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(71) Applicant: **SCANIA CV AB** [SE/SE]; 151 87 Södertälje (SE).

(72) Inventor: **ALAM, Assad**; Åsgärdevägen 8 BV, 121 31 Enskededalen (SE).

(74) Agent: **YOUSSEF, Maikel**; Scania CV AB, 151 87 Södertälje (SE).

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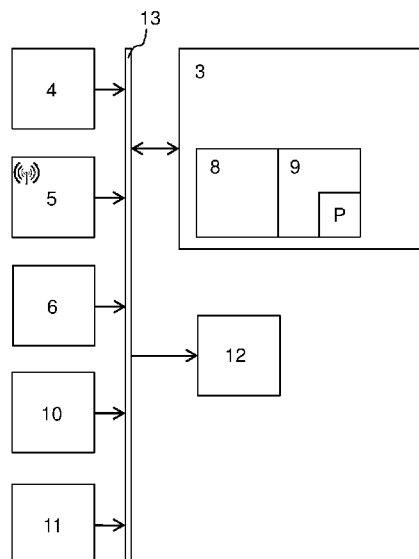


FIG. 2

(57) Abstract: A device (3) and a method for managing communication for a vehicle (1). The device (3) is configured to: receive data from a plurality of communication systems, wherein the data is tagged with information assigning the data to a source of the data, respectively, and to determine a ranking for the plurality of communication systems based on a quality analysis of the content of the received data.

DEVICE AND METHOD FOR MANAGING COMMUNICATION FOR A VEHICLETechnical field

5 The present disclosure relates to technology for managing communication for a vehicle. In particular, the disclosure relates to a device and a method for managing communication for a vehicle with a plurality of communication possibilities. The disclosure also relates to a computer program and a computer program product.

10 Background

Platooning, or cooperative driving, has started to come in question mainly for heavy vehicles. Platooning means to drive in a convoy or platoon with small distances between the vehicles. Studies have shown that fuel consumption may be reduced considerably by driving cooperatively with heavy vehicles because of
15 reduced air resistance. Further, safety is improved through cooperative actions.

Platooning may be performed more or less with automated control systems. One approach is to take advantage of an adaptive cruise controller, ACC, in the vehicle that regulates the velocity of the vehicle in order to maintain a certain small
20 distance between the vehicle and a preceding target vehicle. A further approach is to include automated steering of the vehicle. Platooning may be performed locally by each vehicle in the platoon, or cooperative with cooperative control from e.g. the foremost vehicle in the platoon. The foremost vehicle in the platoon may be referred to as the leader vehicle and is driven manually as normal by the driver
25 and the other vehicle or vehicles in the platoon may be referred to as followers. The follower vehicles thus have automated control of their velocity, and may also have automated control of their steering.

The automated control systems need fast retrieval of real-time information in order
30 to accomplish accurate and secure control of the vehicles in the platoon. The automated control systems may be based on a wide range of information sources for calculation of a control strategy. There is at present no current standard set for

the type of information sources that should be used. One way of exchanging information between vehicles is by using wireless communication between vehicles, also referred to as vehicle-to-vehicle (V2V) communication, or vehicle-to-infrastructure (V2I) communication. However, a wireless communication
5 network may temporarily become unavailable and data access thereby compromised.

From US2013/0157711A1 an apparatus and a method for selecting a communication network for a vehicle is known. A communication network is
10 selected that is most suitable in consideration of communication situations of an area in which the vehicle is located and information set by a user.

Summary

It is an object of the disclosure to provide a device and a method for managing
15 communication of a vehicle. It is a further object of the disclosure to provide a device and a method for managing communication for a vehicle such that the data provided is accurate. It is a still further object of the disclosure to provide a device and a method for managing communication for a vehicle such that the information access is reliable. It is another object of the disclosure to provide a device and a
20 method for managing communication in a confident way for the driver of the vehicle.

Any of these objects and others are at least partly achieved by the device and method according to the independent claims, and by the embodiments according
25 to the dependent claims.

According to a first aspect, the disclosure relates to a device for managing communication for a vehicle. The device is configured to receive data from a plurality of communication systems, wherein the data is tagged with information
30 assigning the data to a source of the data, respectively. The device is further configured to determine a ranking for the plurality of communication systems based on a quality analysis of the content of the received data.

With the device the best available communication system for the vehicle may be chosen. The device may monitor the communication systems available, and determine the best choice for the vehicle. The functions of the vehicle will then
5 always have the best available data. Controllers of the vehicle may then become more reliable, whereby security can be increased.

According to one embodiment, the device is configured to select a current communication system from the plurality of communication systems based on the
10 determined ranking for communication of the data.

According to one embodiment, the device is configured to generate information data indicating the selected current communication system and send the information data to a communication device, whereby the driver of the vehicle is
15 informed of the current selected communication system. Thereby the driver will know which communication system that is used at present, and will invoke a trust in the onboard control system. Thereby, the driver acceptance of the used control system or systems, e.g. a platooning control system, will increase and hopefully be utilized for a more efficient and sustainable transportation system.

20

According to one embodiment, the device is configured to perform a quality analysis comprising to calculate a quality measure for each source based on the received data assigned to the source, respectively. According to one further embodiment, the determination of the ranking comprises to compare the quality
25 measures and to rank the communication systems that transferred the data based on a result of the comparison.

According to one embodiment, the device is configured to use data from the source with the best quality measure as a reference for data from other sources
30 and correcting the data from other sources based on the data from the source with the best quality measure.

According to one embodiment, the device is configured to merge data of the same type from different sources based on the ranking in order to create enhanced merged data.

- 5 According to one embodiment, the device is configured to determine a quality measure of the transfer of data in each communication system, and to determine the ranking of the plurality of communication system also based on the quality measure of the transfer of data.
- 10 According to one embodiment, the device is configured to determine a quality measure being a deviation value.

According to a second aspect, the disclosure relates to a method for managing communication for a vehicle. The method comprises receiving data from a
15 plurality of communication systems, wherein the data is tagged with information assigning the data to a source, respectively; and determining a ranking for the plurality of communication systems based on a quality analysis of the content of the received data.

- 20 According to one embodiment, the method comprises selecting a current communication system from the plurality of communication systems based on the determined ranking for communication of the data.

According to one embodiment, the method comprises informing the driver of the
25 vehicle of the current selected communication system.

According to one embodiment, the quality analysis comprises calculating a quality measure for each source based on the received data assigned to the source, respectively. According to one further embodiment, the determination of the
30 ranking comprises comparing the quality measures and ranking the communication systems that transferred the data based on a result of the comparison.

According to one embodiment, the method comprising using data from the source with the best quality measure as a reference for data from other sources including correcting the data from other sources based on the data from the source with the best quality measure.

5

According to one embodiment, the method comprises merging data of the same type from different sources based on the ranking in order to create enhanced merged data.

10 According to one embodiment, the method comprises determining a quality measure of the transfer of data in each communication system, and determining a ranking of the plurality of communication system also based on the quality measure of the transfer of data.

15 According to one embodiment, the method comprises determining a quality measure being a deviation value.

According to a third aspect, the disclosure relates to a computer program P. The computer program P comprises a computer program code to cause a device, or a
20 computer connected to the device, to perform any of the method steps as disclosed herein.

According to a fourth aspect, the disclosure relates to a computer program product comprising a computer program code stored on a computer-readable
25 medium to perform the method as disclosed herein, when the computer program code is executed by a device or by a computer connected to the device.

Brief description of the drawings

Fig. 1 illustrates two vehicles each being arranged with a device according to one
30 embodiment.

Fig. 2 illustrates a device according to one embodiment with a plurality of communicating systems.

Fig. 3 illustrates a flowchart of a method according to one embodiment of the disclosure.

Detailed description

5 In Fig. 1 two vehicles 1, 2 travelling on a road are illustrated. The vehicles 1, 2 are illustrated as trucks, but may be other kinds of heavy vehicles, or cars. The vehicles 1, 2 may be operated as a platoon. The first vehicle 1 may then be referred to as a leader vehicle 1 and the subsequent vehicle 2 may be referred to as a follower vehicle 2. Each vehicle 1, 2 is equipped with a communication node
10 5, comprising e.g. a transceiver, to be able to wirelessly communicate e.g. exchange data with other vehicles and/or infrastructure 7. The infrastructure 7, e.g. a road side unit, a remote computer, fleet management system, platooning management system etc, may also be connected to a communication node 5. The wireless communication may also be conducted via mobile communication
15 servers, via an application in a communication unit or via a server. Wireless communication may be performed by means of a wireless communication system with WiFi, Bluetooth, IR (Infra Red) communication or a phone network such as GPRS (General Packet Radio Service), 3G, 4G, EDGE (Enhanced Data GSM Environment) etc.
20
The vehicles 1, 2 are arranged with sensors and actuators for retrieval of data used by any system in the vehicle. For example, the data may be used for automated control of the subsequent vehicle 2. Other system that may make use of the data is security systems, route planning systems etc. The vehicles 1, 2 may
25 further be arranged with several ECUs (Electronic Control Units) to control the vehicle 1, 2 or the platoon.

Each vehicle 1, 2 may be arranged with a forward facing sensor unit 4. The forward facing sensor unit 4 may be a radar unit or a lidar unit, arranged to record
30 a parameter such as distance d , relative velocity Δv , relative acceleration Δa between the own vehicle and a preceding vehicle, lateral length of the preceding vehicle etc. The forward facing sensor unit 4 may instead be a camera unit or a

video recording unit, arranged to record images of the preceding vehicle. By using image processing techniques, various parameters may be extracted from the images, such as the distance d , relative velocity Δv , relative acceleration Δa between the own vehicle and the preceding vehicle, lateral length of the preceding vehicle etc.

Each vehicle 1, 2 may also be arranged with a rearward facing sensor unit 6. The rearward facing sensor unit 6 may be a radar unit or a lidar unit, arranged to record a parameter such as distance d , relative velocity Δv , relative acceleration Δa between the own vehicle and a subsequent vehicle, lateral length of the subsequent vehicle etc. The rearward facing sensor unit 4 may instead be a camera unit or a video recording unit, arranged to record images of the subsequent vehicle. By using image processing techniques, various parameters may be extracted from the images, such as the distance d , relative velocity Δv , relative acceleration Δa between the own vehicle and the subsequent vehicle, lateral length of the subsequent vehicle etc.

Each vehicle 1, 2 may also be arranged with sideward facing sensing units (not shown) for monitoring of the sides of the vehicles 1, 2. For example, data from such sideward facing sensing units may be used to monitor the surroundings of the vehicle 1, 2 for safety issues such as pedestrians, bicyclists etc. A sideward facing sensing unit may include a radar unit, a lidar unit, a camera unit or a video recording unit.

Each vehicle 1, 2 is further each arranged with a positioning unit 10 such that the position of each vehicle 10 may be determined. The positioning unit 10 may be configured to receive signals from a global positioning system such as GNSS (Global Navigation Satellite System), for example GPS (Global Positioning System), GLONASS, Galileo or Compass. Alternatively the positioning unit 10 may be configured to receive signals from for example one or several distance sensors 4, 6 in the vehicle 1, 2 that measure relative distances to for example a

road side unit 7, nearby vehicles or similar with a known position. Based on the relative distance or distances the positioning unit 10 may determine the position of the vehicle. A sensor in the vehicle may also be configured to detect a signature in for example a road side unit 7, whereby the signature represents a certain position. The positioning unit 10 may then be configured to determine its own position via detection of the signature. The positioning unit 10 may instead be configured to determine the signal strength in one or a plurality of signals from a base station or road side unit 7 with known position, and thereby determine the position of the vehicle 1, 2 by using triangulation. Some of above mentioned technologies may of course be combined to ensure a correct position determination of the vehicle. The positioning unit 10 is configured to generate a position signal with the position of the vehicle.

Other data that may be detected by sensor units 11 (Fig. 2) in a vehicle 1, 2 or transferred via a wireless network may be engine torque T_e or weight w of the vehicle etc.

Each vehicle 1, 2 may communicate internally between its units, devices, sensors, detectors etc. via a communication bus 13 (Fig. 2), for example a CAN-bus (Controller Area Network) which uses a message based protocol. Examples of other communication protocols that may be used are TTP (Time-Triggered Protocol), Flexray, etc. In that way signals and data described herein may be exchanged between different units, devices, sensors and/or detectors in the vehicle 1, 2. Signals and data may instead be transferred wirelessly between the different units, devices, sensors and/or detectors.

Any or each of the vehicles 1, 2 may be arranged with a device 3 for managing communication for the vehicle. The device 3 may be an ECU, or be incorporated in an ECU of the vehicle 1, 2. The device 3 is further illustrated in Fig. 2, and includes a processing unit 8 and a memory unit 9. The processing unit 8 may be made up of one or more Central Processing Units (CPU). The memory unit 9 may be made up of one or more memory units. A memory unit may include a volatile

and/or a non-volatile memory, such as a flash memory or Random Access Memory (RAM). The device 3 further includes a computer program P including a computer program code to cause the device 3, or a computer connected to the device 3, to perform any of the method steps that will be described in the following.

As illustrated in Fig. 2, the device 3 is configured to receive data from a plurality of communication systems 4, 5, 6, 10, 11. Data may be received via the communication bus 13 from the different systems 4, 5, 6, 10, 11. The communication bus 13 is thus here not regarded as a communication system. A communication system may be a wireless communication system 5 as has been previously explained, e.g. WiFi, Bluetooth, IR (Infra-Red) communication or a phone network such as GPRS (General Packet Radio Service), 3G, 4G, EDGE (Enhanced Data GSM Environment) etc. Other kinds of communication systems may be the previously exemplified forward facing sensor unit 4, rearward facing sensor unit 6, a positioning unit 10, or another sensor unit 11 in a vehicle. These units may as explained comprise radar units, lidar units, camera units, video recording units or positioning units. These other kinds of communication systems may be seen as one-way communication systems, as they gain information of the environment such as information of neighboring vehicles or the vehicle itself.

The data is tagged with information assigning the data to a source of the data, respectively. A source is here an entity that recorded and/or determined the data, e.g. a positioning unit in a certain vehicle, a radar unit in a certain vehicle etc. If a source is arranged in the vehicle where the device 3 is also arranged, the source itself may also be the communication system. The information may include an identification number of the source, a position of the vehicle and/or an identification of the vehicle.

For example, if the data comprises a position p_1 of the first vehicle 1 determined by a positioning unit 10 in the first vehicle 1 and received via two different wireless communication systems 5 e.g. WiFi and GPRS to the subsequent vehicle 2, the

position p_1 is tagged with information identifying the positioning unit of the first vehicle 1. The information may e.g. include the identity of the first vehicle 1, e.g. the registration number of the first vehicle 1, and that the source is a positioning unit. The same type of data may be determined from the subsequent vehicle 2 by
 5 using the forward facing sensor unit 4 of the subsequent vehicle 2, e.g. a radar unit that determines a distance d between the subsequent vehicle 2 and the first vehicle 1. Based on the own position p_2 of the subsequent vehicle 2 determined by a positioning unit 10 in the subsequent vehicle 2, and a known length of the first vehicle 1, the position p_1 of the first vehicle 1 may be determined by the radar
 10 unit, the device 3 or any ECU in the subsequent vehicle 2. Thus, the position of the first vehicle is here retrieved from three different communication systems, i.e. WiFi, GPRS and a radar unit in the own vehicle 2.

Based on the received data, the device 3 is configured to determine a ranking for
 15 the plurality of communication systems 4, 5, 6, 10, 11 based on a quality analysis of the content of the received data. When the same type of data can be retrieved via a plurality of different communication systems 4, 5, 6, 10, 11, the data with the best quality may then be determined and used. Making a quality analysis of the content of the received data may comprise to determine how reliable the source of
 20 the data is. One way of making a quality analysis of the content of the received data is to calculate a quality measure for each source based on the received data assigned to the source, respectively. Such a quality measure may be a standard deviation σ :

$$25 \quad \sigma = \sqrt{\frac{1}{N-1} \cdot \sum_{i=1}^N (x_i - \bar{x})^2} \quad (\text{Eq. 1})$$

where N is the number of data values x_i and $\bar{x}$ is the mean value of the data values. The less deviation σ , the better the quality of the data. In order to determine the standard deviation σ of a source, a plurality of data values from the
 30 source should be retrieved and used. According to one embodiment, the determination of the ranking comprises to compare the quality measures, e.g. the

standard deviation σ , and to rank the communication systems 4, 5, 6, 10, 11 that transferred the data based on a result of the comparison.

Based on the determined ranking of the communication systems 4, 5, 6, 10, 11 for communication of the data, the device 3 may be configured to select a current communication system from the plurality of communication systems 4, 5, 6, 10, 11. The current communication system is the communication system that the vehicle should use at present for retrieval of the data. Different rankings of communication systems may be made for different types of data. Thus, one ranking each for each type of data is possible, and a plurality of different communication systems may be used at the same time for different types of data.

If retrieval of the data with the current communication system fails, the next ranked communication system may be selected as the current communication system, and so on. The device 3 may have the function of a filter of the incoming data from the plurality of communication systems 4, 5, 6, 10, 11, and only let certain data pass through to other devices in the vehicle that are using the data. According to another embodiment, the device 3 may inform other devices in the vehicle which communication system 4, 5, 6, 10, 11 that is the current communication system for data of a certain type. Other devices in the vehicle will then only take notice of data of that certain type retrieved with the current communication system, and neglect data of that type from other communication systems.

The ranking may also be used for merging of data of the same type from different sources based on the ranking in order to create enhanced merged data. For example may data of the same type from the two best ranked communication system be merged. According to another embodiment, the ranking may be used to determine an attribute, e.g. a weight, to the data, where after the data is merged in dependence on its attribute. For example, the weight may be determined based on the ranking, such that data from a less ranked communication system gets a lesser weight.

According to one embodiment, the device 3 is configured to use data from the source with the best quality measure as a reference for data from other sources of the same type. The data from other sources is then corrected based on the data
5 from the source with the best quality measure. Data from the source with the best quality measure may be used to calculate a bias for data of the same type from other lower ranked communication systems. If the communication system with the highest ranking then fails, then the bias may be used to correct the data from a lower ranked communication system. In this way data from lower ranked
10 communication systems may enhanced.

According to one embodiment, the device 3 may be configured to determine a quality measure of the transfer of data in each communication system, and to determine the ranking of the plurality of communication system also based on the
15 quality measure of the transfer of data. The actual transfer of data may for various reasons fail or be of inferior quality, e.g. due to packet loss, multipath fading, signal-to-noise ratio (SNR) etc of the signal with the data. The device 3 may thus determine the quality measure of the transfer of data by determining e.g. the amount of packet loss, if and how much the signal with the data is faded, the SNR
20 ratio of the signal etc. The quality measure of the transfer of data in each communication system may thus be compared with each other, and the communication system ranked depending also in the quality measure of the transfer of data.

25 The device 3 is further configured to generate information data indicating the selected current communication system and send the information data to a communication device 12 of the vehicle, whereby the driver of the vehicle is informed of the current selected communication system. For example, the communication device 12 may include icons representing each communication
30 system that can be lit-up if that communication system is currently used. If several communication systems are used at the same time, then several icons may be lit up. The icons may be displayed in the instrument cluster or any other display in

the vehicle. If one communication system fails, the icon representing that system will be turned off. The icons may be complemented with the type or types of data the communication system is transferring. The communication device 12 may include sound means such as a loud speaker, vibration means, e.g. in the

5 steering wheel or driver seat, or a smell releasing means arranged to release a smell or an odor, that may be arranged to inform the driver that a communication system is used, is down, or is changed. Any of the described means may be used to make the driver aware of the current communication situation. The vehicle may behave differently when the information system is changed. The described means

10 may thus be used to alert the driver that a controller or any other device may behave differently due to a communication system change, or failure. For example, an inter-vehicle spacing might increase or display harsher control actions if the WiFi communication system fails and only radar information is available due to safety reasons since latency is introduced in this case. Another

15 example is that the vehicle might not adjust its velocity over a varying topography if the GPS communication is lost. Thus, as the driver is aware of which information system that is used, driver trust to the technology can be increased as the driver will understand why the vehicle may behave differently. The driver or any controller may thus then take precautions, such as increasing a distance to a

20 preceding vehicle, because the data the controller use for decision making is less reliable than before.

The disclosure also relates to a method for managing communication for a vehicle, which will now be described with reference to the flowchart in Fig. 3. The

25 method may be implemented as program code and saved in the memory unit 9 in the device 3 (Fig. 2). The method may thus be implemented with the above described hardware of the device 3 (Fig. 2) in the vehicle 1.

The method comprises receiving data from a plurality of communication systems,

30 wherein the data is tagged with information assigning the data to a source, respectively (A1). It is here established which communication systems that are available for retrieval of data. The data may be needed e.g. for determining a

control strategy for the vehicle, or for any other function in the vehicle. The control strategy may be for a platooning operation of the vehicle, or for safety applications, or both. The method further comprises determining a ranking for the plurality of communication systems based on a quality analysis of the content of the received data (A2). The quality analysis may comprise calculating a quality measure for each source based on the received data assigned to the source, respectively. A quality measure may be a deviation value determined with the Eq. 1. The determination of the ranking may comprise comparing the quality measures and ranking the communication systems that transferred the data based on a result of the comparison.

Data from the source with the best quality measure may be used as a reference for data from other sources. The data from other sources may be corrected based on the data from the source with the best quality measure. A bias for the data from other sources may be calculated, and used to correct the data from other data sources if the communication system with the data from the source with the best quality measure fails.

Based on the determined ranking for communication of the data, the method may comprise selecting a current communication system from the plurality of communication systems. The method may further comprise informing the driver of the vehicle of the current selected communication system. The driver may be informed via the above described communication device 12 of the vehicle 1, 2.

The method may also comprise merging data of the same type from different sources based on the ranking in order to create enhanced merged data. This enhanced data may then be used for different controllers etc in the vehicle 1, 2.

The method may also comprise determining a quality measure of the transfer of data in each communication system, and determining a ranking of the plurality of communication system also based on the quality measure of the transfer of data. A quality measure may be determined with any of the described methods, by

determining e.g. the amount of packet loss, if and how much the signal with the data is faded, the SNR ratio of the signal etc. The quality measure of the transfer of data in each communication system may thus be compared with each other, and the communication system ranked depending also in the quality measure of the transfer of data.

The present invention is not limited to the above-described preferred embodiments. Various alternatives, modifications and equivalents may be used. Therefore, the above embodiments should not be taken as limiting the scope of the invention, which is defined by the appending claims.

Claims

1. A device (3) for managing communication for a vehicle (1),
characterized in that the device (3) is configured to:
 - receive data from a plurality of communication systems, wherein the
5 data is tagged with information assigning the data to a source of the data,
respectively;
 - determine a ranking for the plurality of communication systems
based on a quality analysis of the content of the received data.
2. The device (3) according to claim 1, configured to select a current
10 communication system from the plurality of communication systems based on
the determined ranking for communication of the data.
3. The device (3) according to claim 2, configured to generate
information data indicating the selected current communication system and
send the information data to a communication device (12), whereby the driver
15 of the vehicle is informed of the current selected communication system.
4. The device (3) according to any of the preceding claims, configured to
perform a quality analysis comprising to calculate a quality measure for each
source based on the received data assigned to the source, respectively.
5. The device (3) according to claim 4, wherein the determination of the
20 ranking comprises to compare the quality measures and to rank the
communication systems that transferred the data based on a result of the
comparison.
6. The device (3) according to claim 4 or 5, configured to use data from
the source with the best quality measure as a reference for data from other
25 sources and correcting the data from other sources based on the data from the
source with the best quality measure.
7. The device (3) according to any of the claims 4 to 6, configured to
merge data of the same type from different sources based on the ranking in
order to create enhanced merged data.
- 30 8. The device (3) according to any of the preceding claims, configured to
determine a quality measure of the transfer of data in each communication

system, and to determine the ranking of the plurality of communication system also based on the quality measure of the transfer of data.

9. The device (3) according to any of the preceding claims, configured to determine a quality measure being a deviation value.

5 10. A method for managing communication for a vehicle, the method comprising:

- receiving data from a plurality of communication systems, wherein the data is tagged with information assigning the data to a source, respectively;

10 - determining a ranking for the plurality of communication systems based on a quality analysis of the content of the received data.

11. A computer program P, wherein said computer program P comprises a computer program code to cause a device (2), or a computer connected to said device (2), to perform the method according to claim 10.

15 12. A computer program product comprising a computer program code stored on a computer-readable medium to perform the method according to claim 10, when said computer program code is executed by a device (2) or by a computer connected to said device (2).

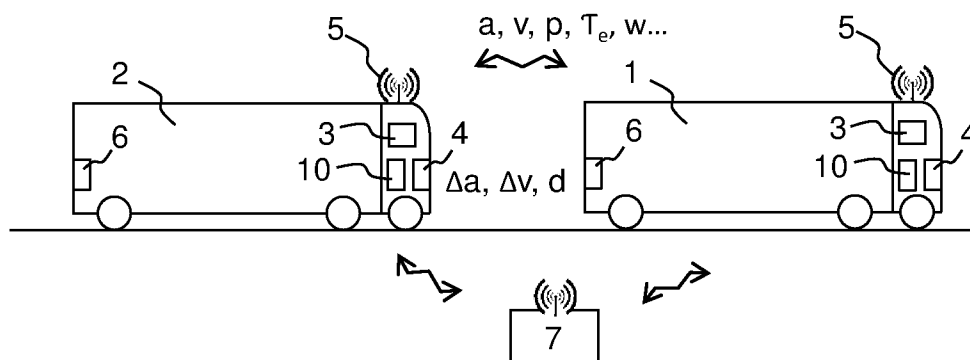


FIG. 1

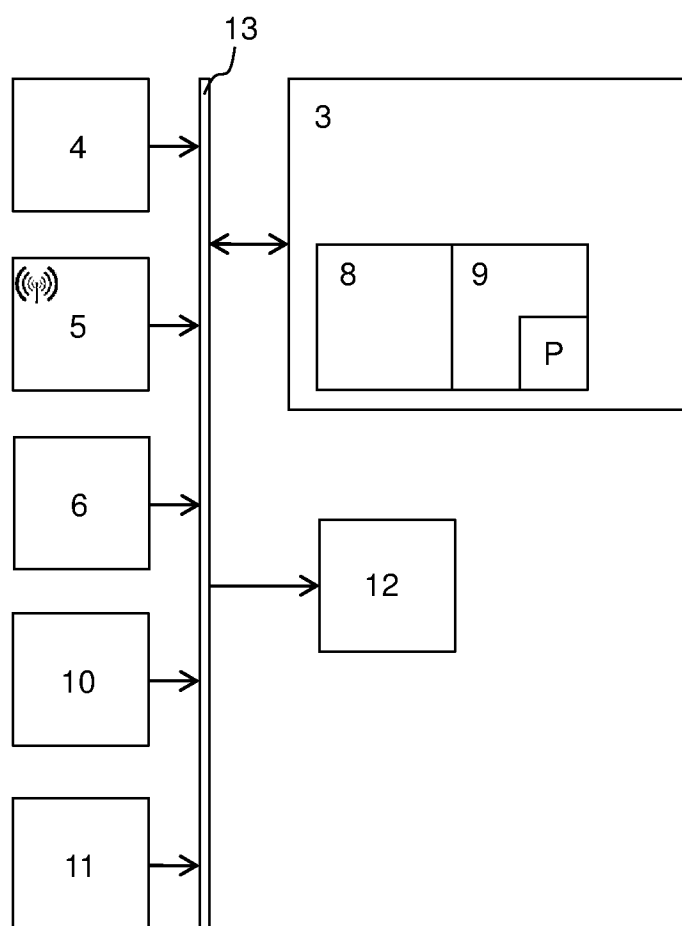


FIG. 2

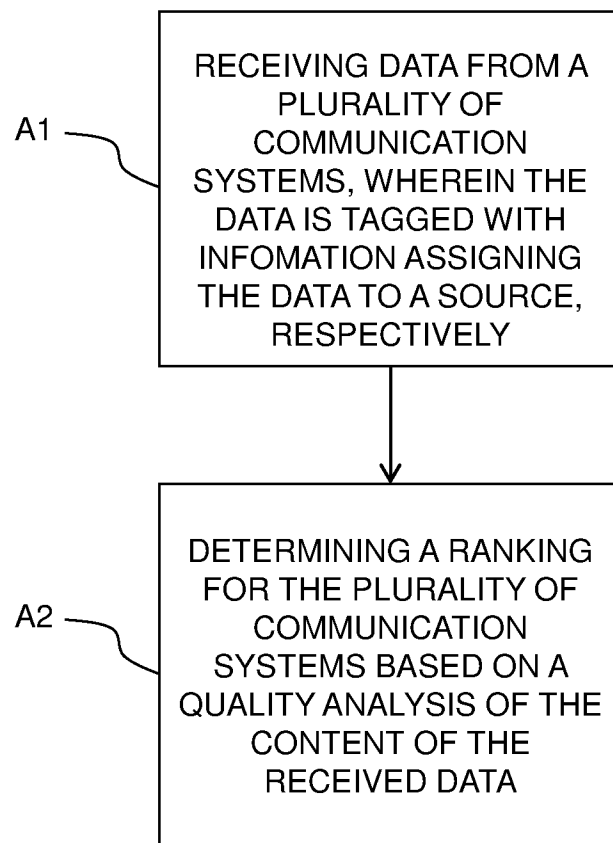


FIG. 3

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE2016/050270

A. CLASSIFICATION OF SUBJECT MATTER

IPC: see extra sheet

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC: B60W, G05D, G08G, H04B, H04W

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE, DK, FI, NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, PAJ, WPI data, COMPENDEX, INSPEC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2014172320 A1 (FLEXTRONICS AP LLC), 23 October 2014 (2014-10-23); abstract; paragraphs [0117]-[0118], [0620]-[0623], [0627], [0733] --	1-12
X	US 20140199987 A1 (WRIGHT ANDREW S ET AL), 17 July 2014 (2014-07-17); abstract; paragraphs [0009], [0012], [0122]-[0124]; figure 9; claim 6 --	1-12
A	US 5311195 A (MATHIS DARRELL L ET AL), 10 May 1994 (1994-05-10); abstract --	1-12

☒ Further documents are listed in the continuation of Box C.☒ See patent family annex.

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Box 5055

S-102 42 STOCKHOLM

Facsimile No. + 46 8 666 02 86

Authorized officer

Emma Hedlund

Telephone No. + 46 8 782 28 00

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE2016/050270

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International Patent Classification (IPC)

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H04W 4/04 (2009.01)

B60W 30/165 (2012.01)

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