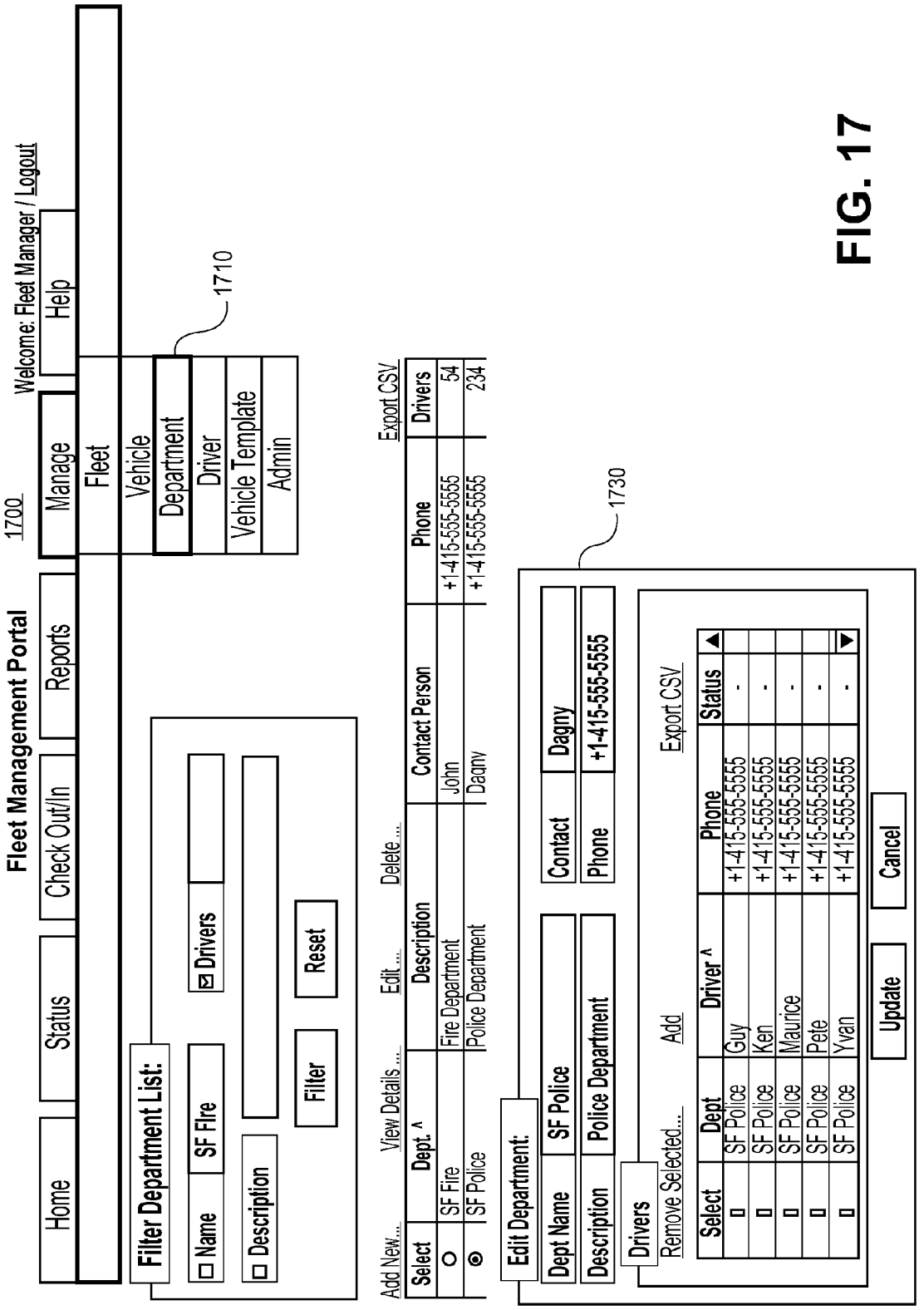

Fleet Management Portal
1700
Welcome: Fleet Manager / Logout
Home
Status
Check Out/In
Reports
Manage
Help
Fleet
Vehicle
Department
Driver
Vehicle Template
Admin
1710
Filter Department List:
Name
SF Fire
Drivers
Description
Filter
Reset
Add New...
View Details...
Edit...
Delete...
Export CSV
Select
Dept. ^
Description
Contact Person
Phone
Drivers
SF Fire
Fire Department
John
+1-415-555-5555
54
SF Police
Police Department
Dagny
+1-415-555-5555
234
1730
Edit Department:
Dept Name
SF Police
Contact
Dagny
Description
Police Department
Phone
+1-415-555-5555
Drivers
Remove Selected...
Add
Export CSV
Select
Dept
Driver ^
Phone
Status
SF Police
Guy
+1-415-555-5555
SF Police
Ken
+1-415-555-5555
SF Police
Maurice
+1-415-555-5555
SF Police
Pete
+1-415-555-5555
SF Police
Yvan
+1-415-555-5555
Update
Cancel

FIG. 17

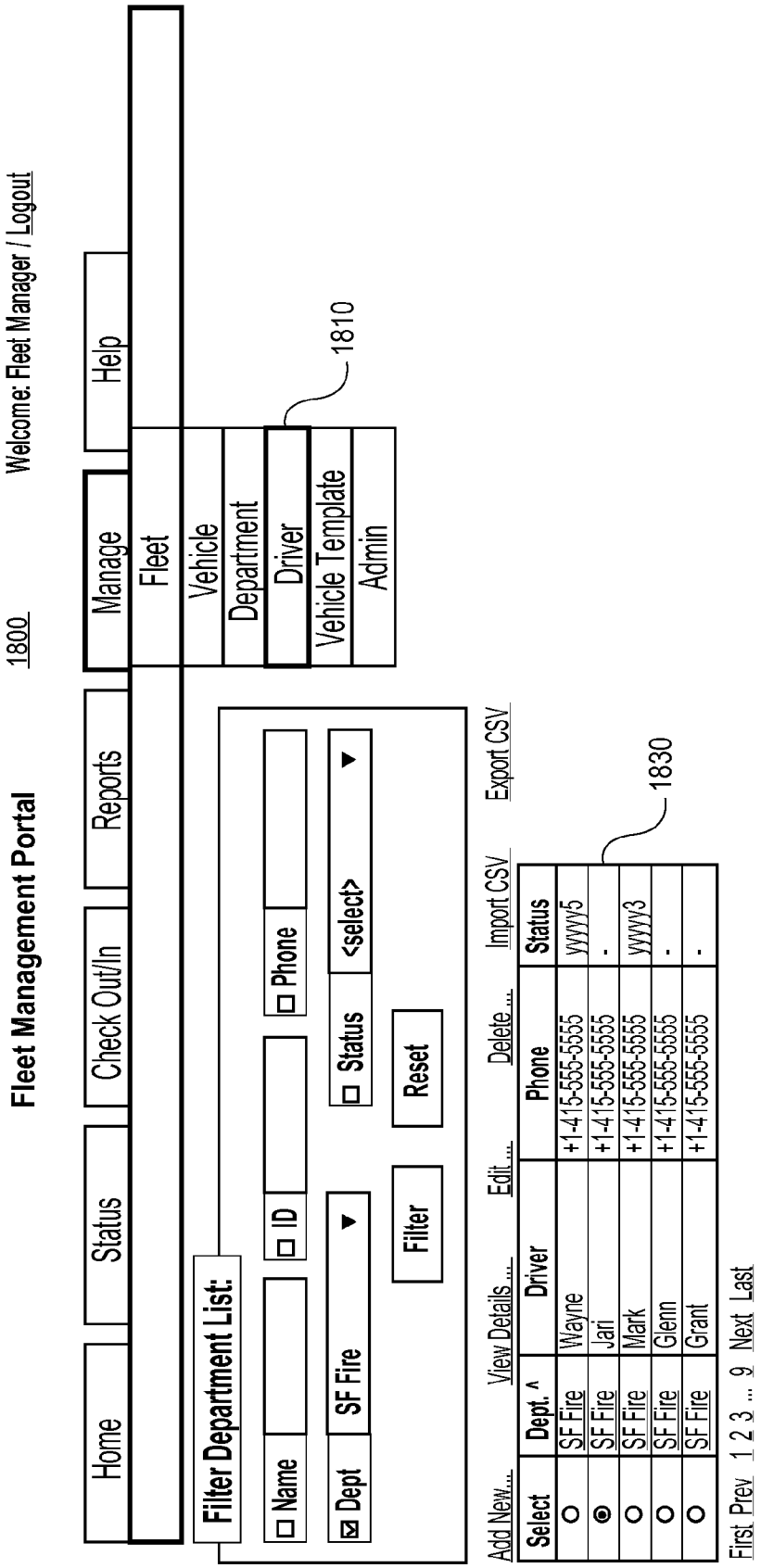

Fleet Management Portal
1800
Welcome: Fleet Manager / Logout
Home
Status
Check Out/In
Reports
Manage
Help
Fleet
Vehicle
Department
Driver
Vehicle Template
Admin
1810
Filter Department List:
Name
ID
Phone
Dept
SF Fire
Status
<select>
Filter
Reset
Add New...
View Details ...
Edit ...
Delete ...
Import CSV
Export CSV
1830
Select
Dept.
Driver
Phone
Status
SF Fire Wayne +1-415-555-5555 yyyyy5
SF Fire Jari +1-415-555-5555 -
SF Fire Mark +1-415-555-5555 yyyyy3
SF Fire Glenn +1-415-555-5555 -
SF Fire Grant +1-415-555-5555 -
First Prev 1 2 3 ... 9 Next Last

FIG. 18

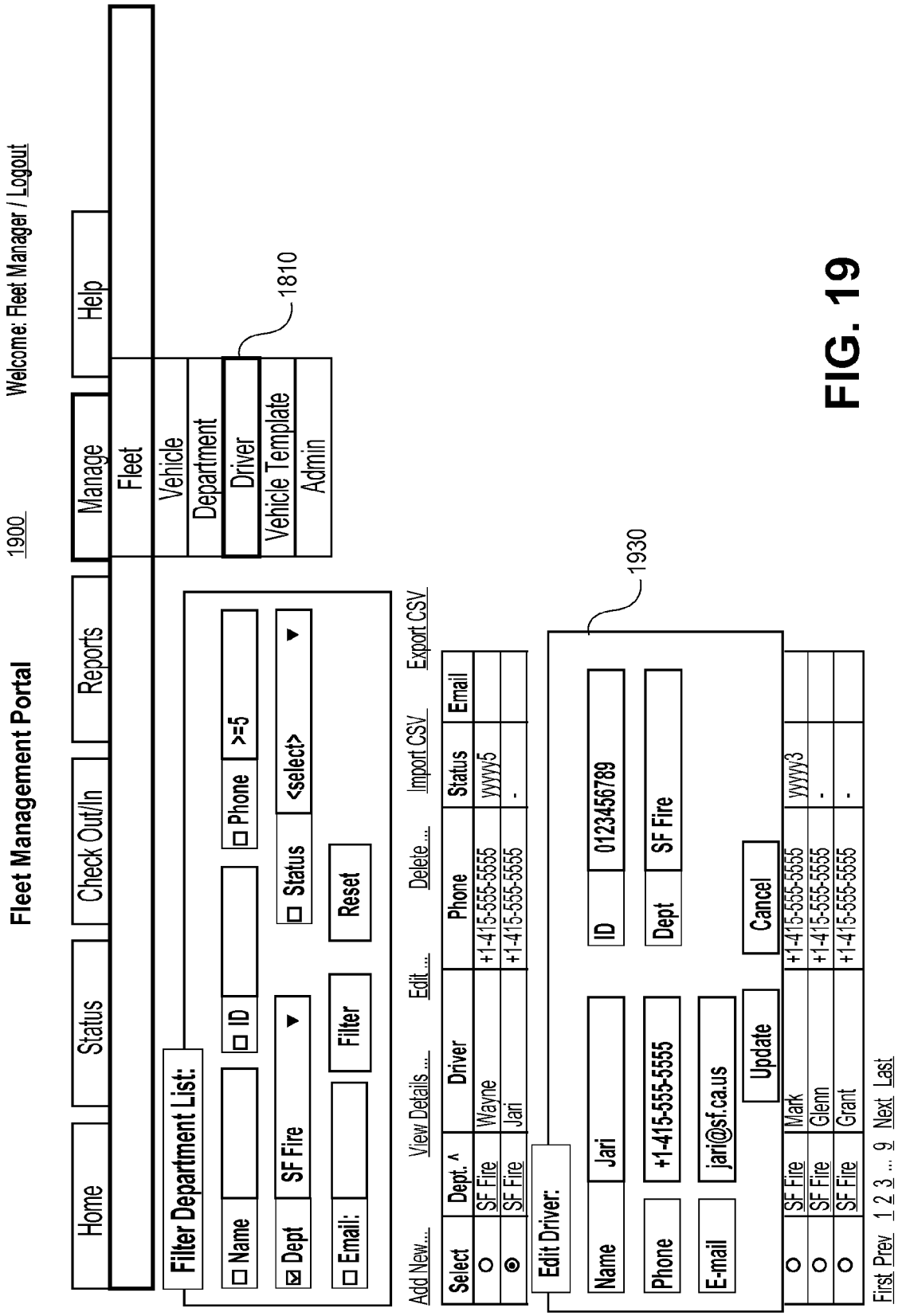

Fleet Management Portal
1900
Welcome: Fleet Manager / Logout
Home
Status
Check Out/In
Reports
Manage
Help
Fleet
Vehicle
Department
Driver
Vehicle Template
Admin
1810
Filter Department List:
Name
ID
Phone
>=5
Dept
SF Fire
Status
<select>
Email:
Filter
Reset
Add New...
View Details ...
Edit ...
Delete ...
Import CSV
Export CSV
Select
Dept. ^
Driver
Phone
Status
Email
SF Fire
Wayne
+1-415-555-5555
yyyyy5
SF Fire
Jari
+1-415-555-5555
-
1930
Edit Driver:
Name
Jari
ID
0123456789
Phone
+1-415-555-5555
Dept
SF Fire
E-mail
jari@sf.ca.us
Update
Cancel
SF Fire
Mark
+1-415-555-5555
yyyyy3
SF Fire
Glenn
+1-415-555-5555
-
SF Fire
Grant
+1-415-555-5555
-
First Prev 1 2 3 ... 9 Next Last

FIG. 19

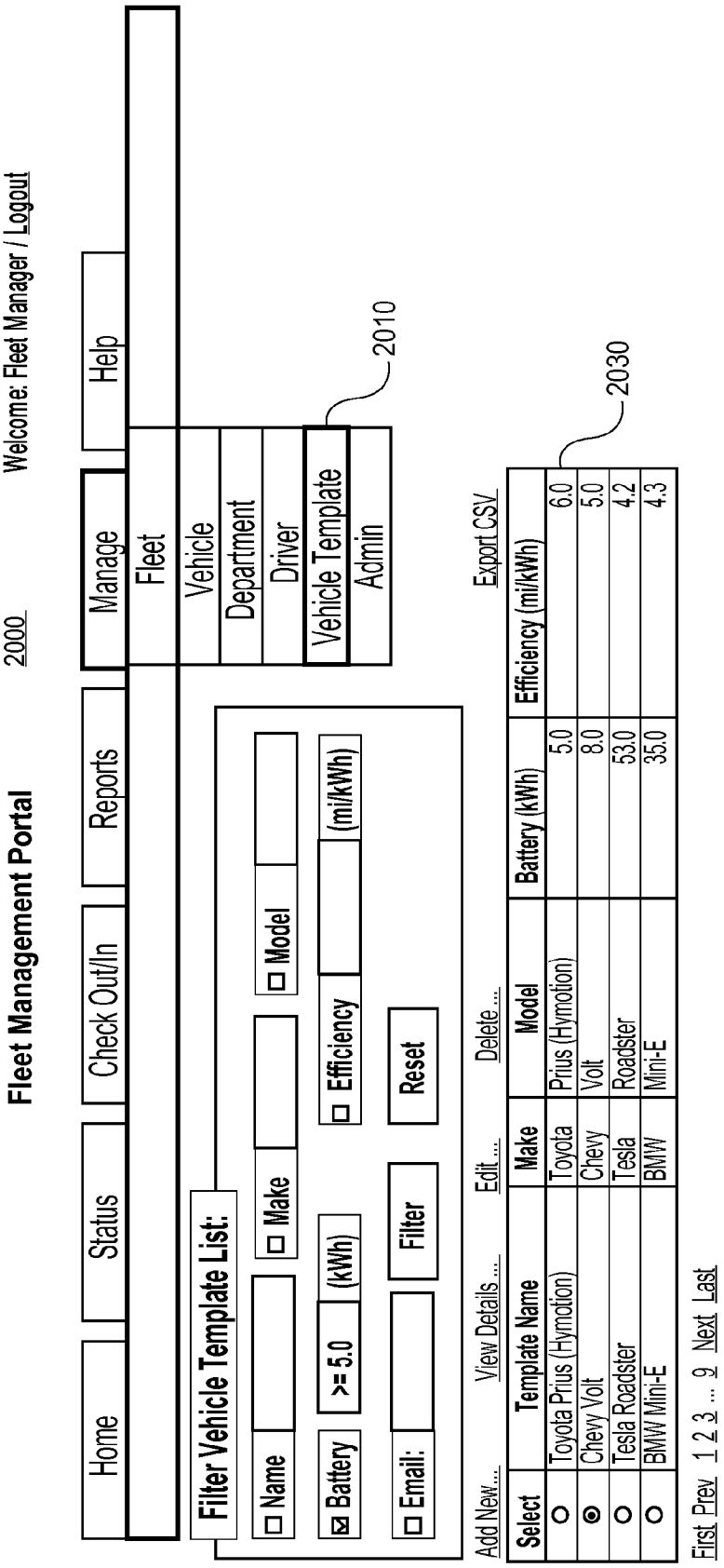

Fleet Management Portal
2000
Welcome: Fleet Manager / Logout
Home
Status
Check Out/In
Reports
Manage
Help
Fleet
Vehicle
Department
Driver
Vehicle Template
Admin
2010
Filter Vehicle Template List:
Name
Make
Model
Battery
>= 5.0
(kWh)
Efficiency
(mi/kWh)
Email:
Filter
Reset
Add New...
View Details ...
Edit ...
Delete ...
Export CSV
2030
Select
Template Name
Make
Model
Battery (kWh)
Efficiency (mi/kWh)
Toyota Prius (Hymotion)
Toyota
Prius (Hymotion)
5.0
6.0
Chevy Volt
Chevy
Volt
8.0
5.0
Tesla Roadster
Tesla
Roadster
53.0
4.2
BMW Mini-E
BMW
Mini-E
35.0
4.3
First Prev 1 2 3 ... 9 Next Last

FIG. 20

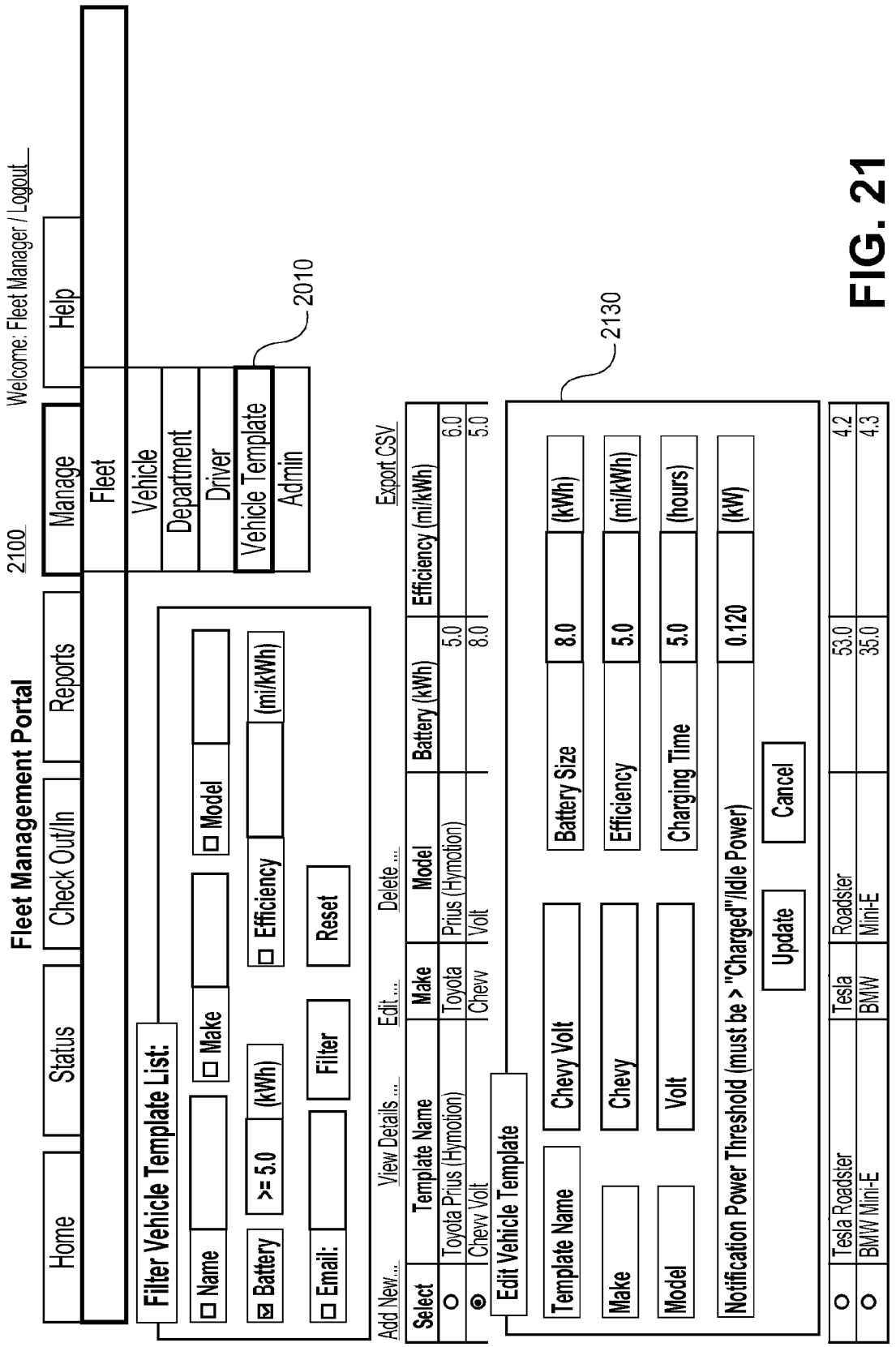

Fleet Management Portal
2100
Welcome: Fleet Manager / Logout
Home
Status
Check Out/In
Reports
Manage
Help
Fleet
Vehicle
Department
Driver
Vehicle Template
Admin
2010
Filter Vehicle Template List:
Name
Make
Model
Battery
>= 5.0
(kWh)
Efficiency
(mi/kWh)
Email:
Filter
Reset
Add New...
View Details ...
Edit ...
Delete ...
Export CSV
Select
Template Name
Make
Model
Battery (kWh)
Efficiency (mi/kWh)
Toyota Prius (Hymotion)
Toyota
Prius (Hymotion)
5.0
6.0
Chevy Volt
Chevy
Volt
8.0
5.0
2130
Edit Vehicle Template
Template Name
Chevy Volt
Battery Size
8.0
(kWh)
Make
Chevy
Efficiency
5.0
(mi/kWh)
Model
Volt
Charging Time
5.0
(hours)
Notification Power Threshold (must be > "Charged"/Idle Power)
0.120
(kW)
Update
Cancel
Tesla Roadster
Tesla
Roadster
53.0
4.2
BMW Mini-E
BMW
Mini-E
35.0
4.3
First Prev 1 2 3 ... 9 Next Last

FIG. 21

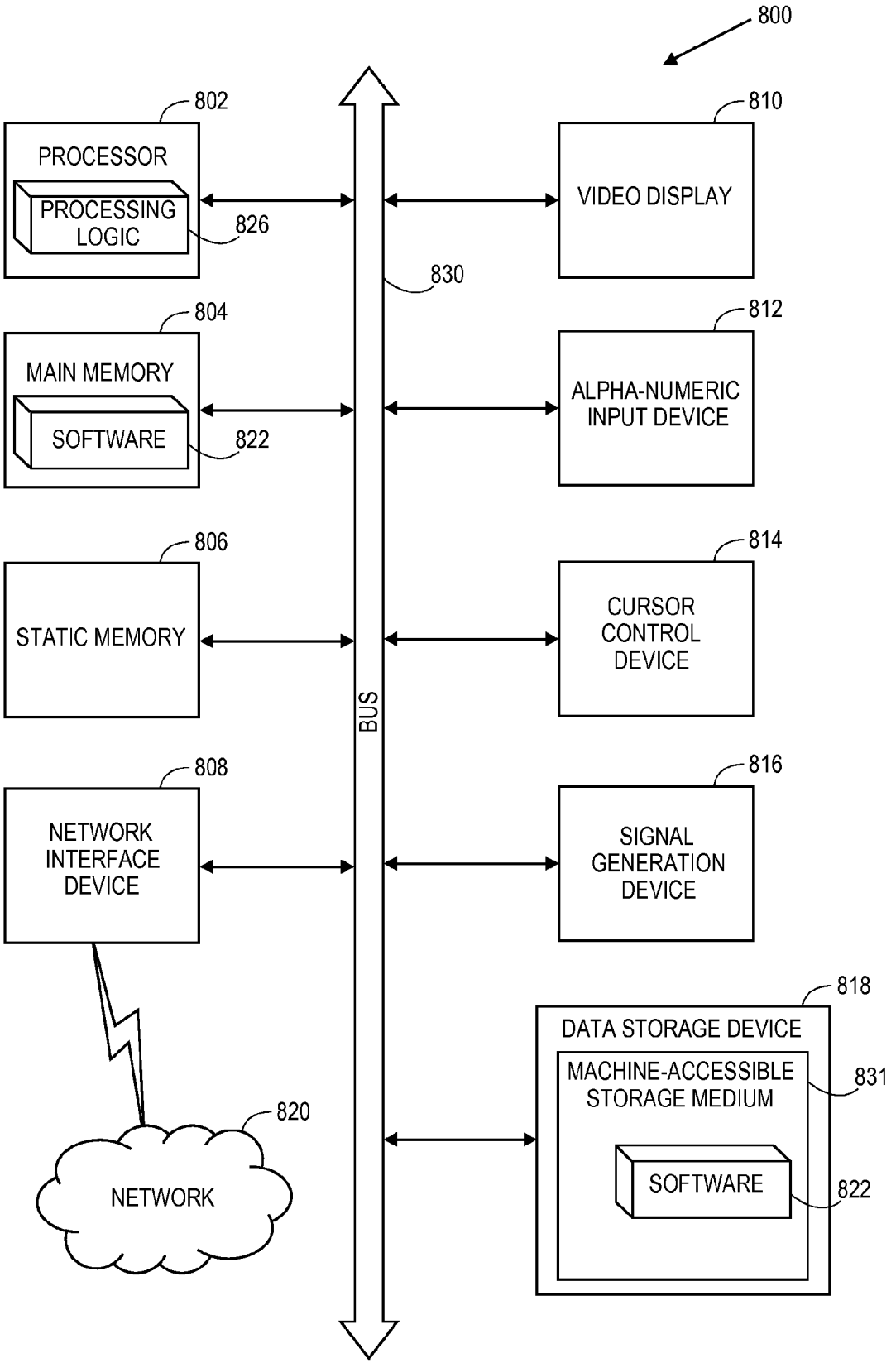

800
802
PROCESSOR
PROCESSING LOGIC
826
804
MAIN MEMORY
SOFTWARE
822
806
STATIC MEMORY
808
NETWORK INTERFACE DEVICE
820
NETWORK
BUS
830
810
VIDEO DISPLAY
812
ALPHA-NUMERIC INPUT DEVICE
814
CURSOR CONTROL DEVICE
816
SIGNAL GENERATION DEVICE
818
DATA STORAGE DEVICE
MACHINE-ACCESSIBLE STORAGE MEDIUM
831
SOFTWARE
822

FIG. 22

SYSTEM AND METHOD FOR MANAGING ELECTRIC VEHICLES

FIELD

[0001] This invention relates to the field of systems and methods for managing the charging of electric vehicles.

BACKGROUND

[0002] The electric car, electric vehicle (EV) and battery electric vehicle are all used to describe automobiles powered by one or more electric motors utilizing energy stored in rechargeable battery(ies) (or other electricity storage devices such as supercapacitors). The batteries are recharged by connecting to an electrical outlet. Efficient recharging of the batteries typically requires hours and is often done overnight or while the electric vehicle is parked for a significant time. The use of electric vehicles is limited by the sparse availability of recharging facilities. A grouping of electric vehicles may be associated with a particular charging station. These electric vehicles need to recharge during periods of non-use in order to be charged for and ready for periods of use. One or more drivers of the electric vehicles may forget to recharge an electric vehicle or improperly connect the electric vehicle during a period of non-use causing one or more electric vehicles to be unavailable for a subsequent period of use. Additionally, a limited number of charging stations having a limited number of charge transfer devices, which may cause scheduling difficulties for the efficient and timely recharging of the electric vehicles.

BRIEF DESCRIPTION OF THE DRAWINGS

[0003] The invention may best be understood by referring to the following description and accompanying drawings that are used to illustrate embodiments of the invention.

[0004] FIG. **1**A is a schematic diagram of a network-connected charging outlet system according to one embodiment of the invention;

[0005] FIG. **1**B is a schematic diagram of a network-connected charge transfer device according to one embodiment of the invention;

[0006] FIG. **2** is a block diagram of a fleet management system having a fleet management portal according to one embodiment of the invention;

[0007] FIG. **3** is a schematic diagram of a server in accordance with one embodiment of the invention;

[0008] FIG. **4** is a flow diagram exemplary illustrating managing a plurality of electric vehicles in accordance with one embodiment of the invention;

[0009] FIG. **5** illustrates an exemplary fuel savings user interface of a software program for managing electric vehicles in accordance with one embodiment of the invention;

[0010] FIG. **6** illustrates an exemplary electric vehicle status user interface of a software program for managing electric vehicles in accordance with one embodiment of the invention;

[0011] FIG. **7** illustrates an exemplary electric vehicle check out user interface of a software program for managing electric vehicles in accordance with one embodiment of the invention;

[0012] FIG. **8** illustrates an exemplary electric vehicle check in user interface of a software program for managing electric vehicles in accordance with one embodiment of the invention;

[0013] FIG. **9** illustrates an exemplary session report user interface of a software program for managing electric vehicles in accordance with one embodiment of the invention;

[0014] FIG. **10** illustrates an exemplary check out/in report user interface of a software program for managing electric vehicles in accordance with one embodiment of the invention;

[0015] FIGS. **11-13** illustrate exemplary fleet manage user interfaces of a software program for managing electric vehicles in accordance with one embodiment of the invention;

[0016] FIGS. **14** and **15** illustrate exemplary vehicle manage user interfaces of a software program for managing electric vehicles in accordance with one embodiment of the invention;

[0017] FIGS. **16** and **17** illustrate exemplary department manage user interfaces of a software program for managing electric vehicles in accordance with one embodiment of the invention;

[0018] FIGS. **18** and **19** illustrate exemplary driver manage user interfaces of a software program for managing electric vehicles in accordance with one embodiment of the invention;

[0019] FIGS. **20** and **21** illustrate exemplary vehicle template manage user interfaces of a software program for managing electric vehicles in accordance with one embodiment of the invention; and

[0020] FIG. **22** illustrates a diagrammatic representation of a machine in the exemplary form of a computer system within which a set of instructions, for causing the machine to perform any one or more of the methodologies discussed herein, may be executed.

DETAILED DESCRIPTION

[0021] In the following description, numerous specific details are set forth. However, it is understood that embodiments of the invention may be practiced without these specific details. In other instances, well-known circuits, structures and techniques have not been shown in detail in order not to obscure the understanding of this description. Those of ordinary skill in the art, with the included descriptions, will be able to implement appropriate functionality without undue experimentation.

[0022] References in the specification to "one embodiment", "an embodiment", "an example embodiment", etc., indicate that the embodiment described may include a particular feature, structure, or characteristic, but every embodiment may not necessarily include the particular feature, structure, or characteristic. Moreover, such phrases are not necessarily referring to the same embodiment. Further, when a particular feature, structure, or characteristic is described in connection with an embodiment, it is submitted that it is within the knowledge of one skilled in the art to effect such feature, structure, or characteristic in connection with other embodiments whether or not explicitly described.

[0023] In the following description and claims, the terms "coupled" and "connected," along with their derivatives, may be used. It should be understood that these terms are not intended as synonyms for each other. Rather, in particular

embodiments, "connected" may be used to indicate that two or more elements are in direct physical or electrical contact with each other. "Coupled" may mean that two or more elements are in direct physical or electrical contact. However, "coupled" may also mean that two or more elements are not in direct contact with each other, but yet still co-operate or interact with each other.

[0024] The present invention will now be described in detail with reference to the drawings, which are provided as illustrative examples of the invention so as to enable those skilled in the art to practice the invention. Notably, the figures and examples below are not meant to limit the scope of the present invention to a single embodiment, but other embodiments are possible by way of interchange of some or all of the described or illustrated elements.

[0025] A system and method for managing one or more fleets of electric vehicles with a fleet management portal is described herein. In one embodiment, a machine implemented method for managing one or more fleets of electric vehicles includes monitoring one or more fleets of electric vehicles using a fleet management portal associated with a server. Next, the method includes monitoring a plurality of charge transfer devices using the fleet management portal. Next, the method includes receiving charging information from the charge transfer devices. Next, the method includes determining a charging status for each electric vehicle based on the charging information. Next, the method includes generating one or more reports having the charging status for each electric vehicle.

[0026] A first embodiment of the network-controlled charge transfer system **100** for charging electric vehicles is shown in FIG. **1**A. The system **100** comprises a network-controlled charge transfer device **110**, a local power grid **120**, a data control unit **130**, and a server **140**. The system **100** interfaces with an electric vehicle **150**, with an electrical connector **152**, and an electric vehicle operator **160**, via a mobile communication device **162**. The network-controlled charge transfer device **110** is connected to the local power grid **120** by an electric power line **170**, and to the electric vehicle **150** by the electrical connector **152** and charging cord **175**. The flow of electrical power may be in either direction for both of these electrical connections. In other words, the electric vehicle **150** can be recharged from the local power grid **120**, or the local power grid **120** can receive power from the electric vehicle **150**. The charge transfer device **110** is coupled with the data control unit **130** over the WPAN (Wireless Personal Area Network) link **180** (e.g., Bluetooth, ZigBee, etc.) or WLAN (Wireless Local Area Network) (e.g., WiFi, etc.). The data control unit **130** is coupled with the server **140** over the WAN (Wide Access Network) connection **185** (e.g., Cellular (CDMA, GPRS, etc.), WiFi Internet connection, Plain Old Telephone Service modem, leased line, etc.). The electric vehicle operator **160** uses the mobile communication device **162** to establish a communication link to the charge transfer device **110** over a wireless network **190**. According to one embodiment of the invention, the communication device **162** is a radio-frequency identification (RFID) device, which the operator **160** presents to establish a charging session for the electric vehicle **150**. The RFID device includes unique operator-specific information (e.g., operator identification information, etc.). The communication link between the electric vehicle operator **160** and the charge transfer device **110** allows information to be shared which enables recharging of the electric vehicle **150**.

[0027] The charge transfer device **110** comprises an electrical receptacle **112** and indicator lights **114**. The electrical receptor **112** and the electrical connector **152** are configured to make an electrical connection allowing safe flow of electrical power between the charge transfer device **110** and circuitry **154** associated with an electricity storage device **156** of the electrical vehicle **150**. Examples of suitable receptacles are those conforming to the NEMA (National Electrical Manufacturers Association) standards 5-15, 5-20 and 14-50. Although, other receptacles will be used for systems outside the United States which operate at voltages other than 120V (for example 240V) and which are required to meet different standards. In preferred embodiments the electrical receptacle **112** has a cover. The cover is lockable and is released by the charge transfer device **110** upon receipt of a request for charging of an electrical vehicle **150** by the electric vehicle operator **160**. This request may be made by the mobile communication device **162**.

[0028] The indicator lights **114** are used to show the operational status of the Charge transfer device **110**—for example, the status may be: charging in progress, charging complete, vehicle-to-grid (V2G) in progress and error warning. The indicator lights **114** may be LEDs (light emitting diodes), may be capable of showing a number of different colors and may be capable of continuous or flashing modes of operation. Alternatively, the indicator lights **114** may be replaced by an alphanumeric display.

[0029] The local power grid **120** is the electrical supply grid owned and operated by local utility companies. Although, the local power grid **120** does extend to parts of the electrical supply network that are not owned by the utility company, such as electrical cables on private premises.

[0030] The data control unit **130** acts as a bridge between the LAN and the WAN, and enables communication between the charge transfer device **110** and the server **140**. The server **140** is generally remote from the charge transfer device **110**. Alternatively, the server **140** may be collocated with the charge transfer device **110** and the data control unit **130**.

[0031] The system **100** is shown in FIG. **1**A with only one charge transfer device **110**; however, the system may include many charge transfer devices **110**, all linked to the server **140** through one or more data control units **130**. There will be one or more data control unit(s) **130** for each group of geographically proximate (within the range of the same local area network) charge transfer devices **110**.

[0032] The electric vehicle **150** is any battery operated electric vehicle, including EVs and plug in hybrids. Electric vehicles **150** that have the necessary V2G electronics are able to provide power to the local power grid **120**.

[0033] Examples of compatible communication devices **162** are: one way and two-way RFID devices, an example of the latter being a FasTrak® card; Wi-Fi® devices, such as a personal computer; BlueTooth® devices, such as a mobile phone; and ZigBee® devices. In some embodiments of the invention the vehicle user **160** can monitor charging using the mobile communication device **162**. This can be implemented by allowing access to the vehicle user **160** of the power consumed by the electric vehicle **150**, which is monitored by the charge transfer device **110** and stored on the server **140**. Access can either be directly to the charge transfer device **110** over a LAN or to the server **140** over the Internet.

[0034] In an embodiment, data control unit **130** is a payment station having a communication link to the server **140** over a WAN **185**. The electric vehicle operator **160** may use

the mobile communication device **162** to establish a communication link to the charge transfer device **110** over a wireless network **190**. Instead of using a mobile communication device **162**, the electric vehicle operator **160** may manually interact with the payment station, which then sends appropriate instructions to the charge transfer device **110** regarding charging of the electric vehicle **150**. In preferred embodiments these instructions will include an instruction to unlock a cover over the electrical receptacle **112**, thus allowing the vehicle operator **160** to connect the electric vehicle **150** to the electrical receptacle **112** with the electrical connector **152**.

[0035] FIG. **1**B is a schematic diagram of a network-connected charge transfer device according to one embodiment of the invention. The charge transfer device **110** comprises an electrical receptacle **112**, a lockable cover **1125** over the electrical receptacle **112**, a control device **171**, a current measuring device **172**, an electric power line **170**, a controller **111**, a display unit **113**, a vehicle detector **115**, a WLAN transceiver **181**, an alternating current line transceiver **182**, a WPAN transceiver **191** and an RFID transceiver **192**.

[0036] Electric power is delivered to receptacle **112** along power line **170**. Controller **111** is used to lock and unlock the cover **1125**; the lock mechanism is electro-mechanical. When unlocked, the cover **1125** may be lifted by the vehicle operator **160** in order to connect the electric vehicle **150** to the electrical receptacle **112** using the electrical connector **152**. Control device **171** is used to turn the electric supply at the receptacle **112** on and off. The control device **171** is preferably a solid state device and is controlled by controller **111**. The current flowing along the power line **170** is measured by current measuring device **172**. An example of a suitable measuring device **172** is an induction coil. The controller **111** is programmed to monitor the signal from the current measuring device **172** and to calculate the total energy either: consumed (in recharging the electric vehicle); or transferred to the local power grid **120** from the electric vehicle **150** (V2G). Alternatively, a power measuring device may be used for calculating the total energy consumed or transferred to the local power grid **120** from the electric vehicle **150**. It is also envisaged that energy may be both consumed and transferred to the grid during the time an electric vehicle is connected to the charge transfer device **110**, in which case the controller **111** will calculate both the energy consumed and the energy transferred to the local power grid **120**.

[0037] The indicators **114** and display **113** are controlled by the controller **111** and are used to provide information to the charge transfer device **110** user. Vehicle detector **115** is used to detect the presence of a vehicle in the parking space corresponding to the charge transfer device **110**. The vehicle detector **115** is controlled by the controller **111**. The vehicle detector **115** is a detector such as a sonar sensor array, a camera, or an induction coil. The sonar array is an array as used on the rear bumper of automobiles to detect close proximity to an object; this array can be attached to the charge transfer device **110** or will be mounted to a support structure in close proximity to the charge transfer device **110**. The camera is a digital camera providing a video signal to the charge transfer device **110**; the video signal is processed by an object recognition program to detect the presence of a vehicle or other obstruction. The induction coil is either embedded in the pavement of the parking space or is protected by a roadworthy casing attached to the surface of the pavement. The induction coil is connected to the charge transfer device **110** and detects the presence of large metal objects in close proximity to the coil (such as an engine block, electric motor or rear differential of a vehicle).

[0038] The controller **111** is shown with four transceivers—a WLAN transceiver **181**, an alternating current line transceiver **182**, a WPAN transceiver **191** and an RFID transceiver **192**. A transceiver is a device that both sends and receives signals, allowing for two-way communication. The WLAN transceiver **181** allows for the controller to communicate with charge transfer devices **110** and with a data control unit **130** or payment station. WLAN transceiver **181** could be a Wi-Fi® transceiver. The alternating current line transceiver allows the controller to communicate on a PLC network with a data control unit **130** or payment station. The WPAN transceiver **191** allows the controller **111** to communicate with charge transfer devices **110**. The WPAN transceiver **191** could be a BlueTooth® or ZigBee® transceiver. The RFID transceiver **192** allows the controller to communicate with a compatible RFID device carried by the vehicle operator **160**. An example of an RFID device that could be carried by the vehicle operator **160** is a FasTrak® card. A FasTrak® device is an example of a two-way RFID communication device. Although, a one-way RFID communication device from vehicle operator **160** to controller **111** can be utilized. Not all embodiments of the charge transfer device **110** have all four types of transceiver; however, all charge transfer device **110** will have at least one wireless transceiver for communication with compatible mobile wireless communication devices **162** available to vehicle operators **160**, and one transceiver for communication with the data control unit **130**.

[0039] FIG. **2** is a block diagram of a fleet management system having a fleet management portal for managing one or more fleets of electric cars according to one embodiment of the invention. The fleet management system **200** includes a server **210** having a fleet management portal **212**. The fleet management portal **212** is used by fleet managers associated with data processing devices **272** and **248** to monitor and manage fleets **249** and **270** of electric vehicles. Each fleet **270** and **249** includes a plurality of electric vehicles (e.g., **260-269**, **250-259**). The data processing devices **272** and **248** connect to the portal **212** via a wide area network.

[0040] The server **210** and/or fleet management portal **212** monitors and manages gateways **220** and **230** (e.g., data control unit **130**) that are associated with charge transfer devices (e.g., **231-236**, **221-224**). The gateways may also be charge transfer devices. A charge transfer device directly communicates with a gateway or indirectly via other charge transfer device(s). An electric vehicle may be associated with a charge transfer device in order to recharge the electricity storage device of the electric vehicle.

[0041] The fleet management portal **212** may include one or more software programs used to track subscriber and vehicle information associated with the fleets and also charging information associated with the charge transfer devices. This information is collected, stored, and analyzed to generate reports and manage the fleets.

[0042] FIG. **3** is a schematic diagram of a server in accordance with one embodiment of the invention. The server **330** comprises a data processing system **141**, a processing unit **320**, a report generator **142**, input/output (I/O) devices, and a memory **340**, which includes a plurality of software programs **350** and a database **143**. The server **330** has similar functionality in comparison to the servers **140** and **210** previously discussed. The server **330** is configured to communicate with

the following: network **195**; World Wide Web **197**; utility companies **144**, for receiving power load management data; credit card companies **145**, for credit authorization and charging; FasTrak® database **146**, for debiting FasTrak® accounts; and banks **147**, for debiting bank accounts. The database **143** is used to store consumer profiles and other data required for report generation, as described below.

[0043] In some embodiments, the server **330** manages a plurality of electric vehicles (e.g., fleet). One or more programs **350** are stored in the memory **340** and configured to be executed by the processing unit **320**. The programs **350** include instructions monitoring one or more fleets of electric vehicles using a fleet management portal associated with the server **300**, monitoring a plurality of charge transfer devices using the fleet management portal, receiving charging information from the charge transfer devices, and determining a charging status for each electric vehicle based on the charging information. One of the programs may be a fleet management program used to generate various reports **370** including a report with charging information for each electric vehicle, which will be discussed in more detail in conjunction with FIGS. **5-23**.

[0044] The report generator **142** also creates reports such as: utility company reports **1421**, detailing energy consumed and vehicle to grid (V2G) energy sold to local power grid **120**; subscriber reports **1422**, detailing energy consumed and V2G energy sold to the local power grid **120**, account balance, payments and invoices, and subscriber profile data; and tax authority reports **1423**, providing details of taxable transactions.

[0045] The network **195** comprises a multiplicity of data control units **130** and/or payment stations, each data control unit **130** and/or payment station being connected by a communication link **180** to a multiplicity of charge transfer devices **110**. The communication link **185** between the computer **141** and the network **195** is a WAN.

[0046] The server **330** is interfaced with the Web **197** to allow subscribers (owners and operators **160** of electric vehicles **150**) to do the following: (1) set-up user/consumer profiles; and (2) determine availability of charge transfer devices for recharging their electric vehicles **150**. A user profile contains financial account information—details required for payment—and may also include information such as whether the vehicle operator wants to: charge the electric vehicle only during periods of lower power rates; not charge the vehicle during periods of high power grid load; and sell power to the local grid. The availability of charge transfer devices **110** is stored on the server and the information is collected from the network **195**. There are two ways that the availability of a charge transfer device **110** can be determined: (1) using a vehicle detector **115** (see FIG. **3** and related description) to determine whether the parking space corresponding to the charge transfer device **110** is available; and (2) flagging a charge transfer device **110** as being unavailable whenever charging is ongoing, V2G is ongoing or parking has been paid for.

[0047] FIG. **4** is a flow diagram exemplary illustrating managing a plurality of electric vehicles in accordance with one embodiment of the invention. A machine implemented method for managing the plurality of electric vehicles includes monitoring one or more fleets of electric vehicles using a fleet management portal associated with a server at block **402**. A fleet manager can access the fleet management portal via an internet connection and monitor the one or more fleets. Next, the method includes monitoring a plurality of charge transfer devices using the fleet management portal at block **404**. The fleet manager can use the fleet management portal to monitor the charge transfer device as well. Next, the method includes receiving charging information at the server from the charge transfer devices at block **406**.

[0048] The server may also receive other information (e.g., vehicle information, user information) from a charge transfer device that is used to form an association or mapping between an electric vehicle connected to a charge transfer device. In one embodiment, an association between an electric vehicle and a charge transfer device is formed when an electricity storage device of the electric vehicle is plugged into the charge transfer device. A user **160** of the electric vehicle uses a wireless communication device **162** to receive access to a charge transfer device **110**. The device **162** identifies the user **160** who is associated with a particular electric vehicle. In one embodiment, a one to one mapping is forced between the communication device **162** and the electric vehicle in order to know which electric vehicle is being charged by the charge transfer device **110**.

[0049] Next, the method includes determining a charging status for each electric vehicle based on the charging information at block **408**. The charging status may include a charging state, a fully charged state, or an unknown state. An electric vehicle having no current association or current mapping with a charge transfer device may have an unknown state. For example, this electric vehicle may be associated with the vehicle operator **160** currently using or driving the electric vehicle with no charging session being currently established. In another embodiment, an electric vehicle does not have an unknown state even when in use because the electric vehicle has a transmitter for transmitting the current charging state (e.g., fully charged, partially charged, nearly discharged, etc.) directly or indirectly to the server. Next, the method includes generating one or more reports having the charging status for each electric vehicle at block **410**. The status information in the one or more reports is discussed in more detail in conjunction with FIG. **6**.

[0050] The charging status can be determined in various ways. For example, the charging status is determined by (1) determining a total plug-in time for a vehicle electricity storage device, (2) determining a total energy delivered to a vehicle electricity storage device since a start of the plug-in time, and/or (3) determining an instantaneous power being currently delivered to a vehicle electricity storage device. For the first two cases, a "worst case" recharging time and a "total number" of kWh that each electricity storage device requires is known and stored on the server. If a measured time or total number of kWh for a charging session exceeds those values, then it is known that the electricity storage device is fully charged. In the third case, a trickle charge for each storage device is known and if the power approaches the trickle charge, then it is known that the storage device is fully charged. For example, an electric vehicle may have a trickle drawn power of 25 W indicating a fully charged state and a recharging drawn power of 1000 W when the storage device is actually charging. These ways can be used separately or in combination to determine the charging status for each electric vehicle.

[0051] In an alternative embodiment, an electricity storage device is associated with a transceiver that can be queried for a state of charge and then transmit this state of charge to the charge transfer device if currently charging and then the

charge transfer device can transmit this information to the server. Alternatively, if the electric vehicle is in use, the state of charge can be transmitted directly to the server or to another communication entity or server, which transmits this information to the server (e.g., **140**, **210**, **330**).

[0052] Next, the method includes generating fuel savings information and GHG information at block **412**. The fuel saving information and GHG information is discussed in more detail in conjunction with FIG. **5**. Next, the method further includes sending one or more notification messages to a subscriber or user of an electric vehicle at block **414**. A notification message may be in the form of an email or a SMS message or other types of electronic messaging. For example, a notification message may be sent to the user if the electric vehicle is fully charged or almost charged, or not charging, or periodic updates providing the amount of energy transferred thus far. Alternatively, a notification message may be sent if a time period for plugging in the electric vehicle has expired, which may occur if a user forgets to plug in his electric vehicle. Alternatively, a notification message may be sent if a time period for checking in the electric vehicle has expired, which may occur if a user forgets to return or check in his electric vehicle. For example, a user or subscriber may check out a vehicle for 5 hours, but the subscriber has not returned the vehicle 5 hours after starting a session. In this case, a notification message is sent to the subscriber. In an embodiment, a notification message is sent to a user or subscriber at the same time each day (e.g., 6pm) if the vehicle is not charging at this time.

[0053] In one embodiment, a subscriber establishes a session with a charge transfer device by waving their communication device **162** near the charge transfer device, opening a door to the charge transfer device, plugging in the cord to the charge transfer device, and then shutting and locking the door to the charge transfer device. However, if the subscriber forgets to plug the other end of the cord into the electricity storage device **156** or circuitry **154** associated with the electricity storage device **156** (or has a bad connection), then, a timer may be set to expire within a certain time period if no current is seen being transferred to the electric vehicle. A power receptacle associated with the charge transfer device can be de-energized and a notification message sent to the subscriber.

[0054] In one embodiment, the server is programmed to transmit notification messages to those subscribers (or to other person(s) as designated by the subscribers and/or the fleet manager) that will have their charging sessions suspended due to the amount of load on the power grid. These messages are referred to as Demand Response notification messages. In some situations, only those subscribers which have registered for grid-friendly charging will have their charging sessions suspended while in other situations subscribers, regardless of service plan, will have their charging sessions suspended.

[0055] In one embodiment, the server is programmed to transmit notification messages responsive to an alarm generated by a charging station or triggered by the server. These notification messages may be sent to the appropriate operators, administrators, and/or owners of the charging stations experiencing an alarm event and/or to the subscribers using a charging station that is experiencing an alarm event. Example alarm events include the following: a charge transfer device has failed to respond to a periodic heartbeat from the server, a charge transfer device has unexpectedly rebooted, a charge transfer device has detected a problem (hardware and/or software), a GFCI in the charge transfer device has tripped.

[0056] In one embodiment of the invention, the server determines that a subscriber has established a charging session with a charge transfer device but has failed to plug their charging cord into their vehicle by examining the charging data received from that charge transfer device. For example, if the charging data indicates that the charging session has been established for a threshold amount of seconds and the electricity transferred is below a certain threshold, the server may notify the subscriber that charging has not occurred. In addition, the server may transmit a command to the charge transfer device instructing it to suspend the session and prevent electricity from flowing through the power receptacle.

[0057] FIGS. **5-23** illustrate exemplary user interfaces of a software program for managing electric vehicles in accordance with one embodiment of the invention. The software program may be a fleet management portal program located on the server. The fleet management portal program may be used by a fleet manager to monitor and manage one or more fleets of electric vehicles.

[0058] FIG. **5** illustrates an exemplary fuel savings user interface of a software program for managing electric vehicles in accordance with one embodiment of the invention. The fuel savings information **500** as discussed in block **406** includes a monthly fuel savings of gasoline that is saved by the user or grouping of users (e.g., SF Fire) of the plurality of electric vehicles, which is illustrated in the chart **510**. The monthly fuel savings, in one example, varies from 200 to 300 gallons. The fuel savings information **500** includes an annual fuel savings of gasoline that is saved by the user of the plurality of electric vehicles, which is also illustrated in the chart **510**. The annual fuel savings for the SF Fire fleet, in one example, is approximately 3,000 gallons of gasoline. An additional chart and calculation is performed to convert this into a monetary savings based on the cost of gasoline.

[0059] For example, if a typical gasoline car has an efficiency of 23.9 miles/gallons and gasoline costs $2/gal, then the gasoline operating cost is 8.4 cents/mile (2/23.9). If electricity costs 11 cents/kWh with an electric car having an efficiency of 5.0 mi/kWh, then the electricity operating cost is 2.3 cents/mile (0.11/5.0). Thus, the resulting cost savings with these estimates is 6.1 cents/mile. Using EPA gas efficiency estimates, a net fuel cost savings is $0.30/kWh and a net gasoline savings is 0.209 gallon/kWh.

[0060] The fuel savings information **500** may also include a monthly reduction in an emission of green house gas resulting from the use of the plurality of electric vehicles and an annual reduction in emission of green house gas resulting from the use of the plurality of electric vehicles. For example, if you drive 23 miles in a gasoline vehicle, then the vehicle emits x pounds of CO_2. If you drive the same 23 miles in an electric vehicle, then the vehicle emits y pounds of CO_2 with x being significantly larger than y. Using EPA gas CO_2 emission and household CO_2 emission estimates, gasoline as fuel emits 19.4 lbs of CO_2 emitted/gallon, which, using EPA gas efficiency estimates and electric vehicle efficiency estimates, emits an equivalent of 4.06 lbs of CO_2/kWh and 1.841 kg/kWh. The CO_2 emitted as a result of generating electricity to power an electric vehicle is 0.621 kg/kWh and 1.37 lbs/kWh, based on EPA estimates of 14796 lbs/house/year and 900 kWh/month/house. Thus, a net GHG savings with CO_2 being 95% of GHG is 1.284 kg/kWh and 2.83 lbs/kWh for using an electric vehicle rather than a gasoline vehicle.

[0061] FIG. **6** illustrates an exemplary electric vehicle status user interface of a software program for managing electric vehicles in accordance with one embodiment of the invention. The status information **600** as discussed in block **408** includes summary information **610** having the charging status of the plurality of electric vehicles. The status information also includes vehicle status information **620** for each electric vehicle that includes a license plate identifier, a charging status, a charging station, a power delivered to each battery in unit of kW, an energy delivered to each battery in units of kWh, a charging session time, and a time period until a battery is fully charged. The vehicle status information **620** may also include a status of an associated user. For example, John is out driving vehicle ffffff and is due back at 01:33.

[0062] FIG. **7** illustrates an exemplary electric vehicle check out user interface of a software program for managing electric vehicles in accordance with one embodiment of the invention. A check out option **710** is selected for this user interface **700**. This user interface **700** includes driver, vehicle, duration, and notification options as well as driver list and vehicle list filters. The notification options include vehicle not returned, vehicle not plugged in, and vehicle fully charged. These notification messages can be sent to a driver, a fleet manager, or both.

[0063] FIG. **8** illustrates an exemplary electric vehicle check in user interface of a software program for managing electric vehicles in accordance with one embodiment of the invention. A check in (return) option **892** is selected to generate this user interface **890**. This user interface **890** includes a driver/vehicle pick list filter with department, fleet, and vehicle type filters. A driver/vehicle combination is submitted for check in.

[0064] FIG. **9** illustrates an exemplary session report user interface of a software program for managing electric vehicles in accordance with one embodiment of the invention. A sessions option **910** is selected to generate this user interface **900**. This user interface **900** includes a filter session list having driver, vehicle, station, department, fleet, and type filters along with start and end time period options. A total (as filtered) section **920** displays a time period (e.g., duration), an energy consumed (e.g., 695 kWh), and a GHG savings (e.g., 783 kg). A report **930** based on the filter is generated that includes driving session data. For example, the report **930** includes columns for fleet, vehicle, dept, driver, driving start time, driving end time, driving duration, electricity consumed, GHG emitted, and station.

[0065] FIG. **10** illustrates an exemplary check out/in report user interface of a software program for managing electric vehicles in accordance with one embodiment of the invention. A check out/in option **1010** is selected to generate this user interface **1000**. This user interface **1000** includes a filter check-out/check-in list having driver, vehicle, department, fleet, and type filters along with start and end time period options. A total (as filtered) section **1020** displays a time period (e.g., duration). A report **1030** based on the filter is generated that includes check-out and check-in data. For example, the report **1030** includes columns for fleet, vehicle, dept, driver, check-out time and date, check-in time and date, and a difference between the check-in and check-out times.

[0066] FIGS. **11-13** illustrate exemplary fleet manage user interfaces of a software program for managing electric vehicles in accordance with one embodiment of the invention. A fleet manage option **1110** is selected to generate this user interface **1100**. This user interface **1100** includes a filter fleet list having name of a fleet, description of the fleet, and vehicle filters. A report **1130** based on the filter(s), which in this case is fleets having more than 4 vehicles, is generated that includes fleet data. For example, the report **1030** includes columns for editing, name, description, contact name and number, and number of vehicles.

[0067] If a top row associated with the SF Fire Airport fleet is selected for editing, then a user interface **1200** is generated as illustrated in FIG. **12**. This user interface **1200** includes an edit fleet section **1230** having editable information for the SF Fire Airport fleet. If 'Add' link is selected by a user, then user interface **1300** is generated as illustrated in FIG. **13**. Add vehicle section **1330** allows the addition of vehicles this fleet. Vehicles can also be removed with the 'Remove Selected' link.

[0068] FIGS. **14** and **15** illustrate exemplary vehicle manage user interfaces of a software program for managing electric vehicles in accordance with one embodiment of the invention. A vehicle manage option **1410** is selected to generate this user interface **1400**. This user interface **1400** includes a filter vehicle list having information associated with a vehicle such as license plate identifier, RFID, color, status, and template filters. A report **1430** based on the filter(s), which in this case is license plate identifier, is generated that includes vehicle data. For example, the report **1430** includes columns such as select, license plate identifier, RFID, template name, color, year, and status.

[0069] If a second row associated with the license plate _____2 is selected, then a user interface **1500** is generated as illustrated in FIG. **15**. This user interface **1500** includes an edit vehicle section **1230** having editable information for the vehicle with license plate _____2.

[0070] FIGS. **16** and **17** illustrate exemplary department manage user interfaces of a software program for managing electric vehicles in accordance with one embodiment of the invention. A department manage option **1610** is selected to generate this user interface **1600**. This user interface **1600** includes a filter department list having information associated with a department name filter, a description filter, and a number of drivers filter. A report **1630** based on the filter(s), which in this case is SF Fire departments having more than or equal to 5 electric vehicles, is generated that includes department data. For example, the report **1630** includes columns such as select, department name, description, contact person, phone number, and number of drivers.

[0071] If a second row associated with the SF police is selected, then a user interface **1700** is generated as illustrated in FIG. **17**. This user interface **1700** includes an edit department section **1730** having editable information for the selected department. For example, a list of drivers in the SF police department is displayed. Drivers can be added or deleted.

[0072] FIGS. **18** and **19** illustrate exemplary driver manage user interfaces of a software program for managing electric vehicles in accordance with one embodiment of the invention. A driver manage option **1810** is selected to generate this user interface **1800**. This user interface **1800** includes a filter driver list having information associated with a driver name, department name, driver ID, driver phone number, and status. A report **1830** based on the filter(s), which in this case is the SF Fire department, is generated that includes driver data. For example, the report **1830** includes columns such as select, department name, driver name, phone number, status, and email address.

[0073] If a second row associated with a driver (e.g., Jari) of the SF police is selected, then a user interface **1900** is generated as illustrated in FIG. **19**. This user interface **1900** includes an edit driver section **1930** having editable information for the selected driver.

[0074] FIGS. **20** and **21** illustrate exemplary vehicle template manage user interfaces of a software program for managing electric vehicles in accordance with one embodiment of the invention. A vehicle template manage option **2010** is selected to generate this user interface **2000**. This user interface **2000** includes a filter vehicle template list having information associated with a template name, vehicle make, vehicle model, battery, and efficiency. A report **2030** based on the filter(s), which in this case is batteries having a capacity greater than or equal to 5 kWh, is generated that includes vehicle template data. For example, the report **2030** includes columns such as select, template name, vehicle make, vehicle model, battery, and efficiency.

[0075] If a second row associated with a template name (e.g., Chevy Volt) is selected, then a user interface **2100** is generated as illustrated in FIG. **21**. This user interface **2100** includes an edit vehicle template section **2130** having editable information for the selected vehicle template.

[0076] FIG. **22** illustrates a diagrammatic representation of a machine in the exemplary form of a computer system **800** within which a set of instructions, for causing the machine to perform any one or more of the methodologies discussed herein, may be executed. In alternative embodiments, the machine may be connected (e.g., networked) to other machines in a LAN, an intranet, an extranet, or the Internet. The machine may operate in the capacity of a server or a client machine in a client-server network environment, or as a peer machine in a peer-to-peer (or distributed) network environment. The machine may be a personal computer (PC), a tablet PC, a set-top box (STB), a Personal Digital Assistant (PDA), a cellular telephone, a web appliance, a server, a network router, switch or bridge, or any machine capable of executing a set of instructions (sequential or otherwise) that specify actions to be taken by that machine. Further, while only a single machine is illustrated, the term "machine" shall also be taken to include any collection of machines that individually or jointly execute a set (or multiple sets) of instructions to perform any one or more of the methodologies discussed herein.

[0077] The exemplary computer system **800** includes a processing device (processor) **802**, a main memory **804** (e.g., read-only memory (ROM), flash memory, dynamic random access memory (DRAM) such as synchronous DRAM (SDRAM) or Rambus DRAM (RDRAM), etc.), a static memory **806** (e.g., flash memory, static random access memory (SRAM), etc.), and a data storage device **818**, which communicate with each other via a bus **830**.

[0078] Processor **802** represents one or more general-purpose processing devices such as a microprocessor, central processing unit, or the like. More particularly, the processor **802** may be a complex instruction set computing (CISC) microprocessor, reduced instruction set computing (RISC) microprocessor, very long instruction word (VLIW) microprocessor, or a processor implementing other instruction sets or processors implementing a combination of instruction sets. The processor **802** may also be one or more special-purpose processing devices such as an application specific integrated circuit (ASIC), a field programmable gate array (FPGA), a digital signal processor (DSP), network processor, or the like. The processor **802** is configured to execute the processing logic **826** for performing the operations and steps discussed herein.

[0079] The computer system **800** may further include a network interface device **808**. The computer system **800** also may include a video display unit **810** (e.g., a liquid crystal display (LCD) or a cathode ray tube (CRT)), an alphanumeric input device **812** (e.g., a keyboard), a cursor control device **914** (e.g., a mouse), and a signal generation device **816** (e.g., a speaker).

[0080] The data storage device **818** may include a machine-accessible storage medium **831** on which is stored one or more sets of instructions (e.g., software **822**) embodying any one or more of the methodologies or functions described herein. The software **822** may also reside, completely or at least partially, within the main memory **804** and/or within the processor **802** during execution thereof by the computer system **800**, the main memory **804** and the processor **802** also constituting machine-accessible storage media. The software **822** may further be transmitted or received over a network **820** via the network interface device **808**. The machine-accessible storage medium **831** may also be used to store data structure sets that define user identifying states and user preferences that define user profiles. Data structure sets and user profiles may also be stored in other sections of computer system **800**, such as static memory **806**.

[0081] While the machine-accessible storage medium **831** is shown in an exemplary embodiment to be a single medium, the term "machine-accessible storage medium" should be taken to include a single medium or multiple media (e.g., a centralized or distributed database, and/or associated caches and servers) that store the one or more sets of instructions. The term "machine-accessible storage medium" shall also be taken to include any medium that is capable of storing, encoding or carrying a set of instructions for execution by the machine and that cause the machine to perform any one or more of the methodologies of the present invention. The term "machine-accessible storage medium" shall accordingly be taken to include, but not be limited to, solid-state memories, optical, and magnetic media.

[0082] The above embodiments of the present invention have been given as examples, illustrative of the principles of the present invention. Variations of the system and method will be apparent to those skilled in the art upon reading the present disclosure. These variations are to be included in the spirit of the present invention. For example, the network of charge transfer devices may be used for public and private garage and parking lot charging of electric vehicles. Furthermore, the network of charge transfer devices may be used for home charging of electric vehicles, in which case a receptacle in the home is connected via a LAN and a WAN to the server **140**. Those skilled in the art will appreciate that the network may also be used for non-vehicle applications, including selling electricity to people in places such as airports and coffee shops.

What is claimed is:

1. A machine implemented method for managing one or more fleets of electric vehicles, comprising:

monitoring one or more fleets of electric vehicles using a fleet management portal associated with a server;

monitoring a plurality of charge transfer devices using the fleet management portal;

receiving charging information from the charge transfer devices;

determining a charging status for each electric vehicle based on the charging information; and

generating a report having the charging status for each electric vehicle.

2. The method as in claim **1**, wherein the charging status further comprises a charging state, a fully charged state, or an unknown state.

3. The method as in claim **1**, wherein determining the charging status further comprises determining a total plug-in time.

4. The method as in claim **1**, wherein determining the charging status further comprises determining a total energy delivered to a vehicle electricity storage device since a start of the plug-in time.

5. The method as in claim **1**, wherein determining the charging status further comprises determining an instantaneous power being currently delivered to a vehicle electricity storage device.

6. The method as in claim **1**, wherein the report further comprises:

generating status information that includes at least one of the following:

summary information for the charging status of the plurality of electric vehicles; and

vehicle status information for each electric vehicle that includes at least one of a license plate identifier, a charging status, a charging station, a power delivered to each electricity storage device, energy delivered to each electricity storage device, a charging session time, and a time period until a electricity storage device is fully charged.

7. The method as in claim **1**, further comprising:

generating fuel savings information; and

generating green house gas reduction information.

8. The method as in claim **1**, further comprising:

sending a notification message to a user of an electric vehicle of the plurality of electric vehicles for at least one of the following conditions:

the electric vehicle is fully charged;

a time period for plugging in the electric vehicle has expired; and

a time period for checking in the electric vehicle has expired.

9. A machine-accessible medium storing executable program instructions which when executed cause a machine to perform a method comprising:

monitoring one or more fleets of electric vehicles using a fleet management portal associated with a server;

monitoring a plurality of charge transfer devices using the fleet management portal;

receiving charging information from the charge transfer devices;

determining a charging status for each electric vehicle based on the charging information; and

generating a report having the charging status for each electric vehicle.

10. The medium as in claim **9**, wherein the charging status further comprises a charging state, a fully charged state, or an unknown state.

11. The medium as in claim **9**, wherein determining the charging status further comprises determining a total plug-in time.

12. The medium as in claim **9**, wherein determining the charging status further comprises determining a total energy delivered to a vehicle electricity storage device since a start of the plug-in time.

13. The medium as in claim **9**, wherein determining the charging status further comprises determining an instantaneous power being currently delivered to a vehicle electricity storage device.

14. The medium as in claim **9**, the method further comprising:

generating status information that includes at least one of the following:

summary information for the charging status of the plurality of electric vehicles; and

vehicle status information for each electric vehicle that includes at least one of a license plate identifier, a charging status, a charging station, a power delivered to each electricity storage device, energy delivered to each electricity storage device, a charging session time, and a time period until a electricity storage device is fully charged.

15. The medium as in claim **9**, the method further comprising:

generating fuel savings information; and

generating green house gas reduction information.

16. The medium as in claim **9**, the method further comprising:

sending a notification message to a user of an electric vehicle of the plurality of electric vehicles for at least one of the following conditions:

the electric vehicle is fully charged;

a time period for plugging in the electric vehicle has expired; and

a time period for checking in the electric vehicle has expired.

17. A server for managing a plurality of electric vehicles, comprising:

a processing unit coupled to an input/output (I/O) device;

a memory coupled to the processor; and

one or more programs, wherein the one or more programs are stored in the memory and configured to be executed by the processing unit, the programs including:

instructions for monitoring one or more fleets of electric vehicles using a fleet management portal associated with the server;

monitoring a plurality of charge transfer devices using the fleet management portal;

receiving charging information from the charge transfer devices;

determining a charging status for each electric vehicle based on the charging information; and

generating a report having the charging status for each electric vehicle.

18. The server as in claim **17**, wherein determining the charging status further comprises instructions for at least one of determining a total plug-in time, determining a total energy delivered to a vehicle electricity storage device since a start of the plug-in time, and determining an instantaneous power being currently delivered to a vehicle electricity storage device.

19. The server as in claim **17**, wherein the programs further comprise instructions for generating status information in the report that includes at least one of the following:

summary information for the charging status of the plurality of electric vehicles; and

vehicle status information for each electric vehicle that includes at least one of a license plate identifier, a charging status, a charging station, a power delivered to each electricity storage device, energy delivered to each electricity storage device, a charging session time, and a time period until a electricity storage device is fully charged.

20. The server as in claim **17**, wherein the programs further comprise instructions for

sending a notification message to a user of an electric vehicle of the plurality of electric vehicles for at least one of the following conditions:

the electric vehicle is fully charged;

a time period for plugging in the electric vehicle has expired; and

a time period for plugging in the electric vehicle has expired.

21. A system for managing a plurality of electric vehicles, comprising:

a plurality of charge transfer devices communicatively coupled to each other; and

a server, communicatively coupled to at least one charge transfer device, the server comprises:

a processing unit coupled to an input/output (I/O) device;

a memory coupled to the processor; and

one or more programs, wherein the one or more programs are stored in the memory and configured to be executed by the processing unit, the programs including:

instructions for monitoring one or more fleets of electric vehicles using a fleet management portal associated with the server;

monitoring the plurality of charge transfer devices using the fleet management portal;

receiving charging information from the charge transfer devices;

determining a charging status for each electric vehicle based on the charging information; and

generating a report having the charging status for each electric vehicle.

22. The server as in claim **21**, wherein determining the charging status further comprises instructions for at least one of determining a total plug-in time, determining a total energy delivered to a vehicle electricity storage device since a start of the plug-in time, and determining an instantaneous power being currently delivered to a vehicle electricity storage device.

23. The server as in claim **21**, wherein the programs further comprise instructions for sending a notification message to a user of an electric vehicle of the plurality of electric vehicles for at least one of the following conditions:

the electric vehicle is fully charged;

a time period for plugging in the electric vehicle has expired; and

a time period for plugging in the electric vehicle has expired.

* * * * *