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Umlauf et al.

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(54) **AGRICULTURAL VEHICLE WITH IMPLEMENT-SPECIFIC OPERATIONAL PROFILES**

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F16H 59/50 (2006.01)
F16H 61/00 (2006.01)

(52) **U.S. Cl.**
CPC ***A01B 71/06*** (2013.01); ***F16H 59/50*** (2013.01); ***F16H 61/00*** (2013.01); *F16H 2061/0087* (2013.01)

(58) **Field of Classification Search**
None
See application file for complete search history.

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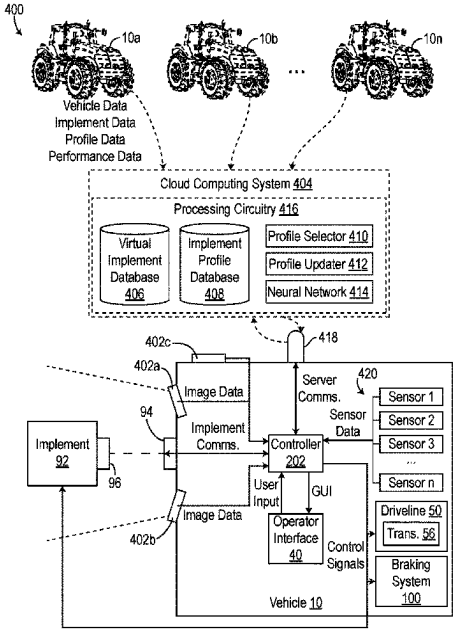
(57) **ABSTRACT**

An agricultural vehicle includes a driveline, an interface, and a control system. The driveline includes an engine, a transmission, and a power take off (PTO). The interface is configured to removably couple an implement with the agricultural vehicle. The implement configured to perform an agricultural function. The control system includes processing circuitry configured to obtain an indication of a type of the implement that is removably coupled with the agricultural vehicle. The processing circuitry is also configured to determine a profile for at least the transmission based on the type of the implement that is removably coupled with the agricultural vehicle. The profile defines an operating parameter for at least the transmission such that the transmission operates in a specific manner for the type of the implement. The processing circuitry is also configured to operate at least the transmission according to the operating parameter of the profile.

20 Claims, 11 Drawing Sheets



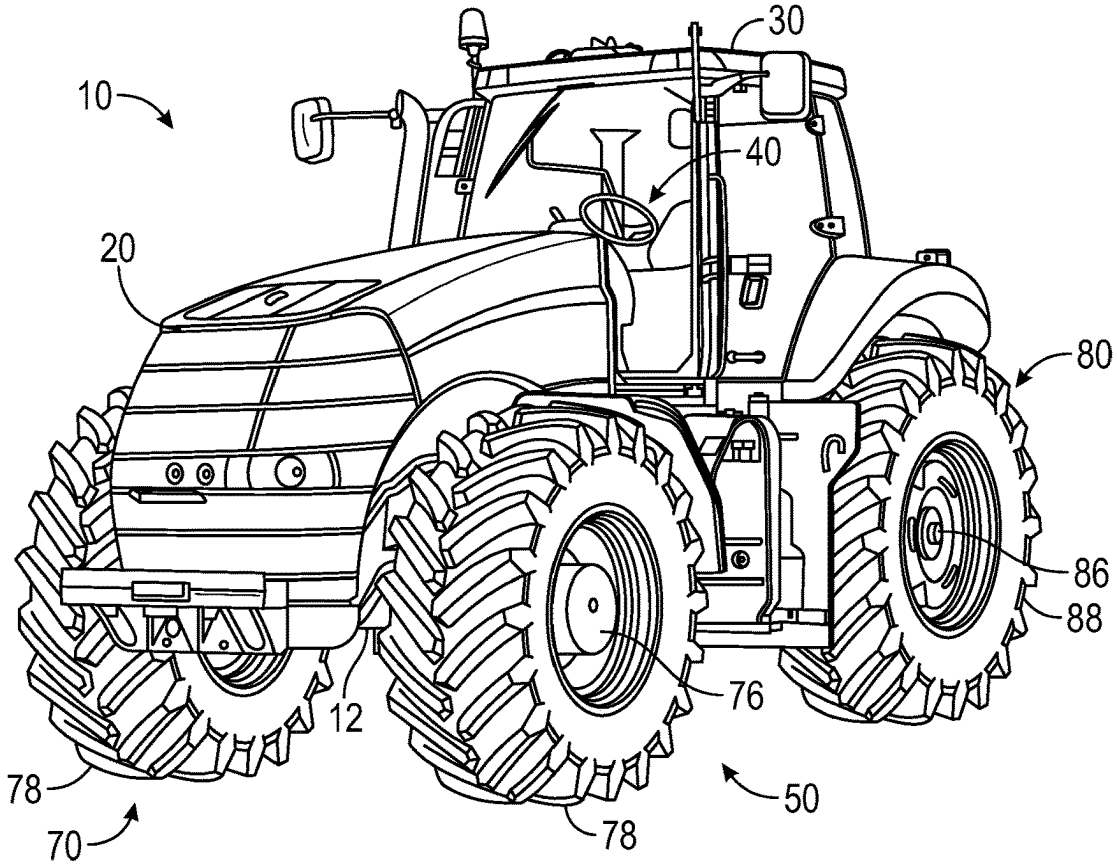

10
30
40
20
80
86
88
76
12
78
70
78
50

FIG. 1

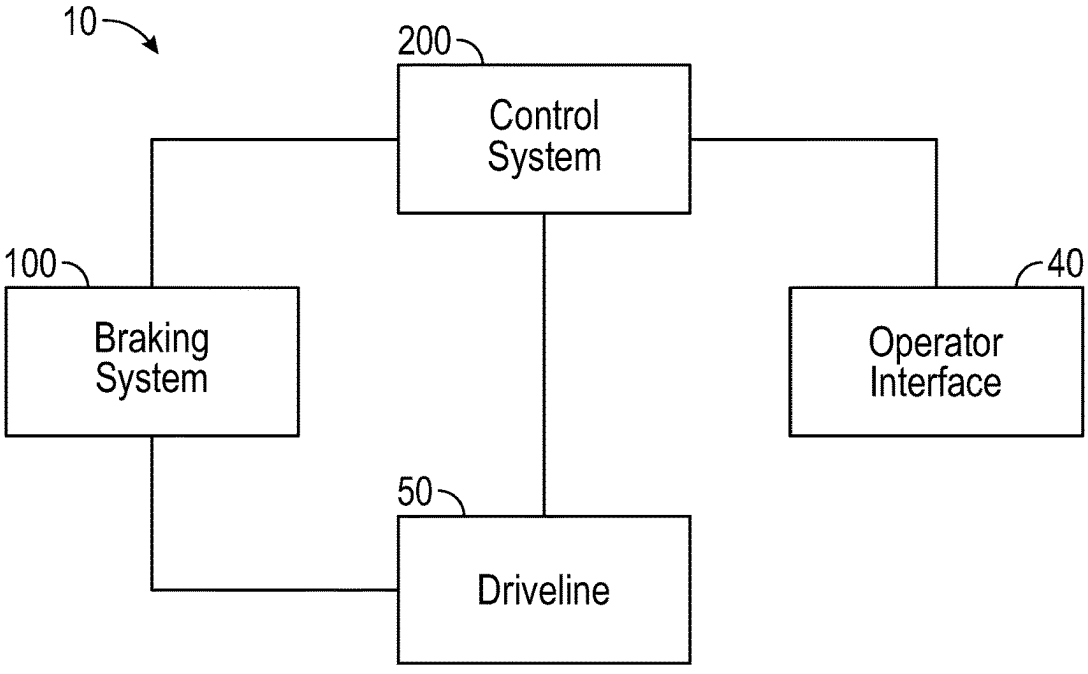

10
200
Control System
100
Braking System
40
Operator Interface
50
Driveline

FIG. 2

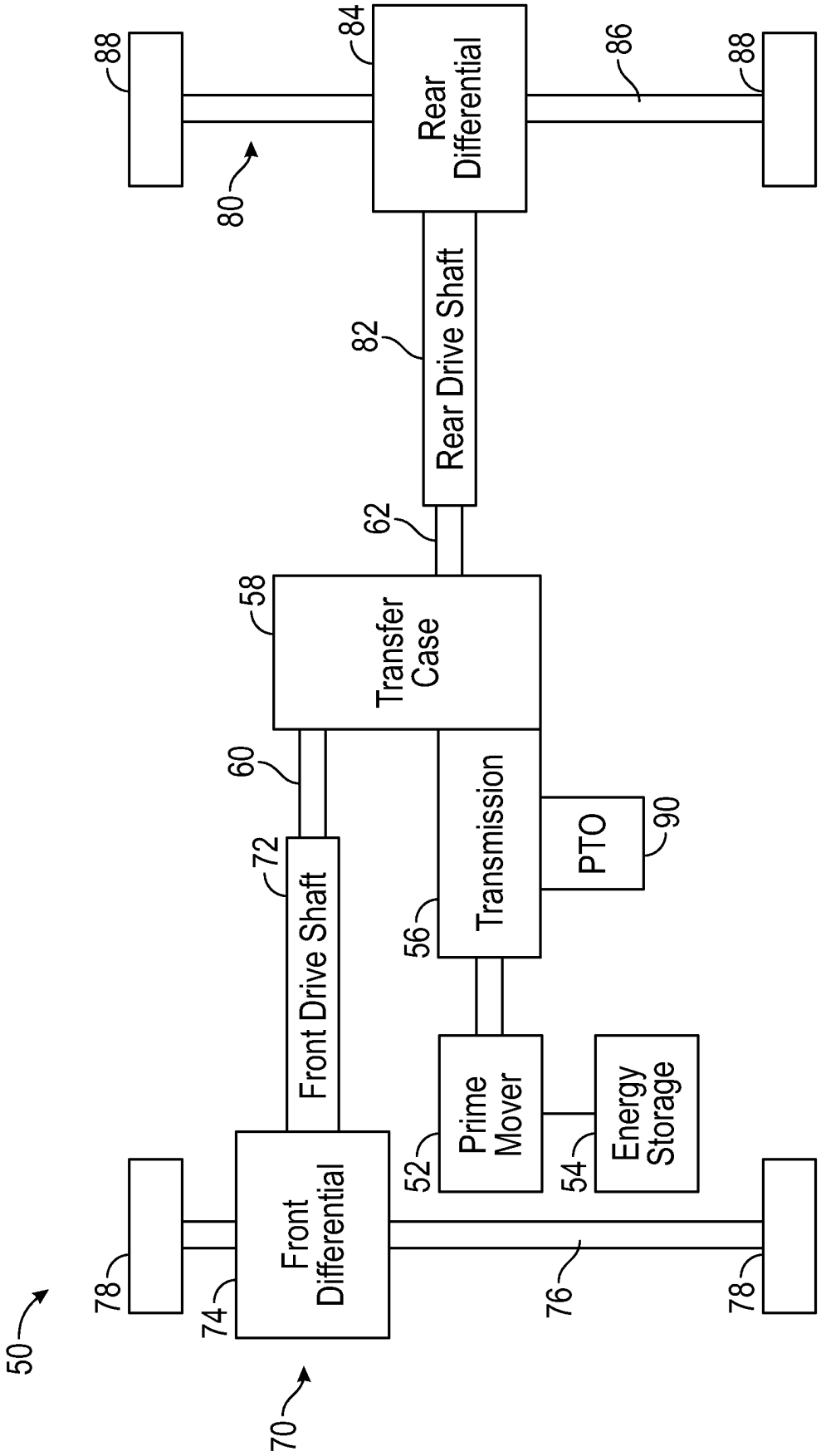

50
70
80
88
84
Rear Differential
86
88
82
Rear Drive Shaft
62
58
Transfer Case
60
72
Front Drive Shaft
56
Transmission
PTO
90
52
Prime Mover
54
Energy Storage
78
74
Front Differential
76
78

FIG. 3

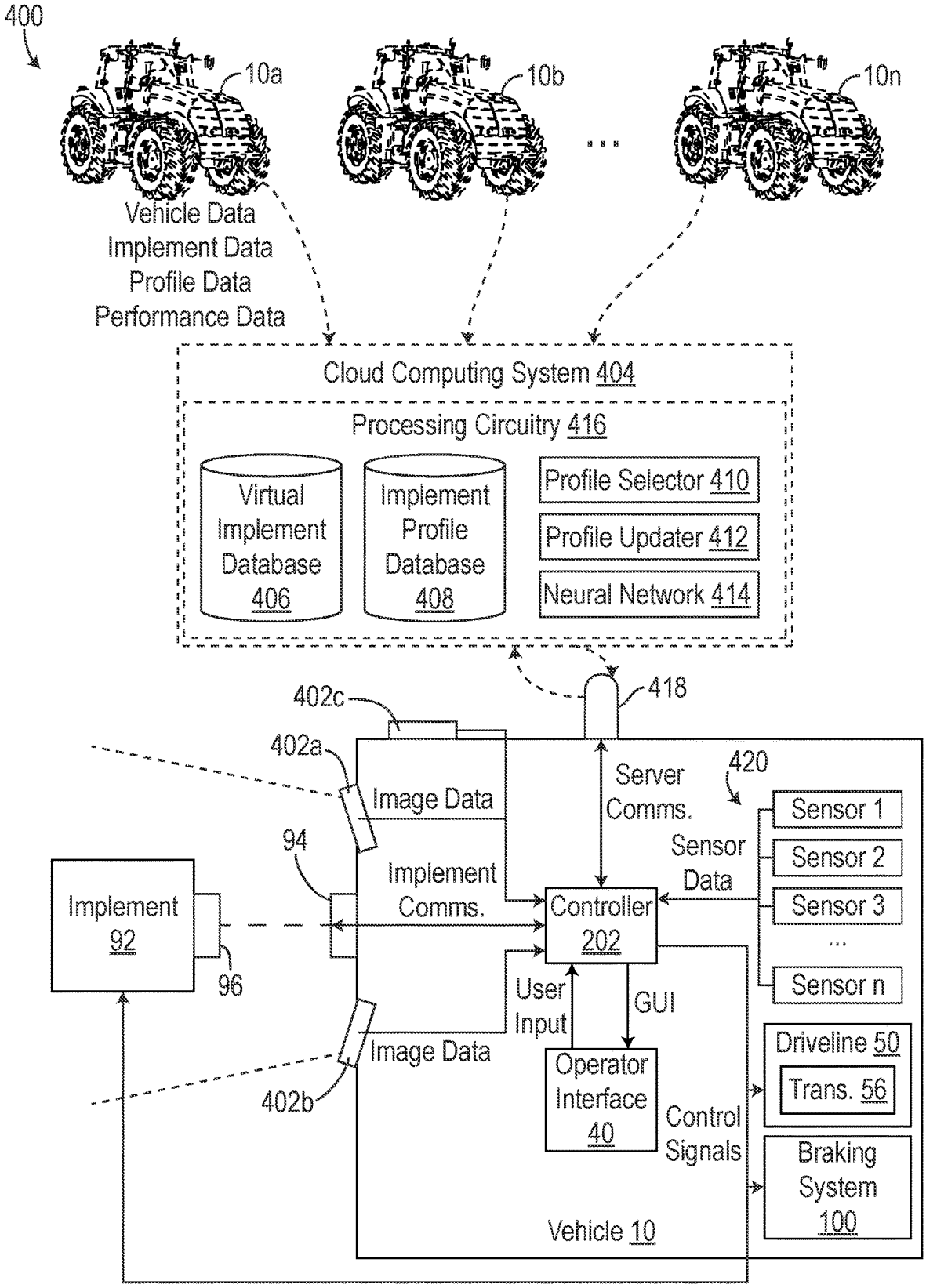

400
10a
10b
10n
Vehicle Data
Implement Data
Profile Data
Performance Data
Cloud Computing System 404
Processing Circuitry 416
Virtual Implement Database 406
Implement Profile Database 408
Profile Selector 410
Profile Updater 412
Neural Network 414
418
402c
402a
Image Data
Server Comms.
420
Sensor 1
Sensor 2
Sensor 3
Sensor n
Sensor Data
94
Implement Comms.
Implement 92
96
Controller 202
User Input
GUI
Image Data
402b
Operator Interface 40
Control Signals
Driveline 50
Trans. 56
Braking System 100
Vehicle 10

FIG. 4

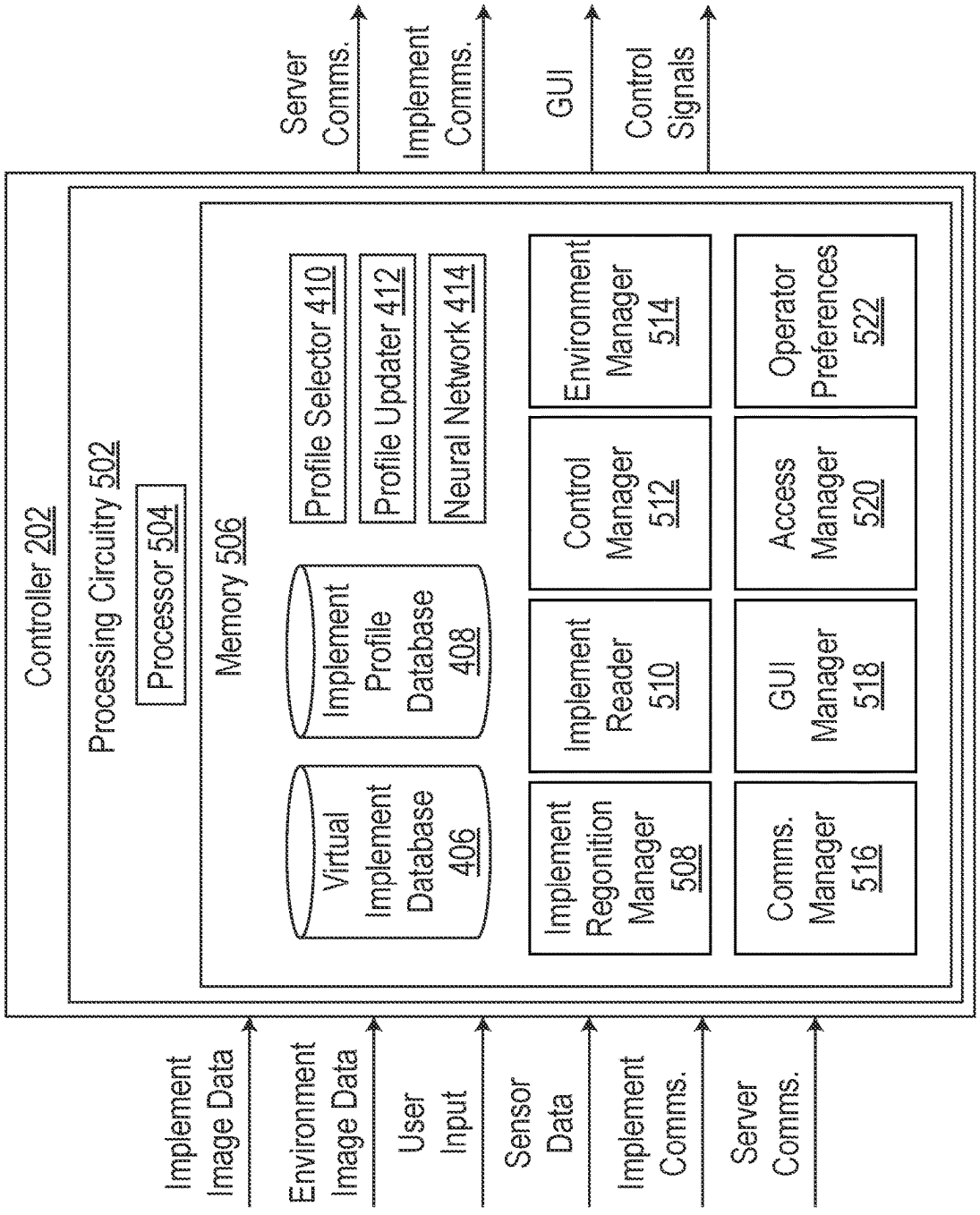

Controller 202
Processing Circuitry 502
Processor 504
Memory 506
Virtual Implement Database 406
Implement Profile Database 408
Profile Selector 410
Profile Updater 412
Neural Network 414
Implement Regonition Manager 508
Implement Reader 510
Control Manager 512
Environment Manager 514
Comms. Manager 516
GUI Manager 518
Access Manager 520
Operator Preferences 522
Implement Image Data
Environment Image Data
User Input
Sensor Data
Implement Comms.
Server Comms.
Server Comms.
Implement Comms.
GUI
Control Signals

FIG. 5

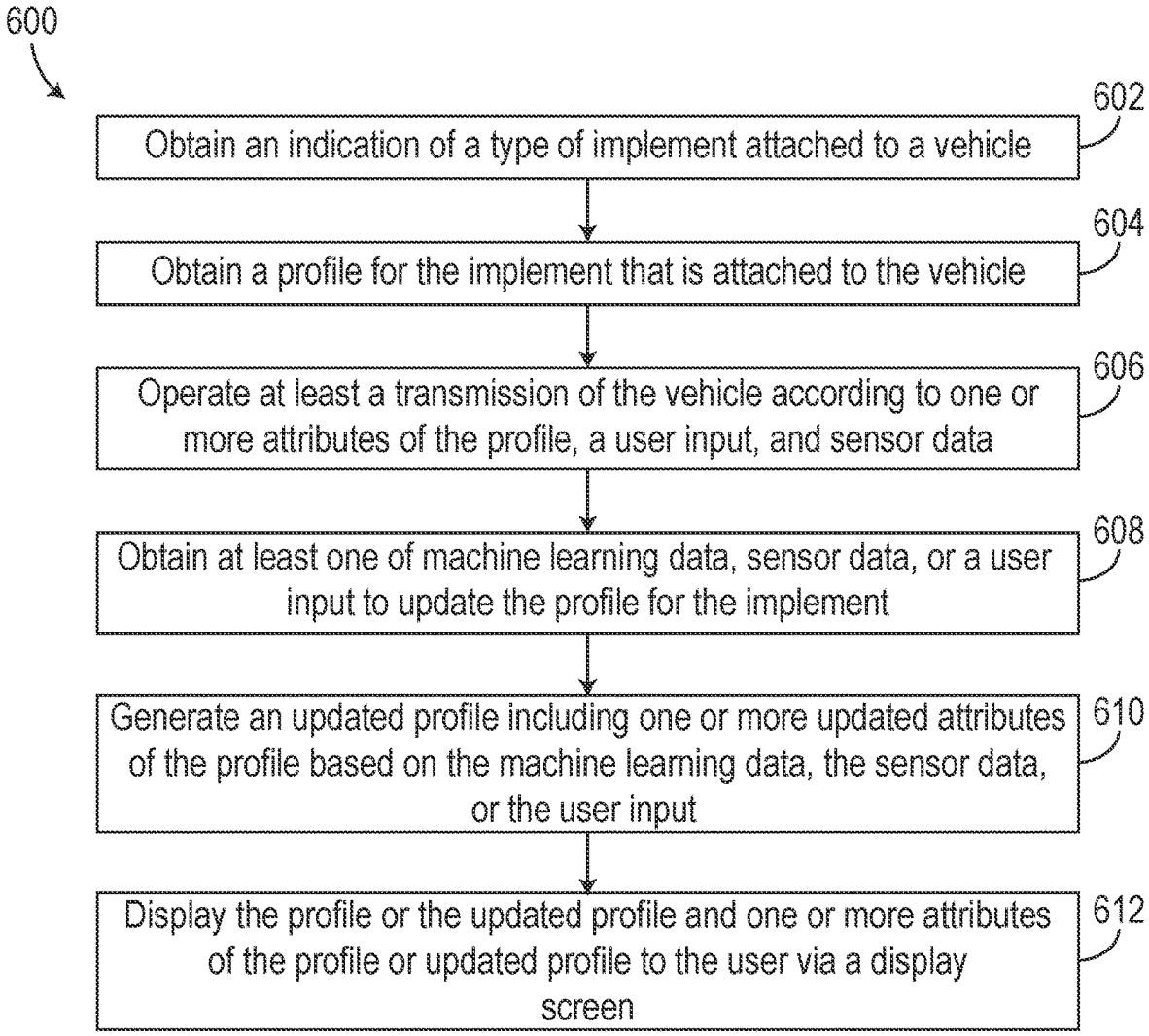

600
602
Obtain an indication of a type of implement attached to a vehicle
604
Obtain a profile for the implement that is attached to the vehicle
606
Operate at least a transmission of the vehicle according to one or more attributes of the profile, a user input, and sensor data
608
Obtain at least one of machine learning data, sensor data, or a user input to update the profile for the implement
610
Generate an updated profile including one or more updated attributes of the profile based on the machine learning data, the sensor data, or the user input
612
Display the profile or the updated profile and one or more attributes of the profile or updated profile to the user via a display screen

FIG. 6

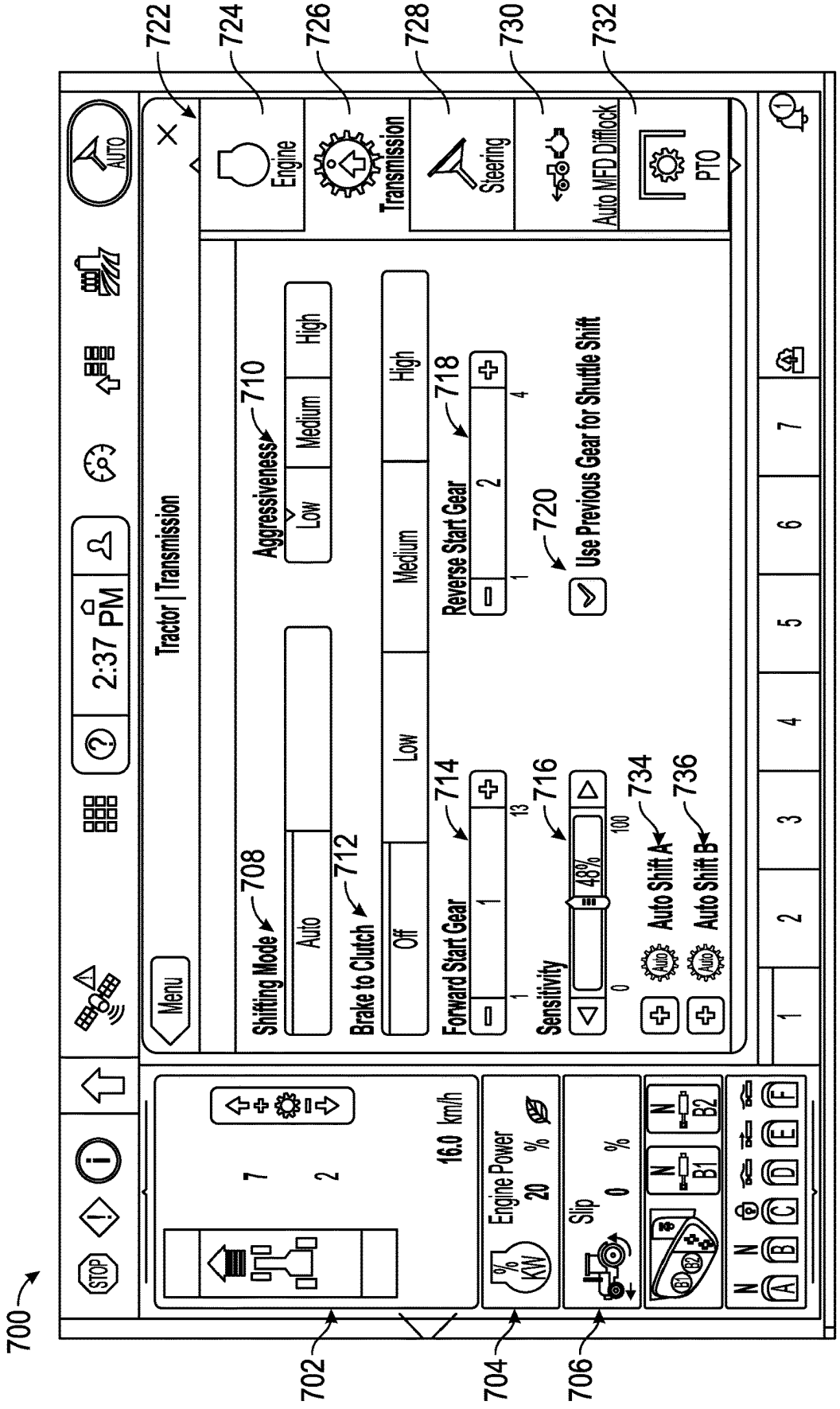

700
722
724
726
728
730
732
Engine
Transmission
Steering
Auto MFD Diffock
PTO
Tractor | Transmission
Menu
Shifting Mode
Auto
Aggressiveness
Low
Medium
High
Brake to Clutch
Off
Low
Medium
High
Forward Start Gear
Reverse Start Gear
Use Previous Gear for Shuttle Shift
Sensitivity
48%
Auto Shift A
Auto Shift B
708
710
712
714
716
718
720
734
736
2:37 PM
AUTO
STOP
16.0 km/h
Engine Power
20 %
Slip
0 %
702
704
706

FIG. 7

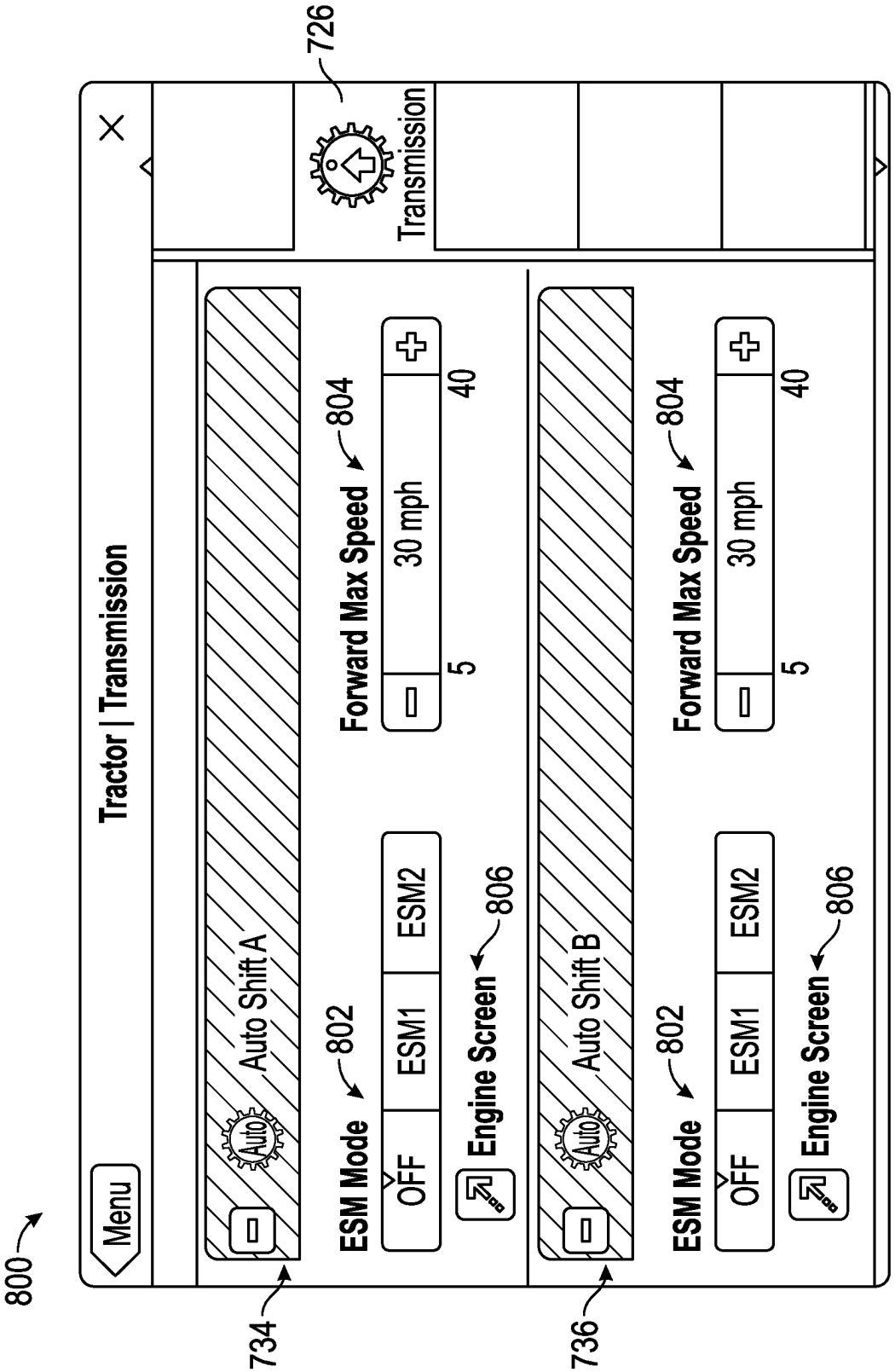

800
Menu
Tractor | Transmission
726
Transmission
Auto Shift A
Auto
734
ESM Mode
802
OFF
ESM1
ESM2
Engine Screen
806
Forward Max Speed
804
5
30 mph
40
Auto Shift B
736

FIG. 8

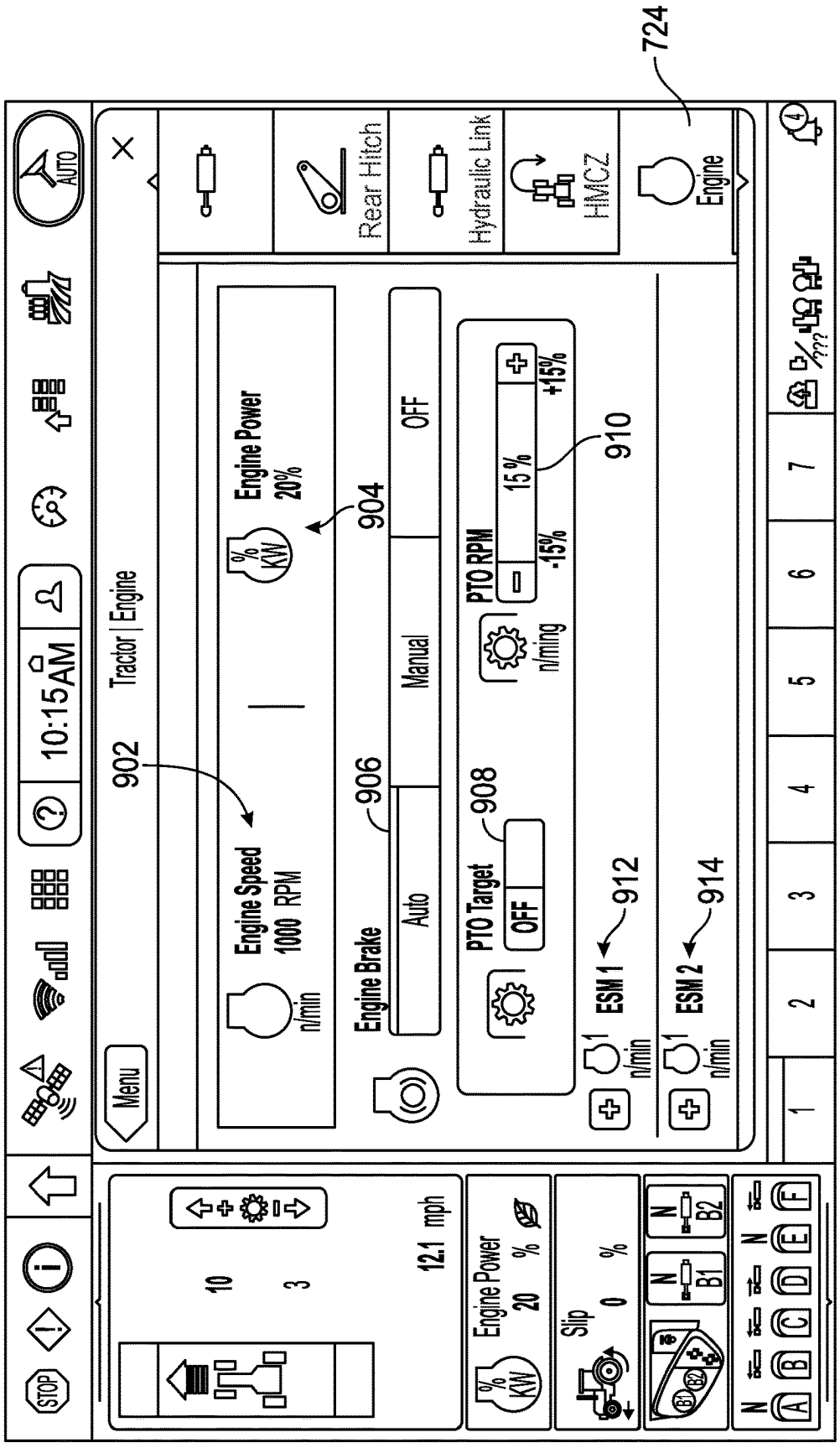

900
724
902
904
906
908
910
912
914
Menu
Tractor | Engine
Engine Speed
1000 RPM
n/min
Engine Power
20%
Engine Brake
Auto
Manual
OFF
PTO Target
OFF
PTO RPM
15 %
+15%
-15%
n/mimg
ESM 1
n/min
ESM 2
n/min
Rear Hitch
Hydraulic Link
HMCZ
Engine
AUTO
10:15AM
STOP
12.1 mph
Engine Power
20 %
Slip
0 %

FIG. 9

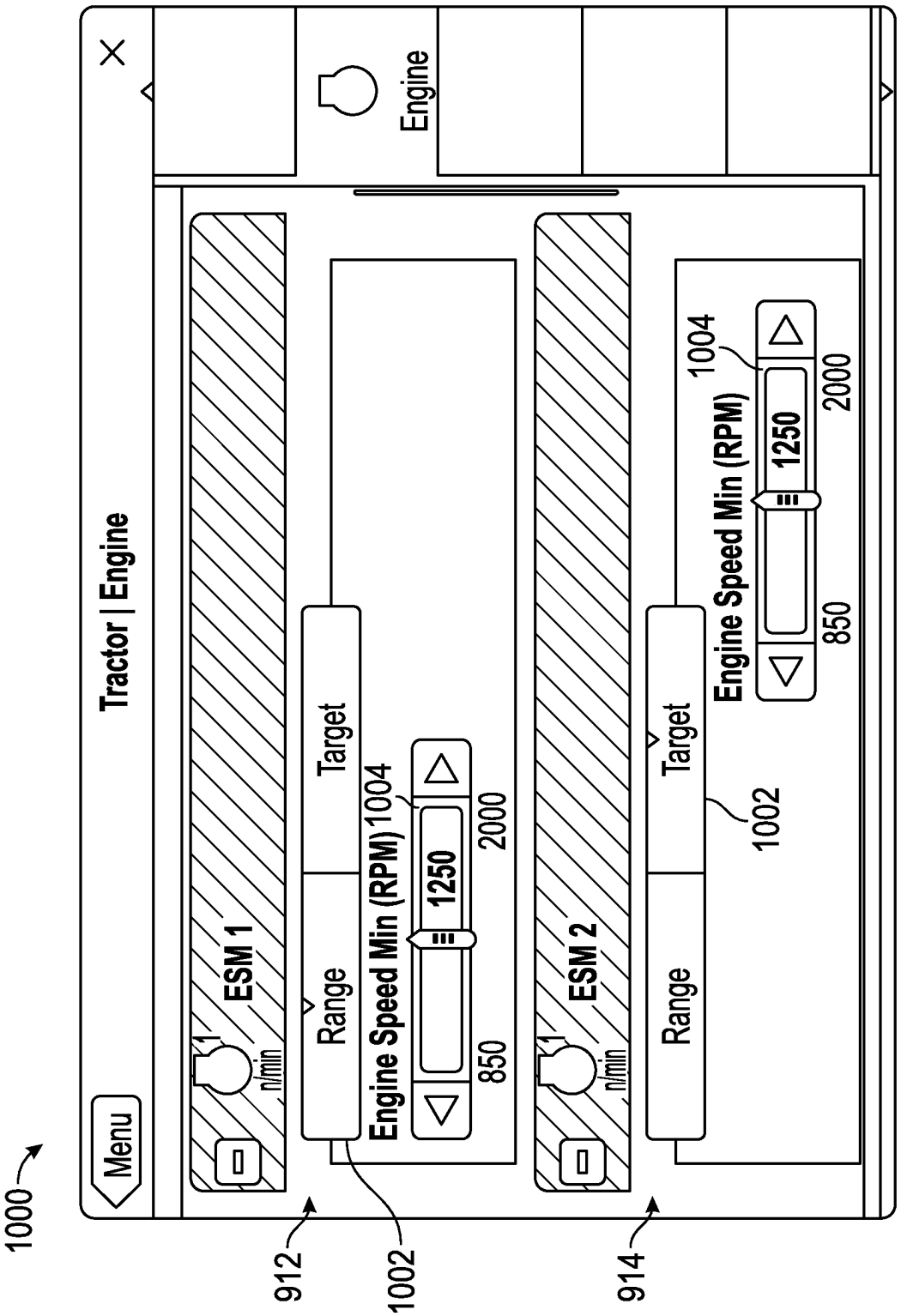
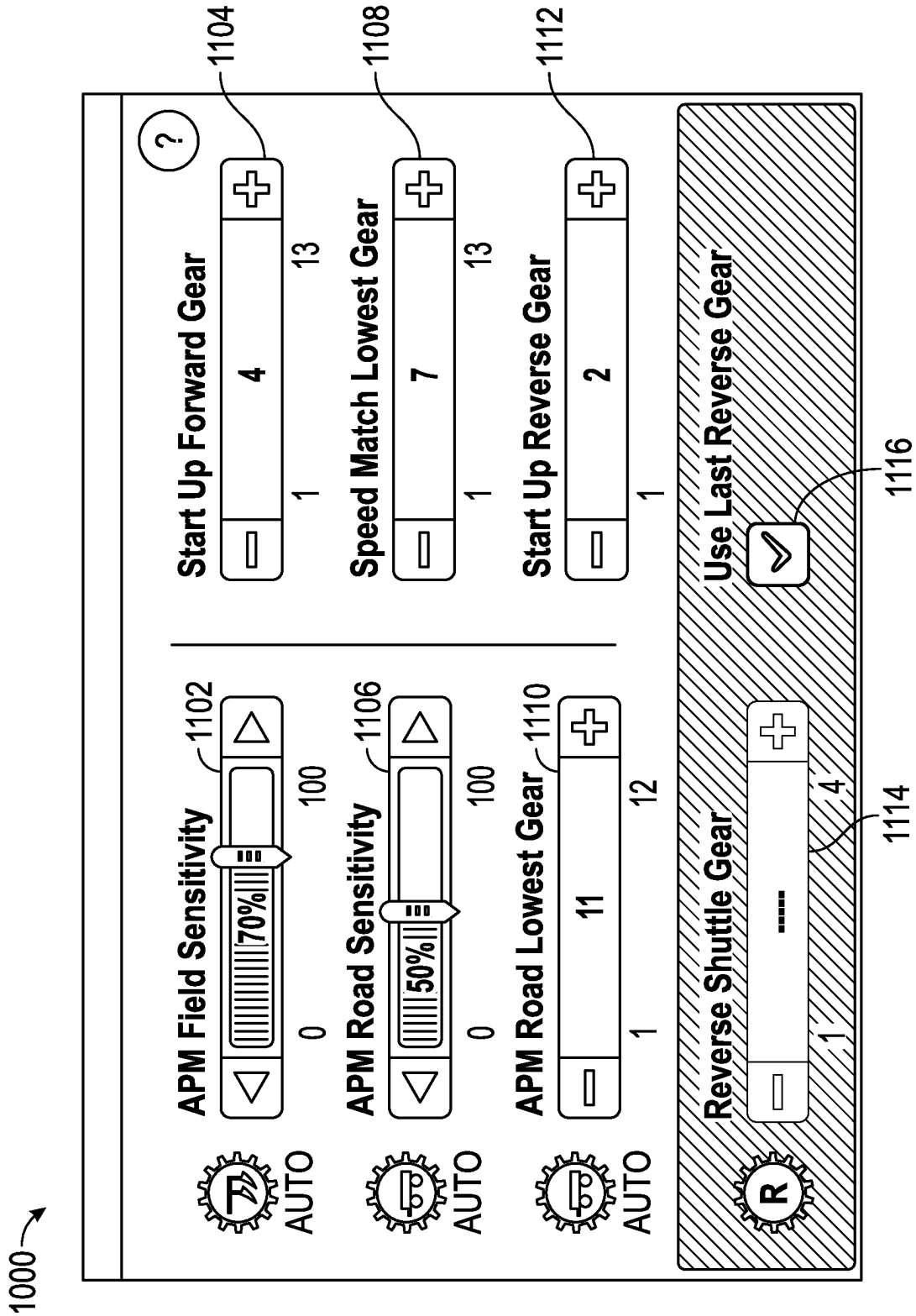

1000
Menu
Tractor | Engine
Engine
ESM 1
n/min
Range
Target
Engine Speed Min (RPM)
1004
1250
2000
850
ESM 2
n/min
Range
Target
1002
Engine Speed Min (RPM)
1004
1250
2000
850
912
1002
914

FIG. 10


1000
?
Start Up Forward Gear
1104
4
1
13
Speed Match Lowest Gear
1108
7
1
13
Start Up Reverse Gear
1112
2
1
Use Last Reverse Gear
1116
APM Field Sensitivity
1102
70%
0
100
AUTO
APM Road Sensitivity
1106
50%
0
100
AUTO
APM Road Lowest Gear
1110
11
1
12
AUTO
Reverse Shuttle Gear
1114

1
4
R

FIG. 11

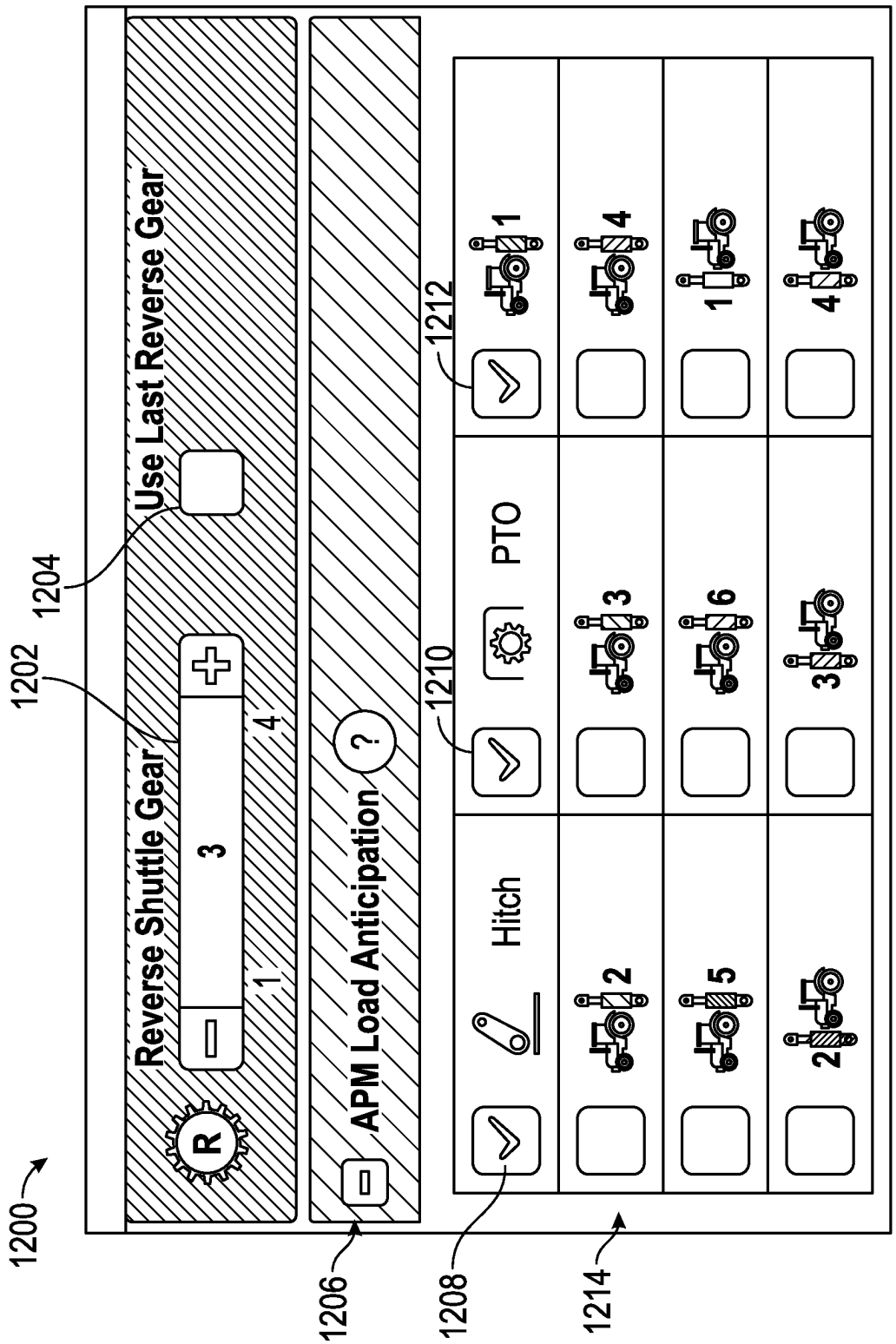

1200
1202
1204
1206
1208
1210
1212
1214
Use Last Reverse Gear
Reverse Shuttle Gear
R
3
4
1
APM Load Anticipation
?
Hitch
PTO
1
4
3
6
2
5

FIG. 12

AGRICULTURAL VEHICLE WITH IMPLEMENT-SPECIFIC OPERATIONAL PROFILES

BACKGROUND

The present disclosure relates generally to an agricultural vehicle. More specifically, the present disclosure relates to a control system for an agricultural vehicle.

SUMMARY

One embodiment relates to an agricultural vehicle including a driveline, an interface, and a control system. The driveline includes an engine, a transmission, and a power take off (PTO). The interface is configured to removably couple an implement with the agricultural vehicle. The implement configured to perform an agricultural function. The control system includes processing circuitry configured to obtain an indication of a type of the implement that is removably coupled with the agricultural vehicle. The processing circuitry is also configured to determine a profile for at least the transmission based on the type of the implement that is removably coupled with the agricultural vehicle. The profile defines an operating parameter for at least the transmission such that the transmission operates in a specific manner for the type of the implement. The processing circuitry is also configured to operate at least the transmission according to the operating parameter of the profile.

In some embodiments, the control system includes an imaging device configured to obtain an image of the implement. In some embodiments, obtaining the indication of the type of the implement and determining the profile includes performing an image recognition or analysis technique using the image of the implement to determine the type of the implement, and determining the profile by retrieving a predetermined profile including multiple operating parameters that are specific to the type of the implement. In some embodiments, the multiple operating parameters are configured to be used to operate at least the transmission of the agricultural vehicle in the specific manner for the type of the implement.

In some embodiments, obtaining the indication of the type of the implement includes receiving a user input from a display screen of the control system. In some embodiments, the user input includes the type of the implement.

In some embodiments, obtaining the indication of the type of the implement includes establishing communications between a controller of the implement and the processing circuitry through a communications interface. In some embodiments, obtaining the indication of the type of the implement further includes reading the type of the implement from the controller.

In some embodiments, the profile includes multiple operating parameters. In some embodiments, the multiple operating parameters include a forward start gear for the transmission, a maximum forwards speed of the agricultural vehicle, a load sensitivity for the transmission, a shifting aggressiveness for the transmission, a target speed for the PTO, a minimum speed of the engine, a maximum speed of the engine, and a shifting profile for the transmission.

In some embodiments, the operating parameters are automatically determined and set by the processing circuitry without requiring an operator of the agricultural vehicle to set values for any of the operating parameters.

In some embodiments, the processing circuitry is configured to determine or adjust the profile and the operating parameter of the profile based on an indication of whether the agricultural vehicle is currently in field use or being transported on a road.

Another embodiment of the present disclosure is a control system for an agricultural vehicle. The control system includes processing circuitry configured to obtain an indication of a type of an implement that is removably coupled with the agricultural vehicle. The processing circuitry is also configured to determine a profile for at least a transmission of the agricultural vehicle based on the type of the implement that is removably coupled with the agricultural vehicle. The profile defines an operating parameter for at least the transmission such that the transmission operates in a specific manner for the type of the implement. The processing circuitry is also configured to operate at least the transmission according to the operating parameter of the profile.

In some embodiments, the control system includes an imaging device configured to obtain an image of the implement. In some embodiments, obtaining the indication of the type of the implement and determining the profile include performing an image recognition or analysis technique using the image of the implement to determine the type of the implement, and determining the profile by retrieving a predetermined profile including multiple operating parameters that are specific to the type of the implement. In some embodiments, the multiple operating parameters are configured to be used to operate at least the transmission of the agricultural vehicle in the specific manner for the type of the implement.

In some embodiments, obtaining the indication of the type of the implement includes receiving a user input from a display screen of the control system. In some embodiments, the user input includes the type of the implement.

In some embodiments, obtaining the indication of the type of the implement includes establishing communications between a controller of the implement and the processing circuitry through a communications interface. In some embodiments, obtaining the indication of the type of the implement also includes reading the type of the implement from the controller.

In some embodiments, the profile includes multiple operating parameters. In some embodiments, the operating parameters include a forward start gear for the transmission, a maximum forwards speed of the agricultural vehicle, a load sensitivity for the transmission, a shifting aggressiveness for the transmission, a target speed for the PTO, a minimum speed of the engine, a maximum speed of the engine, and a shifting profile for the transmission.

In some embodiments, the operating parameters are automatically determined and set by the processing circuitry without requiring an operator of the agricultural vehicle to set values for any of the plurality of operating parameters. In some embodiments, the processing circuitry is configured to determine or adjust the profile and the operating parameter of the profile based on an indication of whether the agricultural vehicle is currently in field use or being transported on a road.

In some embodiments, the profile and the operating parameter of the profile are determined by the processing circuitry by performing a machine learning technique that uses performance metrics and corresponding values of the operating parameter obtained from a population of agricultural vehicles that are removably coupled with implements that are a same type of the implement. In some embodiments, the machine learning technique uses the performance metrics and the corresponding values of the operating

parameter as training data to predict a value of the operating parameter that achieves a desired value of the performance metrics.

Still another embodiment of the present disclosure relates to a method for automatically configuring an agricultural vehicle for a specific type of implement. The method includes obtaining an indication of a type of an implement that is removably coupled with the agricultural vehicle. The method also includes determining a profile for at least the transmission based on the type of the implement that is removably coupled with the agricultural vehicle. The profile defines an operating parameter for at least the transmission such that the transmission operates in a specific manner for the type of the implement. The method also includes operating at least the transmission according to the operating parameter of the profile.

In some embodiments, obtaining the indication of the type of the implement and determining the profile includes performing an image recognition or analysis technique using an image of the implement to determine the type of the implement, and determining the profile by retrieving a predetermined profile including multiple operating parameters that are specific to the type of the implement. In some embodiments, the operating parameters are configured to be used to operate at least the transmission of the agricultural vehicle in the specific manner for the type of the implement.

In some embodiments, obtaining the indication of the type of the implement includes receiving a user input from a display screen of the control system. In some embodiments, the user input includes the type of the implement.

In some embodiments, the profile includes multiple operating parameters. In some embodiments, the multiple operating parameters include a forward start gear for the transmission, a maximum forwards speed of the agricultural vehicle, a load sensitivity for the transmission, a shifting aggressiveness for the transmission, a target speed for the PTO, a minimum speed of the engine, a maximum speed of the engine, and a shifting profile for the transmission. In some embodiments, the operating parameters are automatically determined and set without requiring an operator of the agricultural vehicle to set values for any of the operating parameters.

This summary is illustrative only and is not intended to be in any way limiting. Other aspects, inventive features, and advantages of the devices or processes described herein will become apparent in the detailed description set forth herein, taken in conjunction with the accompanying figures, wherein like reference numerals refer to like elements.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a perspective view of a vehicle, according to an exemplary embodiment.

FIG. **2** is a schematic block diagram of the vehicle of FIG. **1**, according to an exemplary embodiment.

FIG. **3** is a schematic block diagram of a driveline of the vehicle of FIG. **1**, according to an exemplary embodiment.

FIG. **4** is a block diagram of a control system of the vehicle of FIG. **1** for automatically determining a profile for the vehicle, according to an exemplary embodiment.

FIG. **5** is a block diagram of a controller of the control system of FIG. **4**, according to an exemplary embodiment.

FIG. **6** is a flow diagram of a process for selecting, updating, and using a profile for an agricultural vehicle, according to an exemplary embodiment.

FIG. **7** is a graphical user interface (GUI) for a display screen of the vehicle of FIG. **1**, according to an exemplary embodiment.

FIG. **8** is another GUI for the display screen of the vehicle of FIG. **1**, according to an exemplary embodiment.

FIG. **9** is another GUI for the display screen of the vehicle of FIG. **1**, according to an exemplary embodiment.

FIG. **10** is another GUI for the display screen of the vehicle of FIG. **1**, according to an exemplary embodiment.

FIG. **11** is another GUI for the display screen of the vehicle of FIG. **1**, according to an exemplary embodiment.

FIG. **12** is another GUI for the display screen of the vehicle of FIG. **1**, according to an exemplary embodiment.

DETAILED DESCRIPTION

Before turning to the figures, which illustrate certain exemplary embodiments in detail, it should be understood that the present disclosure is not limited to the details or methodology set forth in the description or illustrated in the figures. It should also be understood that the terminology used herein is for the purpose of description only and should not be regarded as limiting.

According to an exemplary embodiment, a control system for an agricultural vehicle is configured to automatically detect an implement for installation on the agricultural vehicle. The control system may use image data from a front or rear camera and analyze the image data to determine a type of the implement (e.g., a plow). The control system can also determine a profile for a transmission, an engine, etc., or more generally, for a driveline of the agricultural vehicle. The profile and operating parameters for the driveline can be determined based on the type of the implement in order to optimize operation of the driveline (e.g., improve shifting of the transmission) in a specific-manner for the type of the implement. In this way, different implements can be automatically detected, and appropriate profiles to improve operation of the agricultural vehicle can be determined, selected, or updated.

Overall Vehicle

According to the exemplary embodiment shown in FIGS. **1-3**, a machine or vehicle, shown as vehicle **10**, includes a chassis, shown as frame **12**; a body assembly, shown as body **20**, coupled to the frame **12** and having an occupant portion or section, shown as cab **30**; operator input and output devices, shown as operator interface **40**, that are disposed within the cab **30**; a drivetrain, shown as driveline **50**, coupled to the frame **12** and at least partially disposed under the body **20**; a vehicle braking system, shown as braking system **100**, coupled to one or more components of the driveline **50** to facilitate selectively braking the one or more components of the driveline **50**; and a vehicle control system, shown as control system **200**, coupled to the operator interface **40**, the driveline **50**, and the braking system **100**. In other embodiments, the vehicle **10** includes more or fewer components.

According to an exemplary embodiment, the vehicle **10** is an off-road machine or vehicle. In some embodiments, the off-road machine or vehicle is an agricultural machine or vehicle such as a tractor, a telehandler, a front loader, a combine harvester, a grape harvester, a forage harvester, a sprayer vehicle, a speedrower, and/or another type of agricultural machine or vehicle. In some embodiments, the off-road machine or vehicle is a construction machine or vehicle such as a skid steer loader, an excavator, a backhoe loader, a wheel loader, a bulldozer, a telehandler, a motor grader, and/or another type of construction machine or

vehicle. In some embodiments, the vehicle **10** includes one or more attached implements and/or trailed implements such as a front mounted mower, a rear mounted mower, a trailed mower, a tedder, a rake, a baler, a plough, a cultivator, a rotavator, a tiller, a harvester, and/or another type of attached implement or trailed implement.

According to an exemplary embodiment, the cab **30** is configured to provide seating for an operator (e.g., a driver, etc.) of the vehicle **10**. In some embodiments, the cab **30** is configured to provide seating for one or more passengers of the vehicle **10**. According to an exemplary embodiment, the operator interface **40** is configured to provide an operator with the ability to control one or more functions of and/or provide commands to the vehicle **10** and the components thereof (e.g., turn on, turn off, drive, turn, brake, engage various operating modes, raise/lower an implement, etc.). The operator interface **40** may include one or more displays and one or more input devices. The one or more displays may be or include a touchscreen, a LCD display, a LED display, a speedometer, gauges, warning lights, etc. The one or more input device may be or include a steering wheel, a joystick, buttons, switches, knobs, levers, an accelerator pedal, a brake pedal, etc.

According to an exemplary embodiment, the driveline **50** is configured to propel the vehicle **10**. As shown in FIG. **3**, the driveline **50** includes a primary driver, shown as prime mover **52**, and an energy storage device, shown as energy storage **54**. In some embodiments, the driveline **50** is a conventional driveline whereby the prime mover **52** is an internal combustion engine and the energy storage **54** is a fuel tank. The internal combustion engine may be a spark-ignition internal combustion engine or a compression-ignition internal combustion engine that may use any suitable fuel type (e.g., diesel, ethanol, gasoline, natural gas, propane, etc.). In some embodiments, the driveline **50** is an electric driveline whereby the prime mover **52** is an electric motor and the energy storage **54** is a battery system. In some embodiments, the driveline **50** is a fuel cell electric driveline whereby the prime mover **52** is an electric motor and the energy storage **54** is a fuel cell (e.g., that stores hydrogen, that produces electricity from the hydrogen, etc.). In some embodiments, the driveline **50** is a hybrid driveline whereby (i) the prime mover **52** includes an internal combustion engine and an electric motor/generator and (ii) the energy storage **54** includes a fuel tank and/or a battery system.

As shown in FIG. **3**, the driveline **50** includes a transmission device (e.g., a gearbox, a continuous variable transmission ("CVT"), etc.), shown as transmission **56**, coupled to the prime mover **52**; a power divider, shown as transfer case **58**, coupled to the transmission **56**; a first tractive assembly, shown as front tractive assembly **70**, coupled to a first output of the transfer case **58**, shown as front output **60**; and a second tractive assembly, shown as rear tractive assembly **80**, coupled to a second output of the transfer case **58**, shown as rear output **62**. According to an exemplary embodiment, the transmission **56** has a variety of configurations (e.g., gear ratios, etc.) and provides different output speeds relative to a mechanical input received thereby from the prime mover **52**. In some embodiments (e.g., in electric driveline configurations, in hybrid driveline configurations, etc.), the driveline **50** does not include the transmission **56**. In such embodiments, the prime mover **52** may be directly coupled to the transfer case **58**. According to an exemplary embodiment, the transfer case **58** is configured to facilitate driving both the front tractive assembly **70** and the rear tractive assembly **80** with the prime mover **52** to facilitate front and rear drive (e.g., an all-wheel-drive vehicle, a four-wheel-drive vehicle, etc.). In some embodiments, the transfer case **58** facilitates selectively engaging rear drive only, front drive only, and both front and rear drive simultaneously. In some embodiments, the transmission **56** and/or the transfer case **58** facilitate selectively disengaging the front tractive assembly **70** and the rear tractive assembly **80** from the prime mover **52** (e.g., to permit free movement of the front tractive assembly **70** and the rear tractive assembly **80** in a neutral mode of operation). In some embodiments, the driveline **50** does not include the transfer case **58**. In such embodiments, the prime mover **52** or the transmission **56** may directly drive the front tractive assembly **70** (i.e., a front-wheel-drive vehicle) or the rear tractive assembly **80** (i.e., a rear-wheel-drive vehicle).

As shown in FIGS. **1** and **3**, the front tractive assembly **70** includes a first drive shaft, shown as front drive shaft **72**, coupled to the front output **60** of the transfer case **58**; a first differential, shown as front differential **74**, coupled to the front drive shaft **72**; a first axle, shown front axle **76**, coupled to the front differential **74**; and a first pair of tractive elements, shown as front tractive elements **78**, coupled to the front axle **76**. In some embodiments, the front tractive assembly **70** includes a plurality of front axles **76**. In some embodiments, the front tractive assembly **70** does not include the front drive shaft **72** or the front differential **74** (e.g., a rear-wheel-drive vehicle). In some embodiments, the front drive shaft **72** is directly coupled to the transmission **56** (e.g., in a front-wheel-drive vehicle, in embodiments where the driveline **50** does not include the transfer case **58**, etc.) or the prime mover **52** (e.g., in a front-wheel-drive vehicle, in embodiments where the driveline **50** does not include the transfer case **58** or the transmission **56**, etc.). The front axle **76** may include one or more components.

As shown in FIGS. **1** and **3**, the rear tractive assembly **80** includes a second drive shaft, shown as rear drive shaft **82**, coupled to the rear output **62** of the transfer case **58**; a second differential, shown as rear differential **84**, coupled to the rear drive shaft **82**; a second axle, shown rear axle **86**, coupled to the rear differential **84**; and a second pair of tractive elements, shown as rear tractive elements **88**, coupled to the rear axle **86**. In some embodiments, the rear tractive assembly **80** includes a plurality of rear axles **86**. In some embodiments, the rear tractive assembly **80** does not include the rear drive shaft **82** or the rear differential **84** (e.g., a front-wheel-drive vehicle). In some embodiments, the rear drive shaft **82** is directly coupled to the transmission **56** (e.g., in a rear-wheel-drive vehicle, in embodiments where the driveline **50** does not include the transfer case **58**, etc.) or the prime mover **52** (e.g., in a rear-wheel-drive vehicle, in embodiments where the driveline **50** does not include the transfer case **58** or the transmission **56**, etc.). The rear axle **86** may include one or more components. According to the exemplary embodiment shown in FIG. **1**, the front tractive elements **78** and the rear tractive elements **88** are structured as wheels. In other embodiments, the front tractive elements **78** and the rear tractive elements **88** are otherwise structured (e.g., tracks, etc.). In some embodiments, the front tractive elements **78** and the rear tractive elements **88** are both steerable. In other embodiments, only one of the front tractive elements **78** or the rear tractive elements **88** is steerable. In still other embodiments, both the front tractive elements **78** and the rear tractive elements **88** are fixed and not steerable.

In some embodiments, the driveline **50** includes a plurality of prime movers **52**. By way of example, the driveline **50** may include a first prime mover **52** that drives the front tractive assembly **70** and a second prime mover **52** that

drives the rear tractive assembly **80**. By way of another example, the driveline **50** may include a first prime mover **52** that drives a first one of the front tractive elements **78**, a second prime mover **52** that drives a second one of the front tractive elements **78**, a third prime mover **52** that drives a first one of the rear tractive elements **88**, and/or a fourth prime mover **52** that drives a second one of the rear tractive elements **88**. By way of still another example, the driveline **50** may include a first prime mover that drives the front tractive assembly **70**, a second prime mover **52** that drives a first one of the rear tractive elements **88**, and a third prime mover **52** that drives a second one of the rear tractive elements **88**. By way of yet another example, the driveline **50** may include a first prime mover that drives the rear tractive assembly **80**, a second prime mover **52** that drives a first one of the front tractive elements **78**, and a third prime mover **52** that drives a second one of the front tractive elements **78**. In such embodiments, the driveline **50** may not include the transmission **56** or the transfer case **58**.

As shown in FIG. **3**, the driveline **50** includes a power-take-off ("PTO"), shown as PTO **90**. While the PTO **90** is shown as being an output of the transmission **56**, in other embodiments the PTO **90** may be an output of the prime mover **52**, the transmission **56**, and/or the transfer case **58**. According to an exemplary embodiment, the PTO **90** is configured to facilitate driving an attached implement and/or a trailed implement of the vehicle **10**. In some embodiments, the driveline **50** includes a PTO clutch positioned to selectively decouple the driveline **50** from the attached implement and/or the trailed implement of the vehicle **10** (e.g., so that the attached implement and/or the trailed implement is only operated when desired, etc.).

According to an exemplary embodiment, the braking system **100** includes one or more brakes (e.g., disc brakes, drum brakes, in-board brakes, axle brakes, etc.) positioned to facilitate selectively braking (i) one or more components of the driveline **50** and/or (ii) one or more components of a trailed implement. In some embodiments, the one or more brakes include (i) one or more front brakes positioned to facilitate braking one or more components of the front tractive assembly **70** and (ii) one or more rear brakes positioned to facilitate braking one or more components of the rear tractive assembly **80**. In some embodiments, the one or more brakes include only the one or more front brakes. In some embodiments, the one or more brakes include only the one or more rear brakes. In some embodiments, the one or more front brakes include two front brakes, one positioned to facilitate braking each of the front tractive elements **78**. In some embodiments, the one or more front brakes include at least one front brake positioned to facilitate braking the front axle **76**. In some embodiments, the one or more rear brakes include two rear brakes, one positioned to facilitate braking each of the rear tractive elements **88**. In some embodiments, the one or more rear brakes include at least one rear brake positioned to facilitate braking the rear axle **86**. Accordingly, the braking system **100** may include one or more brakes to facilitate braking the front axle **76**, the front tractive elements **78**, the rear axle **86**, and/or the rear tractive elements **88**. In some embodiments, the one or more brakes additionally include one or more trailer brakes of a trailed implement attached to the vehicle **10**. The trailer brakes are positioned to facilitate selectively braking one or more axles and/or one more tractive elements (e.g., wheels, etc.) of the trailed implement.

Implement-Specific Operational Profiles

Referring to FIGS. **4-14**, systems and methods for adjusting operation of the driveline **50** (or more particularly, the transmission **56**) according to a profile (e.g., a preset profile, a custom generated profile, a profile determined based on aggregated data and a machine learning technique to optimize a specific characteristic or performance parameter of the vehicle **10**, a user updated profile, etc.) are shown. The vehicle **10** may implement the various functionality described herein with reference to obtaining, generating, using, and/or updating the profile (or attributes of the profile) locally on a controller, processing circuitry, a control system, etc., or may communicate with a remote or cloud computing system (e.g., implemented on a server) that performs the functionality described herein with reference to generation, updating, creation, etc., of the profiles. The profiles can be implement and/or vehicle **10** specific such that, when the vehicle **10** operates according to the profile, the vehicle **10** achieves a specific function, operates in a desired manner, or operates in order to optimize a specific performance parameter of the vehicle **10** (e.g., reduced fuel or energy consumption, improved efficiency, improved driving characteristics, improved agricultural characteristics, etc.).

Referring particularly to FIG. **4**, a system **400** for creating, updating, and using one or more profiles for the vehicle **10** includes the vehicle **10**, an implement **92** of the vehicle **10**, and a cloud computing system **404**, according to some embodiments. In some embodiments, the system **400** also includes a fleet of n number of vehicles **10***a*-**10***n* that are configured to provide implement data, profile data (e.g., the attributes of the profile), and performance data to the cloud computing system **404** or the controller **202**. In some embodiments, the cloud computing system **404** may use any of the data provided by the fleet of vehicles **10** to update, tune, or modify one or more profiles (e.g., attributes or data of the profiles) for the vehicle **10** based aggregated data from the fleet of vehicles **10***a*-**10***n* (e.g., a population of vehicles). In some embodiments, the cloud computing system **404** is configured to communicate with telematics systems of various vehicles **10**.

Referring still to FIG. **4**, the vehicle **10** includes a controller **202**, the operator interface **40**, multiple sensors **420** (e.g., n sensors), imaging device **402***a* and imaging device **402***b* (e.g., cameras, sensors, detectors, etc.), and an implement interface **94**. The implement interface **94** may be or include a mechanical interface configured to physically or mechanically couple a corresponding interface **96** of the implement **92** with the vehicle **10** so that the vehicle **10** (e.g., the controller **202**) can use and control the implement **92**. For example, the implement interface **94** may be or include a draw bar three point hitch, a tow hitch, a front coupler, etc. The implement **92** may be a box blade, a mower/cutter, a front end loader, a rear blade, a post hole digger, a snow blower, a hay rake, a plow, a harrow, a planter, etc., that is configured to perform an operation (e.g., an agricultural action). The implement interface **94** can include an electrical or a communications interface that is configured to electrically or communicably couple with the implement **92** (e.g., electrical components of the implement **92**) via the corresponding interface **96**. In some embodiments, the implement **92** includes a controller or sensors that are configured to provide or receive control data to/from the controller **202** of the vehicle **10**. In some embodiments, the implement **92** includes lights that are powered via a power storage system of the vehicle **10** through the electrical connection between the implement interface **94** of the vehicle **10** and the corresponding interface **96** of the implement **92**.

In some embodiments, the sensors **420** include a speed sensor configured to provide a speed of the vehicle **10** to the

controller **202**, a transmission speed sensor of the transmission **56**, a gear sensor that indicates which gear the transmission **56** is currently in, a slip sensor on the rear differential **84**, a lock activity sensor of the rear differential **84** or the front differential **74**, an engine speed sensor that measures a speed of the prime mover **52**, an engine temperature sensor that measures a temperature of the prime mover **52**, a fuel sensor, a battery state of charge sensor, a PTO speed sensor that measures a speed of the PTO **90**, etc.

In some embodiments, the controller **202** communicates with the implement **92** (e.g., a corresponding controller or microcontroller of the implement **92**) via a communications link between the implement and the controller **202** that is established at the communications interfaces of the implement interface **94** and the corresponding interface **96** of the interface **94**. In some embodiments, the implement **92** reports a model number or serial number of the implement **92**, which the controller **202** can use to select or update a corresponding profile for the implement **92**. In some embodiments, the implement **92** (or more specifically, the controller of the implement **92**), is configured to report one or more characteristics of the implement **92** (e.g., weight, configuration, capabilities, etc.) to the controller **202** for use in selecting or adjusting the corresponding profile for the vehicle **10** when using the implement **92**.

In some embodiments, the controller **202** is configured to obtain image data of the implement **92** from the imaging devices **402***a* and **402***b*. In some embodiments, the controller **202** is configured to perform an image recognition technique in order to identify a type and one or more attributes of the implement **92**. In some embodiments, the controller **202** is configured to access a virtual implement database **406** and use an image recognition technique or neural network to determine which of the virtual implements stored in the virtual implement database **406** correspond to the implement **92**. In some embodiments, the implement **92** includes a printed tag, a bar code, a quick response (QR) code, a printed serial number, etc., or any other physically viewable information that can be captured in the image data and interpreted by the controller **202** to determine the type of the implement **92** and one or more attributes of the implement **92**. In some embodiments, the controller **202** is also configured to use the image data to determine where and/or how the implement **92** is physically coupled on the vehicle **10**. In some embodiments, the controller **202** is configured to receive a user input from the operator interface **40** that indicates the type of the implement **92**. In this way, the user or operator of the vehicle **10** can manually report the type and/or an identifier (e.g., serial number, model number, etc.) of the implement **92** to the controller **202**.

The controller **202** is configured to operate a wireless transceiver **418** (e.g., a radio, a cellular dongle, a telematics system, etc.) of the vehicle **10** to communicate with a cloud computing system **404** (e.g., a server, a remote system, a distributed computing system, etc.). In some embodiments, the cloud computing system **404** includes processing circuitry **416** that is configured to facilitate communications between the cloud computing system **404** and the controller **202** of the vehicle **10**. In some embodiments, the processing circuitry **416** includes or represents a single processing unit, multiple processing circuits including processors and memory, multiple servers, etc. In some embodiments, the cloud computing system **404** includes the virtual implement database **406**, an implement profile database **408**, a profile selector **410**, a profile updater **412**, and a neural network **414**. In some embodiments, the cloud computing system **404** is configured to communicate with the vehicle **10** (e.g., the controller **202** of the vehicle **10** via the wireless transceiver **418**) to obtain any vehicle data, implement data, profile data, and/or performance data from the vehicle **10**. In some embodiments, the cloud computing system **404** is also configured to obtain vehicle data, implement data, profile data, and corresponding performance data of any other vehicles **10***a*, **10***b*, . . . **10***n* (e.g., a fleet). In some embodiments, the virtual implement database **406** includes models or digital twins of different implements that are available for the vehicle **10** or that are owned by an owner of the vehicle **10** and are available for physical installation on the vehicle **10**. In some embodiments, the implement profile database **408** includes one or more preset (e.g., predetermined, manufacturer recommended, etc.) profiles, and one or more customized profiles for different implements and corresponding vehicles **10**. For example, the implement **92** may have a corresponding virtual implement stored in the virtual implement database **406** with a unique tag or identifier, that can be used to select one or more predetermined profiles and/or customized profiles for the vehicle **10** to operate according to when using the implement **92**. In some embodiments, the predetermined profiles are tailored or preset for the particular type of the implement **92**, the particular type of vehicle **10** (e.g., model of tractor, size of tractor, performance ratings of the vehicle **10**), a particular application or use of the implement **92**, etc. In this way, the profiles can be selected from the implement profile database **408** (e.g., by the profile selector **410**) based on the type of the implement **92**, the type or rating of the vehicle **10**, and the desired use case or application of the implement **92**. In some embodiments, the cloud computing system **404** is configured to provide the profiles to the controller **202** of the vehicle **10**, where a user may select one of the profiles for the controller **202** to operate the vehicle **10** according to.

In some embodiments, the profile updater **412** and/or the neural network **414** are configured to update the profiles that are stored in the implement profile database **408**, or to create and write new profiles to the implement profile database **408**. In some embodiments, the user of the vehicle **10** provides a user input to update one or more attributes of the profile in the implement profile database **408** (e.g., update an attribute of a customized profile for the implement **92** that is stored in the implement profile database **408**). In some embodiments, the profile updater **412** is configured to update or create a new profile according to the user input (e.g., the updated or new profile having the desired or user selected value of the particular attribute) and store the updated or new profile in the implement profile database **408** for future use by the vehicle **10** (e.g., future retrieval).

The neural network **414** may be configured to aggregate data from the vehicle **10** and the fleet of vehicles **10***a* . . . **10***n*, and determine appropriate corrections or updates for attributes of dynamic profiles (e.g., profiles that are generated by a neural network and updatable responsive to new aggregate data). In some embodiments, the neural network **414** is configured to learn relationships or patterns between specific profile attributes and performance data of the vehicles **10***a* . . . **10***n*, and determine optimal or ideal values of the attributes in terms of their impact on the performance data. For example, the neural network **414** may identify that particular values of attributes improve efficiency of the vehicle **10**, other sets of values of attributes for the profiles result in improved torque output, other sets of values of attributes for the profiles result in maximized work output, etc. In some embodiments, the cloud computing system **404** is configured to use a regression technique instead of or in

addition to the neural network **414** to determine values for the attributes of the dynamic profiles.

The controller **202** is also configured to operate the vehicle **10** (e.g., the driveline **50**, steering systems, or other systems of the vehicle **10**) according to one or more profiles selected from the implement profile database **408** based on sensor data obtained from the sensors **420**, and based on one or more user inputs (e.g., driving inputs, steering inputs, agricultural control inputs, etc.) for the vehicle **10**. In some embodiments, the controller **202** is configured to receive the user inputs from the operator interface **40** (e.g., a human machine interface (HMI)) and use the user inputs to generate control signals for the driveline **50**, the implement **92** (e.g., controllable elements of the implement **92**), and/or the braking system **100**. In this way, the controller **202** may operate the vehicle **10** and/or the implement **92** according to the profile that is currently active for the vehicle **10**.

Referring particularly top FIG. **5**, the controller **202** is shown in greater detail, according to some embodiments. The controller **202** includes a circuit, shown as processing circuitry **502**, a processor, shown as processor **504**, and memory, shown as memory **506**, according to an exemplary embodiment. Controller **202** may be implemented as a general-purpose processor, an application specific integrated circuit (ASIC), one or more field programmable gate arrays (FPGAs), a digital-signal-processor (DSP), circuits containing one or more processing components, circuitry for supporting a microprocessor, a group of processing components, or other suitable electronic processing components. According to the exemplary embodiment shown in FIG. **5**, controller **202** includes the processing circuitry **502** and memory **506**. Processing circuitry **502** may include an ASIC, one or more FPGAs, a DSP, circuits containing one or more processing components, circuitry for supporting a microprocessor, a group of processing components, or other suitable electronic processing components (e.g., processor **504**). In some embodiments, processing circuitry **502** is configured to execute computer code stored in memory **506** to facilitate the activities described herein. Memory **506** may be any volatile or non-volatile computer-readable storage medium capable of storing data or computer code relating to the activities described herein. According to an exemplary embodiment, memory **506** includes computer code modules (e.g., executable code, object code, source code, script code, machine code, etc.) configured for execution by processing circuitry **502**. In some embodiments, controller **202** may represent a collection of processing devices (e.g., servers, data centers, etc.). In such cases, processing circuitry **502** represents the collective processors of the devices, and memory **506** represents the collective storage devices of the devices.

In some embodiments, the controller **202** is configured to locally implement any of the functionality of the virtual implement database **406**, the implement profile database **408**, the profile selector **410**, the profile updater **412**, and/or the neural network **414** as described in greater detail above with reference to FIG. **4**. In some embodiments, the controller **202** offloads the processing of the virtual implement database **406**, the implement profile database **408**, the profile selector **410**, the profile updater **412**, and/or the neural network **414** to the cloud computing system **404**.

The controller **202** also includes an implement recognition manager **508**, an implement reader **510**, a control manager **512**, an environment manager **514**, a communications manager **516**, a GUI manager **518**, an access manager **520**, and operator preferences **522**. In some embodiments, the controller **202** is configured to obtain implement image data, environment image data, one or more user inputs, sensor data, implement communications, and server communications, and output server communications, implement communications, one or more GUIs, and control signals for the vehicle **10** or the implement **92** to operate the vehicle **10** and/or the implement **92** according to a profile that is currently active, selected, or implemented on the controller **202**.

In some embodiments, the implement recognition manager **508** is configured to obtain the implement image data and perform an image recognition technique to identify the implement **92**. In some embodiments, the implement recognition manager **508** is configured to access the virtual implement database **406** and images of various implements of the virtual implement database **406** and compare the implement image data to the images of the various implements in order to identify a match and the type of the implement **92**. In some embodiments, the implement recognition manager **508** is configured to use a neural network, a machine learning technique, or artificial intelligence to compare the implement image data to the images of the various implements and determine the type of the implement **92**. In some embodiments, the implement recognition manager **508** provides the type of implement to the GUI manager **518** for presentation on the GUIs, and to the profile selector **410** so that an appropriate profile for the vehicle **10** when using the implement **92** can be selected.

In some embodiments, the implement reader **510** is configured to monitor or record communications between the vehicle **10** (e.g., the controller **202**) and the implement **92** to identify the type of the implement and/or a specific model number or serial number of the implement **92** based on the implement communications. In some embodiments, the implement reader **510** is configured to generate a query or request message to send to the implement **92** and provides the query or request message to the implement **92**. In some embodiments, the implement reader **510** receives a communication or response from the implement **92** that reports the type and/or serial number of the implement **92**. In some embodiments, the implement reader **510** is configured to scan the implement **92** or identify characteristics of the communications of the implement **92** to determine or identify the type, model number, and/or serial number of the implement **92**.

In some embodiments, the control manager **512** is configured to generate control signals for the vehicle **10** and/or the implement **92** according to the profile that is currently active for the vehicle **10** (e.g., as selected by the profile selector **410**). In some embodiments, the control manager **512** receives requests from the operator (e.g., the user inputs provided by operator via the operator interface **40**), and operates the driveline **50** and/or the braking system **100** based on the requests from the operator using a control scheme. In some embodiments, the control manager **512** is configured to generate the control signals for the driveline **50** and/or the braking system **100**. In some embodiments, for example, the control manager **512** generates control signals according to the profile such as when to shift the transmission **56** between gears, what gear to start the transmission **56** at, speed to run the prime mover **52**, etc.

In some embodiments, the environment manager **514** is configured to obtain the environment image data (e.g., from the imaging device **402***c*) and determine or detect an environment that the vehicle **10** is currently operating within. For example, the environment manager **514** may determine if the vehicle **10** is currently on-road (e.g., for transportation between fields) or in-field. The environment manager **514**

may use image data and detect a road, a median or centerline strip, edges of the road, other vehicles, a field environment, etc., to determine if the vehicle **10** is on-road or in-field. In some embodiments, the environment manager **514** provides the identification of the environment of the vehicle **10** (e.g., on-road or in-field) to the profile selector, the profile updater, and/or the control manager **512** so that the vehicle **10** can be operated according to a sub-mode or a sub-profile of the profile that is active on the vehicle **10** for the specific environment. In some embodiments, the profile selector **410** or the profile updater **412** are configured to use to determination of whether the vehicle **10** is on-road or in-field to select an appropriate profile or to adjust one or more attributes (e.g., parameters) of the profile for the on-road or in-field use of the vehicle **10**.

In some embodiments, the communications manager **516** is configured to control operation of the wireless transceiver **418** to facilitate communications with the cloud computing system **404**. In some embodiments, the communications manager **516** is configured to offload or transmit any of the data collected from the sensors **420**, the image data from the imaging devices **402***a*-**402***c*, any of the implement communications, user inputs or requests to adjust one or more attributes of a profile, etc. The communications manager **516** may receive response messages from the cloud computing system **404** such as the profile, or updated profiles.

In some embodiments, the GUI manager **518** is configured to generate a GUI of the profile and one or more attributes of the profile. In some embodiments, the profile includes multiple profiles for operating different components of the vehicle **10**. For example, the profile may include a transmission profile, an engine profile, a steering profile, a PTO profile, an automatic productivity (APM) profile that coordinates operation of the prime mover **52** and the transmission **56** to either improve efficiency of the vehicle **10** or maximize output, a differential locking profile, an energy storage and usage profile, etc.

In some embodiments, the profile is or includes the transmission profile for the specific implement **92** that is currently coupled with the vehicle **10** (e.g., either the front or the rear of the vehicle **10**). The transmission profile can include various attributes or parameters and specific values such as a forward start gear, a forward maximum vehicle speed, a sensitivity (e.g., load sensitivity), an aggressiveness (e.g., shift aggressiveness), a PTO target speed, engine speed management parameters such as minimum and maximum engine speed, and autoshift A/B presets. In some embodiments, the values of these attributes or parameters are predetermined and specific for different implements. The transmission profiles can be stored in the implement profile database **408** and automatically selected (e.g., due to image recognition using the image data such as from a front or rear imaging device/camera), or selected in response to a user input that indicates the implement **92** (e.g., the type of the implement **92**).

The GUI manager **518** can generate one or more GUIs that illustrate the profile (e.g., the transmission profile) and the attributes or parameters of the profile so that the operator or user can view and/or modify the attributes or parameters of the profile. In some embodiments, the GUIs include fields for modifying or updating the profile. Modifying or updating the attributes of the profile may result in generation and storage of a new custom profile for the vehicle **10** when the vehicle **10** is coupled with the implement **92**. In some embodiments, when the vehicle **10** is later re-coupled with the implement **92**, the vehicle **10** may default to using the custom profile or the predetermined/manufacturer set profile. In some embodiments, the GUI is also configured to display different operating parameters or visualizations of sensor data.

The access manager **520** can store login credentials for the operator or user of the vehicle **10** and may communicate with the cloud computing system **404** in order to access the virtual implement database **406** and/or the implement profile database **408**. In some embodiments, the access manager **520** is configured to validate the operator and facilitate the operator accessing and modifying the profiles.

The operator preferences **522** can include one or more customized profiles or learned preferences for the operator of the vehicle **10** that are stored locally. In some embodiments, the operator preferences **522** include values of the attributes or parameters of the profile that are modified or adjusted by the operator so that the controller **202** can load a customized profile for the user or operator. In some embodiments, the operator preferences **522** are stored in the cloud computing system **404**.

Referring to FIG. **6**, a process **600** for determining and operating an agricultural vehicle according to a profile includes steps **602**-**612**. In some embodiments, the process **600** is performed in order to determine a profile for operating one or more components of the vehicle **10** (e.g., the transmission **56** or more generally the driveline **50**) in an implement-specific manner. Advantageously, process **600** and the system **400** facilitate automatically setting parameters of the vehicle **10** so that the vehicle **10** operates in a desired manner when an implement **92** (e.g., a trailer, a farm implement, a plow, etc.) is coupled on the vehicle **10**.

Process **600** includes obtaining an indication of a type of implement attached to a vehicle (step **602**), according to some embodiments. In some embodiments, step **602** is performed by receiving a user input (e.g., prompting the user to enter the implement type, model number, serial number, etc.). In some embodiments, step **602** is performed by obtaining image data from a front or rear camera (e.g., the imaging devices **402***a* and **402***b*), and detecting the type of the implement based on the image data obtained (e.g., by performing an image recognition technique). In some embodiments, step **602** is performed by establishing communications with a controller of the implement, and reading a model number, an implement type, or a serial number of the implement. In some embodiments, step **602** is performed by the controller **202**.

Process **600** includes obtaining a profile for the implement that is attached to the vehicle (step **604**), according to some embodiments. In some embodiments, the profile is obtained from a database of profiles for the vehicle when the implement is installed or coupled on the vehicle. In some embodiments, the profile is a predetermined profile having various attributes or parameters that are set by a manufacturer. In some embodiments, the profile is customized or a stored profile generated by the user. In some embodiments, the profile is generated as the result of a machine learning technique or neural network that has been trained on datasets from a population of vehicles. In some embodiments, the profile includes values of attributes such as a forward start gear, a forward maximum speed of the vehicle, a sensitivity percent (e.g., load sensitivity), an aggressiveness of gear shifting, a PTO target speed (and/or installation type), an engine speed minimum, an engine speed maximum, and autoshift A/B presets (e.g., shifting profiles). In some embodiments, the autoshift A preset is a field mode or a shifting profile for when the vehicle **10** is operating in a field environment, and the autoshift B preset is a road profile for when the vehicle **10** is operating in a road environment.

Process **600** includes operating at least a transmission of the vehicle according to one or more attributes of the profile, a user input, and sensor data (step **606**), according to some embodiments. For example, the user input may be operation of a steering wheel and/or a gas pedal to perform a driving operation. Step **606** can include obtaining sensor data such as a current gear of the transmission **56**, a current speed of the vehicle, a current engine speed of the prime mover **52**, etc. In some embodiments, step **606** includes using the user input, the sensor data, and the profile to generate control decisions for the transmission **56**, or more generally, the driveline **50** of the vehicle. In some embodiments, the user input indicates a desired operation, and step **606** includes using the sensor data as feedback for generating the control decisions. The profile may define properties or parameters for a closed loop control scheme to generate the control decisions. In some embodiments, step **606** is performed by the controller **202**, or more specifically, by the control manager **512**. Step **606** can include transitioning the transmission **56** into the gear as indicated by the profile when operating the vehicle **10** from a stopped or sufficiently low speed state. Step **606** can also include adjusting operation of the prime mover **52** and/or the transmission **56** in order to maintain the vehicle **10** below the maximum speed. Step **606** can also include shifting gears of the transmission **56** according to the aggressiveness of the profile. Step **606** can also include operating the PTO **90** according to the PTO target speed. Step **606** can also include limiting the speed of the prime mover **52** (e.g., an engine) from operating less than the minimum engine speed, or greater than the maximum engine speed. Step **606** can also include operating the transmission **56** to shift according to the A or the B preset shift profiles.

Process **600** includes obtaining at least one of machine learning data, sensor data, or a user input to update the profile for the implement (step **608**), according to some embodiments. In some embodiments, the machine learning data is an output of a neural network that is trained to predict one or more performance metrics of the vehicle (e.g., the vehicle **10**) as a function of specific values of the attributes or parameters of the profile for the implement. In some embodiments, the sensor data is data obtained from any of the sensors **420** and can be used (e.g., by the controller **202**) to identify if the profile is achieving desired operation of the vehicle. In some embodiments, the user input is a request to modify or update one or more attributes of the profile (e.g., updated values of the forward start gear, the forward maximum speed of the vehicle, the sensitivity percent (e.g., load sensitivity), the aggressiveness of gear shifting, the PTO target speed (and/or installation type), the engine speed minimum, the engine speed maximum, and the autoshift A/B presets (e.g., shifting profiles)). In some embodiments, step **608** is performed by the operator interface **40** (e.g., responsive to a user input or operation of the operator interface **40**), the neural network **414**, and/or the cloud computing system **404**.

Process **600** includes generating an updated profile including one or more updated attributes of the profile based on the machine learning data, the sensor data, or the user input (step **610**), according to some embodiments. In some embodiments, step **610** is performed by the profile updater **412**. In some embodiments, step **610** includes adjusting or updating one or more of the parameters or attributes of the profile according to step **608**.

Process **600** includes displaying the profile or the updated profile and one or more attributes of the profile or updated profile to the user via a display screen (step **612**), according to some embodiments. In some embodiments, step **612** is performed by the GUI manager **518** and the operator interface **40**. In some embodiments, step **612** includes displaying editable fields that the user or operator can provide inputs to in order to adjust or update the one or more attributes or parameters of the profile. In some embodiments, step **612** includes displaying the values of the attributes or parameters of the profile or the updated profile on the operator interface **40** so that the user or operator can view the profile.

Referring to FIGS. **7-14**, various GUIs that can be displayed to the operator or user of the vehicle **10** are shown, according to some embodiments. The GUIs may be displayed on a touch screen so that the operator or user can navigate through the different GUIs, make selections for which profile should be active, adjust or update parameters or attributes of the profiles, etc.

Referring particularly to FIG. **7**, a transmission GUI **700** includes icons **702** that illustrate a direction of travel and a current gear of the vehicle **10**, a current speed of the vehicle, and a gear selector. The transmission GUI **700** also includes an engine power icon **704** that illustrates power output or remaining power level. The transmission GUI **700** may also include a slip icon **706** that illustrates an amount of slip on wheels or tractive elements of the vehicle **10**. In some embodiments, the transmission GUI **700** includes multiple buttons **722** that navigate to different screens. The buttons **722** include an engine button **724** that can be pressed to navigate to an engine screen, a transmission button **726** that can be pressed to navigate to a transmission screen, a steering button **728** that can be pressed to navigate to a steering screen, a differential button **730** that can be pressed to navigate to a differential screen, and a PTO button **732** that can be pressed to navigate to a PTO screen.

The transmission GUI **700** includes a shifting mode selector **708** that can be pressed to toggle between automatic shifting and manual shifting of the transmission **56**. In some embodiments, the transmission **56** can only be switched between automatic shifting and manual shifting when the transmission **56** is in park. In some embodiments, the automatic shifting is configured to remain active through a key-cycle of the vehicle **10**. In some embodiments, when the automatic shifting is selected by the selector **708**, the controller **202** is configured to use either the autoshift profile A or the autoshift profile B to determine when to shift between gears (e.g., what engine speed and vehicle speed to upshift or downshift the transmission **56** between gears). In some embodiments, the controller **202** automatically selects which of the autoshift profile A or the autoshift profile B to use based on an environment or application of the vehicle **10** (e.g., use the autoshift profile A when driving down a road, and use the autoshift profile B when in a field, or vice versa). In some embodiments, the transmission GUI **700** also includes an aggressiveness selector **710** that can be used to select which of a low, medium, or high aggressiveness for the transmission **56** to use when shifting between gears. In some embodiments, the aggressiveness selector **710** is automatically set to the value as indicated by the profile until the operator or user changes the aggressiveness by adjusting the aggressiveness selector **710**. The transmission GUI **700** also includes a brake to clutch selector **712** that includes an off button, a low button, a medium button, and a high button. In some embodiments, the aggressiveness and sensitivity of the transmission **56** are not separate for each of multiple APM modes or presets.

The transmission GUI **700** also includes a forward start gear indicator/selector **714**, according to some embodiments. In some embodiments, the forward start gear indi-

cator/selector **714** displays a current attribute or parameter of the profile (e.g., the gear that the transmission **56** starts at when the vehicle **10** starts from a stop or sufficiently low speed state), and includes an up and down button which can be pressed in order to increase or decrease the attribute or parameter of the profile (e.g., to increase or decrease the start gear that the transmission **56** initially starts in when the vehicle **10** is accelerated from stop or from the sufficiently low speed state). In some embodiments, the transmission GUI **700** also includes a reverse start gear indicator/selector **718** which can be used to increment (e.g., increase or decrease) a reverse start gear. In some embodiments, the reverse start gear is another parameter or attribute of the profile that the controller **202** uses to operate the transmission **56** of the vehicle. The reverse start gear specifically indicates a starting reverse gear that the transmission **56** is shifted into when operating to accelerate the vehicle **10** in the reverse direction from a stop or from a sufficiently low speed state.

The transmission GUI **700** also includes a sensitivity indicator/selector **716** that displays current sensitivity of the transmission **56** to load inputs, and an increase and decrease button. The value displayed on the sensitivity indicator/selector **716** before adjustment by the operator or user corresponds to the value of the sensitivity attribute or parameter of the profile. In some embodiments, the sensitivity can be increased or decreased by pressing the up button or the down button, or by pressing and holding a slider (e.g., between 0% and 100%).

The transmission GUI **700** also includes a selection button **720** to use a previous gear for a shuttle shift. When the selection button **720** is selected, the transmission **56** uses the previous gear for shuttle shifting. When the selection button **720** is not selected, the transmission **56** does not use the previous gear for shuttle shifting.

The transmission GUI **700** also includes an autoshift profile A selector **734**, and an autoshift profile B selector **736** which can be pressed to expand and display the autoshift profile A or the autoshift profile B. When the autoshift profile A selector **734** is expanded, the operator or user may view and adjust parameters of the autoshift profile A. Similarly, when the autoshift profile B selector **736** is expanded, the operator or user may view and adjust parameters of the autoshift profile B.

Referring to FIG. **8**, an autoshift GUI **800** is shown with the autoshift profile A selector **734** expanded and the autoshift profile B selector **736** expanded, according to some embodiments. The autoshift GUI **800** includes multiple engine speed management (ESM) selectors **802** for both the autoshift profile A and the autoshift profile B, which includes an off selector, a first mode, ESM**1** selector, and a second mode ESM**2** selector. The operator or user may select which of the autoshift profiles use which of the ESM modes to use when active by pressing the ESM**1** or the ESM**2** selectors for the autoshift profiles. In some embodiments, the ESM modes are linked to which of multiple APM presets are selected. In some embodiments, the autoshift GUI **800** also includes a forward max speed indicator/selector **804** for the autoshift profile A and the autoshift profile B that displays a maximum allowable forward speed of the vehicle **10** that can be adjusted (e.g., increased or decreased). In some embodiments, the maximum allowable forward speed for the autoshift profile A and the autoshift profile B are preset as the values of the attributes or parameters of the profile until adjusted by the operator or user. The autoshift GUI **800** also include engine screen callout icons **806** for both the autoshift profile A and the autoshift profile B which can be selected by the operator or user to pop out or redirect to an engine screen. In some embodiments, the ESM mode can be selected for the autoshift profile A and the autoshift profile B so that when the autoshift profile A or B is selected, the correspondingly set ESM mode is automatically activated. In some embodiments, the forward max speed is a function of a forward start gear that is chosen as the vehicle **10** is started (e.g., at a key-on event). In some embodiments, the forward max speed of the vehicle **10** correlates with what a high idle in the corresponding gear would achieve. In some embodiments, operating a throttle of the vehicle **10** results in from 40% to 100% of a current setting for the maximum forward speed in order to simulate a range of effectiveness of the throttle in a given gear (e.g., 900 RPM to 2240 RPM of the prime mover **52**).

Referring to FIG. **9**, an engine GUI **900** that is presented when the engine button **724** is selected is shown, according to some embodiments. The engine GUI **900** includes an engine speed icon **902** that illustrates current engine speed, an engine power icon **904** that illustrates current engine power, and an engine braking selector **906**. The engine speed icon **902** may illustrate current revolutions per minute (rpm) of the prime mover **52**. In some embodiments, the engine braking selector **906** can be transitioned between an automatic mode, a manual mode, and an off mode. Updating the engine braking selector **906** between the automatic mode, the manual mode, and the off mode transitions operation of the prime mover **52** between different engine braking modes.

Referring still to FIG. **9**, the engine GUI **900** also includes a PTO target selector **908**, and a PTO RPM selector **910**. When the PTO target selector **908** is toggled to "on" the user or operator can adjust the PTO RPM selector **910** to set a target speed of the PTO **90**. In some embodiments, the operator may control the PTO RPM selector **910** to increase or decrease by 15% from nominal. In some embodiments, the 15% increment amount corresponds to a change resulting from performing a shifting of the transmission **56** between subsequent gears. In some embodiments, a thumbwheel of a joystick or input device can be operated to make minor or incremental adjustments (e.g., smaller than 15%, or by 0.1 of units used for the PTO rpm). The engine GUI **900** also includes an ESM**1** selector **912** and an ESM**2** selector **914** that the operator can expand to view and adjust engine speed management settings for a first and second mode. The engine GUI **900** can also include an economy (ECO) mode to operate the prime mover **52** to conserve fuel consumption and allow the operator to set a maximum engine speed for the ECO mode.

Referring to FIG. **10**, an ESM GUI **1000** illustrates the ESM**1** selector **912** and the ESM**2** selector **914** expanded, according to some embodiments. The ESM GUI **1000** includes a range/target selector **1002** for both the ESM**1** and the ESM**2**. The range/target selectors **1002** can be toggled between a range setting (e.g., a minimum range) or a target setting to either set a range of acceptable engine speed values, or to set a target engine speed value. In FIG. **10**, the ESM**1** is shown with the corresponding range/target selector **1002** toggled to "range" while the ESM**2** is shown with the corresponding range/target selector **1002** toggled to "target." The ESM GUI **1000** includes an engine speed minimum selector **1004** that the operator can adjust to set a minimum speed of the prime mover **52**. If manual shift mode is activated, adjusting the engine speed minimum selector **1004** may result in scaling a throttle input such that full throttle achieves maximum engine speed, and zero throttle results in the engine speed illustrated by the engine speed minimum selector **1004** (which can be adjusted by operating

the engine speed minimum selector **1004**). If autoshift mode is selected, adjusting the engine speed minimum selector **1004** sets a range of allowable engine speed such that a higher value of the minimum engine speed can be used for situations where large load changes occur, to thereby limit how far the transmission **56** will upshift during times of light load. In some embodiments, the ESM GUI **1000** also includes an engine speed maximum selector that is similar to the engine speed minimum selector **1004** so that the operator can adjust the engine speed maximum selector to set a maximum speed for the prime mover **52**.

Referring still to FIG. **10**, the ESM GUI **1000** also includes an engine speed target selector **1004** that the operator can adjust to set a target speed for the prime mover **52**. If manual shift mode is active, then adjusting the engine speed target selector **1004** may result in limiting the prime mover **52** to the engine speed target as illustrated. If autoshift mode is active, then the target speed for the prime mover **52** as set by the engine speed target selector **1004** is used as target engine speed, and this engine speed is prioritized for control purposes over a ground speed so that ground speed of the vehicle **10** is as close as possible to a target ground speed, while achieving the target engine speed as set at the engine speed target selector **1004**. In some embodiments, the operator can adjust the engine speed target selector **1004** once the corresponding range/target selector **1002** for the ESM**2** is set to "target."

Referring to FIGS. **11-13**, a profile GUI **1100** illustrates various parameters or attributes of the profile for the vehicle **10**. The profile GUI **1100** may function to display current values of the parameters or attributes of the profile, and also enable the operator to adjust or the values of the parameters or attributes of the profile. In some embodiments, the values of the attributes or parameters shown in FIGS. **11-13** are set to the values determined by the profile by default (e.g., the) and may be subsequently updated by the operator by providing inputs or adjustments to the profile GUI **1100**.

Referring particularly to FIG. **11**, the profile GUI **1100** includes an APM field sensitivity indicator/selector **1102**, a start up forward gear indicator/selector **1104**, an APM road sensitivity indicator/selector **1106**, a speed match lowest gear indicator/selector **1108**, an APM road lowest gear indicator/selector **1110**, a start up reverse gear indicator/selector **1112**, a reverse shuttle gear indicator/selector **1114**, and a use last gear selector **1116**, according to some embodiments. In some embodiments, the APM field sensitivity is a percentage value that can be adjusted. The APM field sensitivity may be a value that determines how frequently the transmission **56** responds to load changes during field work or operation of the vehicle **10**. In some embodiments, a higher setting or value of the APM field sensitivity results in increased shift frequency of the transmission **56** between gears, while a lower setting or value of the APM field sensitivity results in decreased shift frequency of the transmission **56** between gears. If the transmission **56** is shifting too frequently, or more frequently than the operator desires, the operator can adjust the APM field sensitivity to a decreased value or vice versa by adjusting a slider of the APM field sensitivity indicator/selector **1102**.

Referring still to FIG. **11**, the operator may adjust the start up forward gear by adjusting the start up forward gear indicator/selector **1104**. The start up forward gear defines the gear that the transmission **56** uses at start up of the vehicle **10** if the operator does not select any other gear. In some embodiments, the start up forward gear has a default value of 7 (e.g., the seventh gear). In some embodiments, the start up forward gear can be adjusted by pressing the plus or minus buttons of the start up forward gear indicator/selector **1104**. The start up forward gear may have any value between 1 and 13, according to some embodiments.

Referring still to FIG. **11**, the operator may adjust the APM road sensitivity by adjusting the APM road sensitivity indicator/selector **1106**. In some embodiments, the APM road sensitivity is a percentage value that can be adjusted. The APM road sensitivity may be a value that determines how frequently the transmission **56** responds to load changes during road operation of the vehicle **10**. In some embodiments, a higher setting or value of the APM road sensitivity results in increased shift frequency of the transmission **56** between gears, while a lower setting or value of the APM road sensitivity results in decreased shift frequency of the transmission **56** between gears. If the transmission **56** is shifting too frequently, or more frequently than the operator desires, the operator can adjust the APM road sensitivity to a decreased value or vice versa by adjusting a slider of the APM road sensitivity indicator/selector **1102**.

Referring still to FIG. **11**, the operator may adjust the speed match lowest gear by adjusting the speed match lowest gear indicator/selector **1108**. In some embodiments, the speed match lowest gear defines a lowest gear that the transmission **56** may use to match current speed of the vehicle **10** such that the transmission **56** re-engages smoothly when a pedal is released or when the transmission **56** is re-shifted into a forwards gear. In some embodiments, the speed match lowest gear has a default value of 7, but may have a value of 1 through 13 (e.g., the seventh gear, and the first through thirteenth gear, respectively). In some embodiments, the operator may press the plus or minus buttons of the speed match lowest gear indicator/selector **1108** to increase or decrease the value of the speed match lowest gear.

Referring still to FIG. **11**, the operator may adjust the APM road lowest gear by adjusting the APM road lowest gear indicator/selector **1110**. In some embodiments, the APM road lowest gear defines or is a lowest gear that the transmission **56** can use when transporting on a road with throttle fully open. In some embodiments, a default value of the APM road lowest gear is 11 (e.g., the eleventh gear), but may have a value of 1-12 (e.g., adjustable via pressing the plus or minus buttons of the APM road lowest gear indicator/selector **1110**.

Referring still to FIG. **11**, the operator may adjust the start up reverse gear by adjusting the start up reverse gear **1112**. In some embodiments, the start up reverse gear is or defines a reverse gear that is used at start up of the vehicle **10** if the operator does not select a different gear. The start up reverse gear may have a default value of 2 (e.g., the second gear), but may have any value or may be adjusted by the operator to any value of 1-4 (e.g., the first gear, the second gear, the third gear, or the fourth gear in reverse).

Referring still to FIG. **11**, the operator may adjust the reverse shuttle gear (if the use last reverse gear selector **1116** is not selected) by adjusting the reverse shuttle gear indicator/selector **1114**. In some embodiments, the reverse shuttle gear is or defines the reverse gear that is used whenever the transmission **56** performs shuttle-shifting from a forwards gear to a reverse gear. In some embodiments, the reverse shuttle gear has a default value of 2 (e.g., the second reverse gear). In some embodiments, the reverse shuttle gear can have any value of 1-6, which may be adjusted by the operator pressing the plus or minus buttons of the reverse shuttle gear indicator/selector **1114**.

Referring still to FIG. **11**, the use last reverse gear selector **1116** may be toggled between a selected state or a deselected

state. If the use last reverse gear selector **1116** is in the selected state (e.g., as shown in FIG. **11**), the transmission **56** may select a previously used reverse gear to begin reverse travel of the vehicle **10** during shuttle shifting from a forwards gear to a reverse gear. If the use last reverse gear selector **1116** is in the deselected state, the transmission **56** may select the reverse gear as indicated in the reverse shuttle gear indicator/selector **1114** when shuttle-shifting from a forwards gear to a reverse gear.

Referring to FIG. **12**, a load anticipation GUI **1200** includes an APM load anticipation pane **1206** that may be selectably expanded to view and select one or more anticipated loads. FIG. **12** illustrates a hitch load **1208** that is selected, a PTO load **1210** that is selected, and a first rear remote valve **1212** that are selected. In APM field operations, the loads, when active, may trigger a downshift of the transmission **56** in anticipation of a load increase to thereby maintain speed of the vehicle **10** and mitigate or reduce a likelihood of engine stall. In some embodiments, the various selectable loads of FIG. **12** may depend on a type of the vehicle **10** and one or more available loads. In some embodiments, the loads **1208-1214** may be selected by checking or unchecking boxes for the implement **92**. In some embodiments, the loads **1208-1214** are automatically selected by the controller **202** responsive to identifying the type of the implement **92**. In some embodiments, the selected loads may remain active through various cycles and can be checked or updated when the implement **92** is changed.

As utilized herein with respect to numerical ranges, the terms "approximately," "about," "substantially," and similar terms generally mean +/−10% of the disclosed values, unless specified otherwise. As utilized herein with respect to structural features (e.g., to describe shape, size, orientation, direction, relative position, etc.), the terms "approximately," "about," "substantially," and similar terms are meant to cover minor variations in structure that may result from, for example, the manufacturing or assembly process and are intended to have a broad meaning in harmony with the common and accepted usage by those of ordinary skill in the art to which the subject matter of this disclosure pertains. Accordingly, these terms should be interpreted as indicating that insubstantial or inconsequential modifications or alterations of the subject matter described and claimed are considered to be within the scope of the disclosure as recited in the appended claims.

It should be noted that the term "exemplary" and variations thereof, as used herein to describe various embodiments, are intended to indicate that such embodiments are possible examples, representations, or illustrations of possible embodiments (and such terms are not intended to connote that such embodiments are necessarily extraordinary or superlative examples).

The term "coupled" and variations thereof, as used herein, means the joining of two members directly or indirectly to one another. Such joining may be stationary (e.g., permanent or fixed) or moveable (e.g., removable or releasable). Such joining may be achieved with the two members coupled directly to each other, with the two members coupled to each other using a separate intervening member and any additional intermediate members coupled with one another, or with the two members coupled to each other using an intervening member that is integrally formed as a single unitary body with one of the two members. If "coupled" or variations thereof are modified by an additional term (e.g., directly coupled), the generic definition of "coupled" provided above is modified by the plain language meaning of the additional term (e.g., "directly coupled" means the joining of two members without any separate intervening member), resulting in a narrower definition than the generic definition of "coupled" provided above. Such coupling may be mechanical, electrical, or fluidic.

References herein to the positions of elements (e.g., "top," "bottom," "above," "below") are merely used to describe the orientation of various elements in the figures. It should be noted that the orientation of various elements may differ according to other exemplary embodiments, and that such variations are intended to be encompassed by the present disclosure.

The present disclosure contemplates methods, systems, and program products on any machine-readable media for accomplishing various operations. The embodiments of the present disclosure may be implemented using existing computer processors, or by a special purpose computer processor for an appropriate system, incorporated for this or another purpose, or by a hardwired system. Embodiments within the scope of the present disclosure include program products comprising machine-readable media for carrying or having machine-executable instructions or data structures stored thereon. Such machine-readable media can be any available media that can be accessed by a general purpose or special purpose computer or other machine with a processor. By way of example, such machine-readable media can comprise RAM, ROM, EPROM, EEPROM, or other optical disk storage, magnetic disk storage or other magnetic storage devices, or any other medium which can be used to carry or store desired program code in the form of machine-executable instructions or data structures and which can be accessed by a general purpose or special purpose computer or other machine with a processor. Combinations of the above are also included within the scope of machine-readable media. Machine-executable instructions include, for example, instructions and data which cause a general purpose computer, special purpose computer, or special purpose processing machines to perform a certain function or group of functions.

Although the figures and description may illustrate a specific order of method steps, the order of such steps may differ from what is depicted and described, unless specified differently above. Also, two or more steps may be performed concurrently or with partial concurrence, unless specified differently above. Such variation may depend, for example, on the software and hardware systems chosen and on designer choice. All such variations are within the scope of the disclosure. Likewise, software implementations of the described methods could be accomplished with standard programming techniques with rule-based logic and other logic to accomplish the various connection steps, processing steps, comparison steps, and decision steps.

The term "client or "server" include all kinds of apparatus, devices, and machines for processing data, including by way of example a programmable processor, a computer, a system on a chip, or multiple ones, or combinations, of the foregoing. The apparatus may include special purpose logic circuitry, e.g., a field programmable gate array (FPGA) or an application specific integrated circuit (ASIC). The apparatus may also include, in addition to hardware, code that creates an execution environment for the computer program in question (e.g., code that constitutes processor firmware, a protocol stack, a database management system, an operating system, a cross-platform runtime environment, a virtual machine, or a combination of one or more of them). The apparatus and execution environment may realize various

different computing model infrastructures, such as web services, distributed computing and grid computing infrastructures.

The systems and methods of the present disclosure may be completed by any computer program. A computer program (also known as a program, software, software application, script, or code) may be written in any form of programming language, including compiled or interpreted languages, declarative or procedural languages, and it may be deployed in any form, including as a stand-alone program or as a module, component, subroutine, object, or other unit suitable for use in a computing environment. A computer program may, but need not, correspond to a file in a file system. A program may be stored in a portion of a file that holds other programs or data (e.g., one or more scripts stored in a markup language document), in a single file dedicated to the program in question, or in multiple coordinated files (e.g., files that store one or more modules, sub programs, or portions of code). A computer program may be deployed to be executed on one computer or on multiple computers that are located at one site or distributed across multiple sites and interconnected by a communication network.

The processes and logic flows described in this specification may be performed by one or more programmable processors executing one or more computer programs to perform actions by operating on input data and generating output. The processes and logic flows may also be performed by, and apparatus may also be implemented as, special purpose logic circuitry (e.g., an FPGA or an ASIC).

Processors suitable for the execution of a computer program include, by way of example, both general and special purpose microprocessors, and any one or more processors of any kind of digital computer. Generally, a processor will receive instructions and data from a read only memory or a random access memory or both. The essential elements of a computer are a processor for performing actions in accordance with instructions and one or more memory devices for storing instructions and data. Generally, a computer will also include, or be operatively coupled to receive data from or transfer data to, or both, one or more mass storage devices for storing data (e.g., magnetic, magneto-optical disks, or optical disks). However, a computer need not have such devices. Moreover, a computer may be embedded in another device (e.g., a vehicle, a Global Positioning System (GPS) receiver, etc.). Devices suitable for storing computer program instructions and data include all forms of non-volatile memory, media and memory devices, including by way of example semiconductor memory devices (e.g., EPROM, EEPROM, and flash memory devices; magnetic disks, e.g., internal hard disks or removable disks; magneto-optical disks; and CD ROM and DVD-ROM disks). The processor and the memory may be supplemented by, or incorporated in, special purpose logic circuitry.

To provide for interaction with a user, implementations of the subject matter described in this specification may be implemented on a computer having a display device (e.g., a CRT (cathode ray tube), LCD (liquid crystal display), OLED (organic light emitting diode), TFT (thin-film transistor), or other flexible configuration, or any other monitor for displaying information to the user. Other kinds of devices may be used to provide for interaction with a user as well; for example, feedback provided to the user may be any form of sensory feedback (e.g., visual feedback, auditory feedback, or tactile feedback).

Implementations of the subject matter described in this disclosure may be implemented in a computing system that includes a back-end component (e.g., as a data server), or that includes a middleware component (e.g., an application server), or that includes a front end component (e.g., a client computer) having a graphical user interface or a web browser through which a user may interact with an implementation of the subject matter described in this disclosure, or any combination of one or more such back end, middleware, or front end components. The components of the system may be interconnected by any form or medium of digital data communication (e.g., a communication network). Examples of communication networks include a LAN and a WAN, an inter-network (e.g., the Internet), and peer-to-peer networks (e.g., ad hoc peer-to-peer networks).

It is important to note that the construction and arrangement of the vehicle **10** and the systems and components thereof (e.g., the driveline **50**, the braking system **100**, the control system **200**, etc.) as shown in the various exemplary embodiments is illustrative only. Additionally, any element disclosed in one embodiment may be incorporated or utilized with any other embodiment disclosed herein.

What is claimed is:

1. An agricultural vehicle comprising:

a driveline comprising an engine, a transmission, and a power take off (PTO);

an interface configured to removably couple an implement with the agricultural vehicle, the implement configured to perform an agricultural function; and

a control system comprising processing circuitry configured to:

obtain an indication of a type of the implement that is removably coupled with the agricultural vehicle;

determine a profile for at least the transmission based on the type of the implement that is removably coupled with the agricultural vehicle, the profile comprising one or more operating parameters for at least the transmission such that the transmission operates in a specific manner for the type of the implement, the one or more operating parameters including a forward start gear for the transmission; and

operate at least the transmission according to the one or more operating parameters of the profile.

2. The agricultural vehicle of claim **1**, wherein the control system comprises an imaging device configured to obtain an image of the implement, wherein obtaining the indication of the type of the implement and determining the profile comprise:

performing an image recognition or analysis technique using the image of the implement to determine the type of the implement; and

determining the profile by retrieving a predetermined profile comprising a plurality of the one or more operating parameters that are specific to the type of the implement, the plurality of the one or more operating parameters configured to be used to operate at least the transmission of the agricultural vehicle in the specific manner for the type of the implement.

3. The agricultural vehicle of claim **1**, wherein obtaining the indication of the type of the implement comprises:

receiving a user input from a display screen of the control system, the user input comprising the type of the implement.

4. The agricultural vehicle of claim **1**, wherein obtaining the indication of the type of the implement comprises:

establishing communications between a controller of the implement and the processing circuitry through a communications interface; and

reading the type of the implement from the controller.

5. The agricultural vehicle of claim 1, wherein the one or more operating parameters comprise a plurality of operating parameters including the forward start gear for transition, a maximum forwards speed of the agricultural vehicle, a load sensitivity for the transmission, a shifting aggressiveness for the transmission, a target speed for the PTO, a minimum speed of the engine, a maximum speed of the engine, and a shifting profile for the transmission.

6. The agricultural vehicle of claim 1, wherein the one or more operating parameters are automatically determined and set by the processing circuitry without requiring an operator of the agricultural vehicle to set values for any of the one or more operating parameters.

7. The agricultural vehicle of claim 1, wherein the processing circuitry is configured to determine or adjust the profile and the one or more operating parameters of the profile based on an indication of whether the agricultural vehicle is currently in field use or being transported on a road.

8. A control system for an agricultural vehicle, the control system comprising processing circuitry configured to:

obtain an indication of a type of an implement that is removably coupled with the agricultural vehicle;

determine a profile for at least a transmission of the agricultural vehicle based on the type of the implement that is removably coupled with the agricultural vehicle, the profile defining one or more operating parameters for at least the transmission such that the transmission operates in a specific manner for the type of the implement, the one or more operating parameters including a forward start gear for the transmission; and

operate at least the transmission according to the one or more operating parameters of the profile.

9. The control system of claim 8, wherein the control system comprises an imaging device configured to obtain an image of the implement, wherein obtaining the indication of the type of the implement and determining the profile comprise:

performing an image recognition or analysis technique using the image of the implement to determine the type of the implement; and

determining the profile by retrieving a predetermined profile comprising the one or more operating parameters that are specific to the type of the implement, the one or more operating parameters configured to be used to operate at least the transmission of the agricultural vehicle in the specific manner for the type of the implement.

10. The control system of claim 8, wherein obtaining the indication of the type of the implement comprises:

receiving a user input from a display screen of the control system, the user input comprising the type of the implement.

11. The control system of claim 8, wherein obtaining the indication of the type of the implement comprises:

establishing communications between a controller of the implement and the processing circuitry through a communications interface; and

reading the type of the implement from the controller.

12. The control system of claim 8, the one or more operating parameters further including:

a load sensitivity for the transmission;

a target speed for the PTO;

a maximum forwards speed of the agricultural vehicle;

a shifting aggressiveness for the transmission;

a minimum speed of an engine;

a maximum speed of the engine; and

a shifting profile for the transmission.

13. The control system of claim 12, wherein the one or more operating parameters are automatically determined and set by the processing circuitry without requiring an operator of the agricultural vehicle to set values for any of the one or more operating parameters.

14. The control system of claim 8, wherein the processing circuitry is configured to determine or adjust the profile and the one or more operating parameters of the profile based on an indication of whether the agricultural vehicle is currently in field use or being transported on a road.

15. The control system of claim 8, wherein the profile and the one or more operating parameters of the profile are determined by the processing circuitry by performing a machine learning technique that uses performance metrics and corresponding values of the one or more operating parameters obtained from a population of agricultural vehicles that are removably coupled with implements that are a same type of the implement, the machine learning technique using the performance metrics and the corresponding values of the one or more operating parameters as training data to predict a value of the one or more operating parameters that achieves a desired value of the performance metrics.

16. A method for automatically configuring an agricultural vehicle for a specific type of implement, the method comprising:

obtaining an indication of a type of an implement that is removably coupled with the agricultural vehicle;

determining a profile for at least a transmission based on the type of the implement that is removably coupled with the agricultural vehicle, the profile comprising one or more operating parameters for at least the transmission such that the transmission operates in a specific manner for the type of the implement, the one or more operating parameters comprising a forward start gear for the transmission; and

operating at least the transmission according to the one or more operating parameters of the profile.

17. The method of claim 16, wherein obtaining the indication of the type of the implement and determining the profile comprise:

performing an image recognition or analysis technique using an image of the implement to determine the type of the implement; and

determining the profile by retrieving a predetermined profile comprising the one or more operating parameters that are specific to the type of the implement, the one or more operating parameters configured to be used to operate at least the transmission of the agricultural vehicle in the specific manner for the type of the implement.

18. The method of claim 16, wherein obtaining the indication of the type of the implement comprises:

receiving a user input from a display screen of a control system, the user input comprising the type of the implement.

19. The method of claim 16, wherein the one or more operating parameters are a plurality of operating parameters that further include:

a maximum forwards speed of the agricultural vehicle;

a load sensitivity for the transmission;

a shifting aggressiveness for the transmission;

a target speed for a power take off (PTO);

a shifting profile for the transmission;

a minimum speed of an engine; and

a maximum speed of the engine.

20. The method of claim 19, wherein the plurality of operating parameters are automatically determined and set without requiring an operator of the agricultural vehicle to set values for any of the plurality of operating parameters.

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