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(54) Title: SIGNAL SYSTEM AND METHOD FOR FACILITATING NAVIGATION OF VEHICLES THROUGH A HILLY ROAD

(57) Abstract: The present disclosure discloses a signal system and method for facilitating navigation of vehicles through a hilly road. The signal system (100a) comprises a plurality of posts positioned along the hilly road, Further, the signal system (100a) comprises a processor (205). The processor (205) is configured to detect a traffic congestion at a particular road section of the plurality of road sections and control the first display (103), the second display (107), the first signal post (101), and the second signal post (105) to display information pertaining to the detected traffic congestion at the particular road section to avoid entry of vehicles on the hilly road.

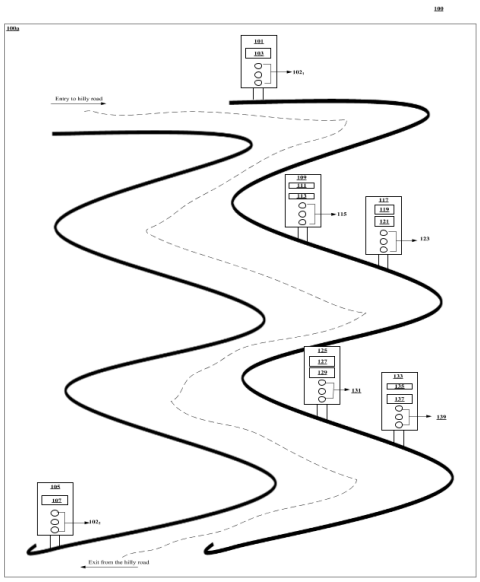

Figure 1A

FORM 2

THE PATENTS ACT 1970
(39 OF 1970)
&
The Patent Rules, 2003

Complete Specification
(See Section 10 and Rule 13)

1. TITLE OF THE INVENTION

SIGNAL SYSTEM AND METHOD FOR FACILITATING NAVIGATION OF VEHICLES THROUGH A HILLY ROAD

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3. PREAMBLE TO THE DESCRIPTION

COMPLETE

The following specification particularly describes the invention and the manner in which it is to be performed

TECHNICAL FIELD

[001] The present disclosure generally relates to traffic management system. More particularly, the present disclosure relates to a signal system and a method for facilitating navigation of vehicles through a hilly road.

BACKGROUND

[002] It is generally helpful to drivers of vehicle if they are made aware of changes in driving situations or conditions ahead of time. If not, there may be several difficulties faced by the drivers of the vehicles (specifically, for the hilly roads). For example, a hilly road may include different road sections. The different road sections may be, for example, the ghat road sections on the hilly road. Sometimes, the ghat road sections may be full of traffic due to some reasons such as accidents etc. Also, the ghat section road may be sometimes filled with the obstacles due to the natural calamities (e.g., landslides of the hill). If the driver is not alerted about the situations on the ghat road in advance, the driver may stick in the road as he cannot move forward because of the traffic congestion and/or obstacles. Alternatively, the driver cannot take his vehicle reverse as the other vehicles are present or the other vehicles following the vehicle. As a result, the driver may spend valuable time on the road till the obstacles/traffic are cleared.

[003] In view of above, there is a need for alerting the drivers about the road conditions or traffic conditions on the road (for example, ghat roads) in advance in order to avoid the vehicles to enter the ghat road sections which are filled with obstacles or presence of traffic.

[004] The information disclosed in this background of the disclosure section is only for enhancement of understanding of the general background of the invention and should not be taken as an acknowledgement or any form of suggestion that this information forms the prior art already known to a person skilled in the art.

SUMMARY

[005] In an embodiment, the present disclosure discloses a signal system for facilitating navigation of vehicles through a hilly road. The signal system comprises a plurality of posts positioned along the hilly road, wherein the plurality of signal posts comprises a first signal post positioned at an entry point of the hilly road and a second signal post positioned at an exit point of the hilly road, and wherein the hilly road comprises a plurality of road sections and each road section of the plurality of road sections comprises at least two signal posts positioned on the same side of the road section, a first display positioned at the entry point and mounted

on the first signal post and a second display positioned at the exit point and mounted on the second signal post, and a processor communicatively coupled with the plurality of signal posts, the first display, and the second display, wherein each signal post comprises a plurality of sensors. The processor is configured to detect a traffic congestion at a particular road section of the plurality of road sections by processing data gathered from one or more of the plurality of sensors associated with the at least two signal posts corresponding to the particular road section and control the first display, the second display, the first signal post, and the second signal post to display information pertaining to the detected traffic congestion at the particular road section to avoid entry of vehicles on the hilly road.

[006] In an embodiment, the present disclosure discloses a method for facilitating navigation of vehicles through a hilly road using a signal system. The method comprises detecting a traffic congestion at a particular road section of the plurality of road sections by processing data gathered from one or more of the plurality of sensors associated with the at least two signal posts corresponding to the particular road section and controlling the first display, the second display, the first signal post, and the second signal post to display information pertaining to the detected traffic congestion at the particular road section to avoid entry of vehicles on the hilly road.

[007] The foregoing summary is illustrative only and is not intended to be in any way limiting. In addition to the illustrative aspects, embodiments, and features described above, further aspects, embodiments, and features will become apparent by reference to the drawings and the following detailed description.

BRIEF DESCRIPTION OF THE ACCOMPANYING DRAWINGS

[008] The novel features and characteristics of the disclosure are set forth in the appended claims. The disclosure itself, however, as well as a preferred mode of use, further objectives, and advantages thereof, will best be understood by reference to the following detailed description of an illustrative embodiment when read in conjunction with the accompanying figures. One or more embodiments are now described, by way of example only, with reference to the accompanying figures wherein like reference numerals represent like elements and in which:

[009] Figure 1A illustrates an exemplary environment **100** comprising a signal system **100a** for facilitating navigation of vehicles through a hilly road, in accordance with some embodiments of the present disclosure.

[0010] Figure 1B illustrates an exemplary environment **100** comprising a signal system 100a for facilitating navigation of vehicles through a hairpin bend of the hilly road, in accordance with some embodiments of the present disclosure.

[0011] Figure 2 illustrates a detailed block diagram **200a** of the signal system **100a** shown in **Figure 1A**, in accordance with some embodiments of the present disclosure.

[0012] Figure 3 illustrates a flow chart illustrating a method **300** for facilitating navigation of vehicles through a hilly road, in accordance with some embodiments of the present disclosure.

[0013] Figure 4 depicts a flow chart illustrating a method **400** for facilitating navigation of vehicles through a hilly road, in accordance with some embodiments of the present.

[0014] It should be appreciated by those skilled in the art that any block diagram herein represents conceptual views of illustrative systems embodying the principles of the present subject matter. Similarly, it will be appreciated that any flow charts, flow diagrams, state transition diagrams, pseudo code, and the like represent various processes which may be represented in computer readable medium and executed by a computer or processor, whether or not such computer or processor is explicitly shown.

DETAILED DESCRIPTION

[0015] In the present document, the word "exemplary" is used herein to mean "serving as an example, instance, or illustration." Any embodiment or implementation of the present subject matter described herein as "exemplary" is not necessarily to be construed as preferred or advantageous over other embodiments.

[0016] While the disclosure is susceptible to various modifications and alternative forms, specific embodiment thereof has been shown by way of example in the drawings and will be described in detail below. It should be understood, however that it is not intended to limit the disclosure to the particular forms disclosed, but on the contrary, the disclosure is to cover all modifications, equivalents, and alternatives falling within the scope of the disclosure.

[0017] The terms “comprises”, “comprising”, or any other variations thereof, are intended to cover a non-exclusive inclusion, such that a setup, device, or method that comprises a list of components or steps does not include only those components or steps but may include other components or steps not expressly listed or inherent to such setup or device or method. In other words, one or more elements in a system or apparatus proceeded by “comprises… a” does not, without more constraints, preclude the existence of other elements or additional elements in the system or apparatus.

[0018] The terms like “at least one” and “one or more” may be used interchangeably throughout the description. The terms like “a plurality of” and “multiple” may be used interchangeably throughout the description.

[0019] **Figure 1A** illustrates an exemplary environment **100** comprising a signal system **100a** for facilitating navigation of vehicles through a hilly road, in accordance with some embodiments of the present disclosure. Though the forthcoming techniques of the present disclosure are described in the context of hilly roads (also referred to as “Ghat Roads”). However, the present disclosure is not limited thereto and in general the signal system and the associated technology of the present disclosure can be used for any type of road and in any type of environment.

[0020] The exemplary environment **100** may comprise a signal system **100a**. For example, the signal system **100a** may be a traffic management system configured to manage traffic on a hilly road. The present disclosure is not limited thereto. In another example, the signal system **100a** may be an obstacle detection system configured to detect the obstacles on the hilly road. In one embodiment, the signal system **100a** may not only manage the traffic on the hilly road, the signal system **100a** may also be configured to manage the traffic on, without limitation, a ghat section road, a normal highway road and the like. Similarly, the signal system **100a** may also be configured to detect the obstacles on, without limitation, the ghat section road, the normal highway road.

[0021] The signal system **100a** may comprise a first signal post **101** and a second signal post **105**. The plurality of signal posts **101, 105** may be positioned along the hilly road. For example, the first signal post **101** may be positioned at an entry point of the hilly road as shown in **Figure 1A**. On the other hand, the second signal post **105** may be positioned at an exit point of the hilly road. The first signal post **101** at the entry point may comprise a first display **103** and a

plurality of traffic signal light **102_1** mounted on the same first signal post **101**. In another embodiment, the first display **103** may be placed separate from the first signal post **101** and the first display **103** may be communicatively coupled with the first signal post **101** through a wireless connection or wired connection. The plurality of traffic signal light **102_1** may include a red traffic light, a yellow traffic light, and a green traffic light. Similarly, the second signal post **105** at the exit point may comprise a second display **107** and a plurality of traffic signal lights **102_2** mounted on the same first signal post **101**. In another embodiment, the second display **107** may be placed separate to the second signal post **105** and the second display **107** may be communicatively coupled with the second signal post **105** through a wireless connection or wired connection. The plurality of traffic signal lights **102_2** may include a red traffic light, a yellow traffic light, and a green traffic light.

[0022] The hilly road may comprise a plurality of road sections and each road section of the plurality of road sections may comprise at least two signal posts positioned on the same side of the road section along the hilly road (e.g., on a mountain side of the hilly road). In another embodiment, the at least two signal posts may be positioned on other side of the road section (e.g., on a valley side of the hilly road). In yet another embodiment, signal posts may be positioned on both side of a particular road section (e.g., on a valley and mountain sides of the hilly road). For example, as shown in **Figure 1A**, the at least two signal posts **109**, **117** positioned on the same side of the road section along the mountain road. Similarly, the at least two signal posts **125**, **133** positioned on the same side of the road section along the mountain road. The at least two signal posts, for example, **109**, **117** may communicate with each other through a communication network (not shown in **Figure 1A**). In another example, the at least two signal posts **109**, **117** may communicate through a wired connection.

[0023] The signal post **109** may comprise a plurality of sensors **111**, an image acquisition sensor **113** and a plurality of traffic signal light**115**. The signal post **109** may also comprise a transmitter (not shown in **Figure 1A**), and the signal post **117** may comprise a plurality of sensors **119**, an image acquisition sensor **121** and a plurality of traffic signal light **123**. The signal post **117** may also comprise a receiver (not shown in **Figure 1A**). Simialrly, the signal post **125** may comprise a plurality of sensors **127**, an image acquisition sensor **129** and a plurality of traffic signal light **131**. The signal post **125** may also comprise a transmitter (not shown in **Figure 1A**), and the signal post **133** may comprise a plurality of sensors **135**, an

image acquisition sensor **137** and a plurality of traffic signal light **139**. The signal post **133** may also comprise a receiver (not shown in **Figure 1A**).

[0024] For example, the plurality of sensors may include, without limitation, a Radio Detection and Ranging (RADAR) sensor, a Light Detection and Ranging (LIDAR) sensor, and the like. The RADAR sensor may be used to identify vehicles speed, the LIDAR sensor may be used to identify vehicles position. The image acquisition sensors **113**, **121**, **129**, **137** may include, without limitation, a camera, any image capturing devices and the like.

[0025] The signal system **100a** may comprise a processor (not shown in **Figure 1A**) communicatively coupled with each of the plurality of signal posts **109**, **117**, **125**, **133**. The processor may also be coupled with the first display **103** associated with the first signal post **101** and the second display **107** associated with the second signal post **105**. The various entities (e.g., the processor, the signal posts, the displays) may be communicatively coupled with each other via any suitable wireless medium or wired communication medium.

[0026] The processor may be configured to detect a traffic congestion at a particular road section of the plurality of road sections by processing data gathered from one or more plurality of sensors associated with the at least two signal posts **109**, **117** corresponding to the particular road section. For example, consider the hilly side the, where the at least two signal posts **109**, **117** communicating with each other through a communication network. Specifically, when there is a traffic congestion on a road section where the at least two signal posts **109**, **117** are placed. The processor may collect real-time data on movement and speed of vehicles at that particular road section using the RADAR sensors and the LIDAR sensors, respectively. For example, the slow movement or blockage of the road may be detected and the information is collected. In the next step, the processor may capture real-time visual information of the hilly road using the image acquisition sensor associated with the at least two signal posts **109**, **117**.

[0027] In the further step, the processor may detect the traffic congestion at the particular road section. For example, the processor may process the real-time data on movement and speed of the vehicles and the real-time visual information of the hilly road and subsequently, detect the traffic congestion at the particular road section. In the next step, after detecting the traffic congestion, the processor may transmit a signal (information regarding to traffic congestion) to the first signal post **101** at entry point and the second signal post **105** at the exit point. For example, the signal post **109** may comprise a transmitter and the processor may transmit a

signal to the first display **103** using a signal post **109**. The first signal post **101** and the second signal post **105** may comprise a receiver and may receive the signal transmitted from the signal post **109**. Consequently, the first display **103** associated with the first signal post **101** and the second display **107** associated with the second signal post **105** may display the traffic congestion information. The vehicles are avoided by entering the hilly road from both sides (entry and exit) of the road. The same functions or operations are performed at the different road sections where the at least two signal posts are placed.

[0028] In another embodiment, each signal posts at different road section may include a plurality of measuring array sensors (not shown in **Figure 1A**). The measuring array sensors of one signal post **109** may communicate with the measuring array sensors of the other signal post **117**. The plurality of measuring array sensors may be configured to record the presence of obstacles on the road sections. For example, the processor may detect presence of obstacles at a particular road section of the plurality of road sections by processing data gathered from the one or more from a plurality of measuring array sensors associated with the at least two signal posts 109, 117 corresponding to the particular road section. Specifically, for example, the signal posts **109**, and **117** may continuously communicate with each other through communication network or with a wired connection. If there is any natural disaster such as landslide, or any obstacles, the communication between the two signal posts **109**, **117** or the plurality of measuring array sensors may be disconnected or stopped. For example, to detect the presence of obstacles at the particular road section, the processor detects where there is a breakdown in a light beam array between the at least two signal posts **109**, **117** along the hilly road corresponding to the particular road section. In the next step, after detecting the break down in the light beam array between the at least two signal posts **109**, **117**, the processor may detect the presence of obstacles at the particular road section. In the next step, after detecting the presence of obstacles on the particular road section, the processor may transmit a signal to the first signal post **101** and the second signal post **105** to display information pertaining to the detected presence of obstacles on the first signal post **101** with the first display **103**, the second signal post **105** with the second display **107**. It may be noted that the processor may additionally determine the exact position/location of the traffic congestion (or distance of traffic congestion from the entry/exit points) and/or may also determine the exact position/location of the obstacle (or distance of obstacle from the entry/exit points) by processing the data gathered from the sensors.

[0029] In another embodiment, as shown in **Figure 1B**, the hilly road may comprise at least one hairpin bend between a first and a second road sections of the plurality of road sections of the hilly road. The signal system **100a** may comprise a first plurality of wireless magnetometers **153** positioned on the first road section at a predefined distance from one end of the hairpin bend and a second plurality of wireless magnetometers **155** positioned on the second road section at the predefined distance from another end of the hairpin bend, wherein the processor is communicatively coupled with the first and second plurality of wireless magnetometers **153**, **155**. The road section maybe classified as a short turning curve **161** and a long turning curve **163**. The short vehicles pass through the short turning curve **161** and the long vehicles pass through the long turning curve **163**. The LED indicators (not shown in **Figure 1B**) may be placed on the short turning curve **161** and the long turning curve **163**.

[0030] The hilly road may also comprise a plurality of signal posts **141**, **147** which comprises a red traffic signal light, a yellow traffic signal light, and a green traffic signal light, and the image acquisition sensors **143**, **149**, respectively. When the vehicle is stepping on the first road section, the processor may activate a red traffic signal light on the signal post **147** associated with the second road section. Subsequently, the processor may determine length of the vehicle stepping on the first road section based on the data received from the first plurality of wireless magnetometers **153** and vehicle images captured by the image acquisition sensor **143** mounted on a signal post **141** associated with the first road section. Similarly, when the vehicle is stepping on the second road section, the processor may activate a red traffic signal light on the signal post **141** associated with the first road section. Subsequently, the processor may determine length of the vehicle stepping on the second road section based on the data received from the second plurality of wireless magnetometers **156** and vehicle images captured by the image acquisition sensor **149** mounted on a signal post **147** associated with the second road section.

[0031] If the processor determines that the length of the vehicle is less than a threshold vehicle length, the processor may recommend a short turning curve **161** and enable the green LED lighting on the short turning curve **161** and disable the LED lighting on the long turning curve **163** on the road. If the processor determines that the length of the vehicles is greater than a threshold vehicle length, the processor may recommend the long turning curve **163** and enable the green LED lighting on the long turning curve **163** on the road and subsequently, disable the LED lighting on the short turning curve **161** on the road. The vehicle short in length may pass

through the short turning curve **161**. Alternatively, the vehicle greater in length may pass through the long turning curve **163**. When the vehicle (short or long) passing through the first road section, the vehicles in the second road section may wait near the mark **159** of the second road section until the vehicles are passed. Similarly, when the vehicle (short or long) passing through the second road section, the vehicles in the first road section may wait near the mark **157** until the vehicles are passed. In one example, if there are no vehicles on both the road sections (first road section and second road section) the signal posts **141**, **147** may display green traffic signal light and the LED lights on the short turning curve **161** and long turning curve **163** may be disabled.

[0032] Figure 2 illustrates a detailed block diagram **200** of a signal system **100a** shown in **Figure 1A**, in accordance with some embodiments of the present disclosure.

[0033] In an embodiment, the signal device **101** may include a plurality of signal posts 101, **105**, an interface **201**, a memory **203**, and a Central Processing Unit (also referred as "CPUs" or "the one or more processors") **205**. In some embodiments, the interface **201** may be the memory **203** may be communicatively coupled to the one or more processors **205**. The memory **203** stores instructions executable by the one or more processors **205**. The one or more processors **205** may comprise at least one data processor for executing program components for executing user or system-generated requests. The one or more processors **205** may perform one or more functions of the signal system **100a** for facilitating navigation of vehicle through a hilly road. The memory **203** may store instructions, executable by the one or more processors **205**, which on execution, may cause the one or more processors **205** to facilitate navigation of vehicles through a hilly road. The interface **201** may be coupled with the one or more processors **205**.

[0034] In an embodiment, the one or more processor **205** may include one or more modules or hardware units, for e.g., a detecting unit **207**, and a control unit **209**, but not limited thereto. In some embodiments, the one or more modules or units may be software modules which may be stored in the memory **203**. The one or more modules or hardware units may be configured to perform the various operations of the present disclosure to facilitate navigation of vehicles through a hilly road.

[0035] Figure 3A-3C illustrates a method **300** for facilitating navigation of vehicles through a hilly road, in accordance with some embodiments of the present disclosure.

[0036] As shown in **Figure 3A**, initially, the process may be started. At block **302**, a signal system **100a** may be turned ON or Switched ON. Subsequently, the processor **205** may read the measuring array sensor as indicated in the block **304**. At the block **306**, the processor **205** may measure the signal level from the array sensor. For example, the processor **205** may determine whether the measuring array sensor signal is high level signal or a low level signal. For example, the processor **205** may monitor the communication between the at least two signal posts, for example, **109**, **117**. If there is any natural disaster the communication between the at least two signal posts disconnected. Specifically, the breakdown of light array beam is identified. When there is breakdown in the light beam array between the at least two signal posts **109**, **117** it indicates that there may be a high level signal. The high level signal may be transmitted to the signal posts **101**, **105** at the entry point and the exit point. If the high level signal is identified, then the processor **205** may enable red traffic signal light both at entry point and the exit point as indicated in the block **308**. At the block **310**, the processor **205** may turn ON the red traffic signal light in the signal posts **101**, 105 (or signal system 1 and system 2). The displays **103**, **107** may display traffic congestion message to alert the vehicles entering the hilly road about the information of traffic congestion and presence of obstacles in the road as indicated in the block **312**. At the block **314**, the traffic congestion message is displayed on the LED display at signal posts at the entry point and exit point At block "B" the vehicles may read the information or message displayed on the displays and may not enter the hilly road.

[0037] Now referring back to the block **306**, if the measuring array sensor identifies the low level signal, processor **205** may read camera images and sensor (RADAR, LIDAR, and camera) values to detect the traffic congestion on the road as shown in the block **316** and **318**. At the block **320**, the processor **205** may verify the signal level based on RADAR, LIDAR and camera captured images. If the signal level is high then the processor **205** may repeat the steps shown in the blocks **308**-**314**. However, if the signal level is low, the step moves forward to block "A" i.e., **Figure 3B**.

[0038] As shown in **Figure 3B**, at the block **322**, when the processor **205** determines that the signal level is low at the block **320**, this indicates that there is a free moving traffic, then processor **205** may enable the green traffic signal light on both entry and exit signal posts **101**, **105**. At block **324**, the processor **205** may display free moving traffic at entry and exit signal post **101**, **105**. Accordingly, the vehicles may enter into the hilly road. At the block **326**, the

processor **205** may read wireless magnetometer sensors **153**, **155** values. At the block **328**, the processor **205** may measure the signal level of the wireless magnetometer sensors **153**. The processor **205** may measure the whether the signal level is high or low. If the signal level is high, the information or signal of the vehicle travelling at the hairpin bend of the road is transmitted to the second signal post **149**, and subsequently, in the second signal post **149** (on the opposite side) the red traffic signal light is enabled as shown in the block **330** and **332**.. The next step moves to block "C" of **Figure 3C.**

[0039] Now referring back to the block **328**, if the signal level is low, then the step moves forward to the block **334**. At the block **334**, the processor **205** may further verify or determine the signal level of the wireless magnetometers **155**. If the signal level is high, the steps in the blocks **330-332** are repeated. If the signal level is low, the processor **205** may enable green traffic signal light as shown in the block 336. The next step moves to block "B".

[0040] As shown in **Figure 3C**, at the block **338**, the processor **205** may detect the vehicle length. When the vehicle stepped on the wireless magnetometer sensors **153**, **155** placed on the road, the wireless magnetometer sensor 153, 155 may detect the vehicle length as shown in the block **338**. At the block **340**, the processor **205** may detect whether the vehicle length is long or short using wireless magnetometer sensors **153**, **155**. If the processor **205** determines that the vehicle length is short, then the step moves to the block **342**. At block **342**, the processor **205** may enable short turning curve **161**, and may enable the green light on the short turning curve **161** as indicated in the block **344** and simultaneously, enable the red traffic signal light in the signal post for the other side vehicles coming from the opposite direction. The short vehicles may pass through the short turning curve **161** lane. In the next step, the vehicles on the other lane from the opposite may wait to cross the short vehicle as indicated in the block **350**. At the block **352**, the processor **205** may disable the curve light and disable the red traffic signal light on the other signal post and enable green lights on the signal post opposite side as indicated in the blocks **354** and **356**. In the next step, the process moves to block "B"

[0041] Now referring back to block **340**, If the processor **205** determines that the vehicle length is long, then then the processor **205** may enable long turning curve **163** as shown in the block **346**, and subsequently, the processor **205** may enable green light on the long turning curve **163** lane. The long vehicles may pass through the long turning curve **163** lane. In the next step, the steps mentioned in the blocks **350-356** are repeated. At the block **358**, the signal system is switched OFF or turned OFF.

[0042] Figure 4 depicts a flow chart illustrating a method **400** for facilitating navigation of vehicles through a hilly road, in accordance with some embodiments of the present.

[0043] As illustrated in **Figure 4**, the method **400** may comprise one or more steps. The method **400** may be described in the general context of computer executable instructions. Generally, computer executable instructions can include routines, programs, objects, components, data structures, procedures, modules, and functions, which perform particular functions or implement particular abstract data types.

[0044] The order in which the method **400** is described is not intended to be construed as a limitation, and any number of the described method blocks can be combined in any order to implement the method. Additionally, individual blocks may be deleted from the methods without departing from the scope of the subject matter described herein. Furthermore, the method can be implemented in any suitable hardware, software, firmware, or combination thereof.

[0045] At block **402**, the method **400** comprises detecting a traffic congestion at a particular road section of the plurality of road sections by processing data gathered from one or more of the plurality of sensors associated with the at least two signal posts corresponding to the particular road section. The operations of block **402** may be performed by the processor **205** (particularly, by a detecting unit **207**) of **Figure 2**.

[0046] At block **404**, the method **400** comprises controlling the first display, the second display, the first signal post, and the second signal post to display information pertaining to the detected traffic congestion at the particular road section to avoid entry of vehicles on the hilly road. The operations of block **404** may be performed by the processor **205** (particularly, by the control unit **209**) of **Figure 2**.

ADVANTAGES OF THE INVENTION

[0047] In the present disclosure, a traffic congestion or obstacles at a particular road section may be detected efficiently, effectively, and in real-time and the information regarding the detected traffic congestion, obstacles is transmitted in real-time to the signal posts at the entry point and the exit point. As a result, the vehicles may get alerts regarding the traffic congestion or presence of obstacles at specific location (even before entering into the hilly road section). Consequently, the driver of the vehicle may avoid entering into the hilly road till the traffic

congestion reduces or till the obstacles are removed or may take alternative road which will result in saving valuable time of drivers/passengers and may also save valuable resources of the vehicle (e.g., battery power, fuel, etc.) thereby enhancing the overall user's/driver's experience & which will also result in providing easy access & more space for supporting vehicle & team to remove the obstacles to clear the traffic congestion at the earliest.

[0048] The terms "including", "comprising", "having" and variations thereof mean "including but not limited to", unless expressly specified otherwise. The enumerated listing of items does not imply that any or all of the items are mutually exclusive, unless expressly specified otherwise. The terms "a", "an" and "the" mean "one or more", unless expressly specified otherwise.

[0049] In alternative embodiments, certain operations may be performed in a different order, modified, or removed. Moreover, steps may be added to the above-described logic and still conform to the described embodiments. Further, operations described herein may occur sequentially or certain operations may be processed in parallel. Yet further, operations may be performed by a single processing unit or by distributed processing units.

[0050] Finally, the language used in the specification has been principally selected for readability and instructional purposes, and it may not have been selected to delineate or circumscribe the inventive subject matter. It is therefore intended that the scope of the invention be limited not by this detailed description, but rather by any claims that issue on an application based here on. Accordingly, the disclosure of the embodiments of the invention is intended to be illustrative, but not limiting, of the scope of the invention, which is set forth in the following claims.

Referral Numerals:

Referral number	Description
100	Exemplary environment
100a	Signal system
101	First signal post at entry point
102_1	Plurality of traffic signal lights at first signal post

102_2	Plurality of traffic signal lights at second signal post
103	Display mounted on first signal post
105	Second signal post at exit point
107	Display mounted on second signal post
109, 117	At least two signal posts on the same side
111	Plurality of sensors
113	Image acquisition sensor
115	Plurality of traffic signal lights associated with signal post
119	Plurality of sensors
121	Image acquisition sensor
123	Plurality of traffic signal lights associated with signal post
125, 133	At least two signal posts on the same side
127	Plurality of sensors
129	Image acquisition sensor
131	Plurality of traffic signal lights
135	Plurality of sensors
137	Image acquisition sensor
139	Plurality of traffic signal lights associated with signal post
141	Signal post at hairpin bend in the first road section
143	Image acquisition sensor
145	Plurality of Traffic signal lights
147	Signal post at hairpin bend in the second road section
149	Image acquisition sensor
151	Plurality of Traffic signal lights
153	First plurality of wireless magnetometer sensors
155	Second plurality of wireless magnetometer sensors

157	Mark on the first road section
159	Mark on the second road section
161	Short turning curve
163	Long turning curve
201	Interface
203	Memory
205	Processor
207	Detecting unit
209	Control unit

WE CLAIM:

1. A signal system (100a) for facilitating navigation of vehicles through a hilly road, the signal system (100a) comprising:

a plurality of signal posts positioned along the hilly road, wherein the plurality of signal posts comprises a first signal post (101) positioned at an entry point of the hilly road and a second signal post (105) positioned at an exit point of the hilly road, and wherein the hilly road comprises a plurality of road sections and each road section of the plurality of road sections comprises at least two signal posts (109, 117; 125, 133) positioned on the same side of the road section;

a first display (103) positioned at the entry point and mounted on the first signal post (101) and a second display (107) positioned at the exit point and mounted on the second signal post (105); and

a processor (205) communicatively coupled with the plurality of signal posts, the first display (103), and the second display (107), wherein each signal post comprises a plurality of sensors, and wherein the processor (205) is configured to:

detect a traffic congestion at a particular road section of the plurality of road sections by processing data gathered from one or more of the plurality of sensors associated with the at least two signal posts (109, 117; 125, 133) corresponding to the particular road section; and

control the first display (103), the second display (107), the first signal post (101), and the second signal post (105) to display information pertaining to the detected traffic congestion at the particular road section to avoid entry of vehicles on the hilly road.

2. The signal system (100a) as claimed in claim 1, wherein the plurality of sensors (111, 119, 127, 135) comprises at least a RADAR sensor, a LIDAR sensor, and an image acquisition sensors (113, 121, 129, 137).

3. The signal system (100a) as claimed in claim 2, wherein to detect the traffic congestion at the particular road section, the processor is configured to:

collect, using the RADAR sensors, LIDAR sensors associated with the at least two signal posts, real-time data on movement and speed of vehicles;

capture, using the image acquisition sensor (113, 121) associated with the at least two signal posts (109, 117), real-time visual information of the hilly road;

detect the traffic congestion at the particular road section by processing the real-time data on movement and speed of vehicles and the real-time visual information of the hilly road; and

transmit a signal to the first signal post (101) at entry point and the second signal post (105) at exit point to display information pertaining to the detected traffic congestion on the first signal post (101) with the first display (103), the second signal post (105) with the second display (107).

4. The signal system (100a) as claimed in claim 2, wherein the processor (205) is further configured to:

detect presence of obstacles at a particular road section of the plurality of road sections by processing data gathered from one or more of the plurality of sensors associated with the at least two signal posts (109, 117) corresponding to the particular road section; and

control the first display (103), the second display (107), the first signal post (101), and the second signal post (105) to display information pertaining to the detected obstacles at the particular road section to avoid entry of vehicles on the hilly road.

5. The signal system (100a) as claimed in claim 1, wherein each signal post comprises a plurality of measuring array sensors and wherein the measuring array sensors of one signal post is communicating with the measuring array sensors of the other signal post, and wherein to detect the presence of obstacles at the particular road section, the processor (205) is configured to:

detect where there is a breakdown in a light beam array between the at least two signal posts (109, 117) along the hilly road corresponding to the particular road section;

upon detecting the breakdown in the light beam array between the at least two signal posts (109, 117), detect the presence of obstacles at the particular road section; and

upon detecting the presence of obstacles, transmit a signal to the first signal post (101) and the second signal post (105) to display information pertaining to the detected presence of obstacles on the first signal post (101) with the first display (103), the second signal post (105) with the second display (107).

6. The system as claimed in claim 1, wherein the hilly road comprises at least one hairpin bend between a first and a second road sections of the plurality of road sections of the hilly road, the system (100a) further comprises a first plurality of wireless magnetometers (153) positioned on the first road section at a predefined distance from one end of the hairpin bend and a second

plurality of wireless magnetometers (155) positioned on the second road section at the predefined distance from another end of the hairpin bend, wherein the processor (205) is communicatively coupled with the first and second plurality of wireless magnetometers (153, 155).

7. The signal system (100a) as claimed in claim 6, wherein each of the plurality of signal posts (141, 147) comprises a plurality of traffic signal lights including a red traffic signal light, a yellow traffic signal light, and a green traffic signal light, wherein LED indicators are mounted on the road, and wherein the processor (205) is further configured to:

upon detecting a vehicle stepping on the first road section, activate a red traffic signal light on the signal post (147) associated with the second road section;

determine length of a vehicle stepping on the first road section based on data received from the first plurality of wireless magnetometers (153) and vehicle images captured by an image acquisition sensor (143) mounted on a signal post (141) associated with the first road section;

upon determining that the length of the vehicle is less than a threshold vehicle length, recommend short turning curve (161) and enable green LED lighting on the short turning curve (161) and disable the LED lighting on the long turning curve (163) on the road; and

upon determining that the length of the vehicle is greater than a threshold vehicle length, recommend long turning curve (163) and enable green LED lighting on the long turning curve (163) and disable the LED lighting on the short turning curve (161).

8. A method (400) for facilitating navigation of vehicles through a hilly road using a signal system (100a), wherein the signal system (100a) comprises a plurality of signal posts positioned along the hilly road, wherein each signal post comprises a plurality of sensors, wherein the plurality of signal posts comprises a first signal post (101) positioned at an entry point of the hilly road and a second signal post (105) positioned at an exit point of the hilly road, wherein the hilly road comprises a plurality of road section and each road section of the plurality of road sections comprises at least two signal posts (109, 117) positioned on the same side of the road section, and a first display (103) positioned at the entry point and mounted on the first signal post (101) and a second display (107) positioned at the exit point and mounted on the second signal post (105), wherein the method comprises:

detecting a traffic congestion at a particular road section of the plurality of road sections by processing data gathered from one or more of the plurality of sensors associated with the at least two signal posts (109, 117) corresponding to the particular road section; and

controlling the first display (103), the second display (107), the first signal post (103), and the second signal post (105) to display information pertaining to the detected traffic congestion at the particular road section to avoid entry of vehicles on the hilly road.

9. The method (400) as claimed in claim 8, wherein the plurality of sensors comprises at least a RADAR sensor, a LIDAR sensor, and an image acquisition sensor.

10. The method (400) as claimed in claim 9, further comprising:

collecting, using the RADAR sensors associated with the at least two signal posts, real-time data on movement and speed of vehicles;

capturing, using the image acquisition sensor associated with the at least two signal posts (109, 117), real-time visual information of the hilly road;

detecting the traffic congestion at the particular road section by processing the real-time data on movement and speed of vehicles and the real-time visual information of the hilly road; and

transmitting a signal to the first signal post (101) at entry point and the second signal post (105) at exit point to display information pertaining to the detected traffic congestion on the first signal post (101)with the first display (103), the second signal post (105) with the second display (107).

11. The method (400) as claimed in claim 9, further comprising:

detecting presence of obstacles at a particular road section of the plurality of road sections by processing data gathered from one or more of the plurality of sensors associated with the at least two signal posts (109, 117) corresponding to the particular road section; and

controlling the first display (103), the second display (107), the first signal post (101), and the second signal post (105) to display information pertaining to the detected obstacles at the particular road section to avoid entry of vehicles on the hilly road from both the sides.

12. The method (400) as claimed in claim 11, wherein each signal post comprises a plurality of measuring array sensors and wherein the measuring array sensors of one signal post is

communicating with the measuring array sensors of the other signal post, and further comprising:

detecting where there is a breakdown in a light beam array between the at least two signal posts (109, 117) along the road corresponding to the particular road section;

upon detecting the breakdown in the light beam array between the at least two signal posts (109, 117), detect the presence of obstacles at the particular road section; and

upon detecting the presence of obstacles, transmitting a signal to the first signal post (101) and the second signal post (105) to display information pertaining to the detected presence of obstacles on the first signal post (101) with first display (103), the second signal post (105) with second display (107).

13. The method (400) as claimed in claim 8, wherein the hilly road comprises at least one hairpin bend between a first and a second road sections of the plurality of road sections of the hilly road, the signal system (100a) further comprises a first plurality of wireless magnetometers (153) positioned on the first road section at a predefined distance from one end of the hairpin bend and a second plurality of wireless magnetometers (155) positioned on the second road section at the predefined distance from another end of the hairpin bend.

14. The method (400) as claimed in claim 13, wherein each of the plurality of signal post comprises a plurality of traffic signal lights including a red traffic signal light, a yellow traffic signal light, and a green traffic signal light, wherein LED indicators are mounted on the road, and wherein the method further comprises:

upon detecting a vehicle stepping on the first road section, activating a red traffic signal light on the signal post (147) associated with the second road section;

determine length of a vehicle stepping on the first road section based on data received from the first plurality of wireless magnetometers (153) and vehicle images captured by an image acquisition sensor (143) mounted on a signal post (141) associated with the first road section;

upon determining that the length of the vehicle is less than a threshold vehicle length, recommending short turning curve (161) and enabling green LED lighting on the short turning curve (161) and disabling the LED lighting on the long turning curve (163) on the road; and

upon determining that the length of the vehicle is greater than a threshold vehicle length, recommending long turning curve (163) and enabling green LED lighting on the long turning curve (163) and disabling the LED lighting on the short turning curve (161) on the road.

Dated this 19th day of March 2024

--Digitally Signed--
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ABSTRACT

SIGNAL SYSTEM AND METHOD FOR FACILITATING NAVIGATION OF VEHICLES THROUGH A HILLY ROAD

The present disclosure discloses a signal system and method for facilitating navigation of vehicles through a hilly road. The signal system (100a) comprises a plurality of posts positioned along the hilly road, Further, the signal system (100a) comprises a processor (205). The processor (205) is configured to detect a traffic congestion at a particular road section of the plurality of road sections and control the first display (103), the second display (107), the first signal post (101), and the second signal post (105) to display information pertaining to the detected traffic congestion at the particular road section to avoid entry of vehicles on the hilly road.

[Figure 1]

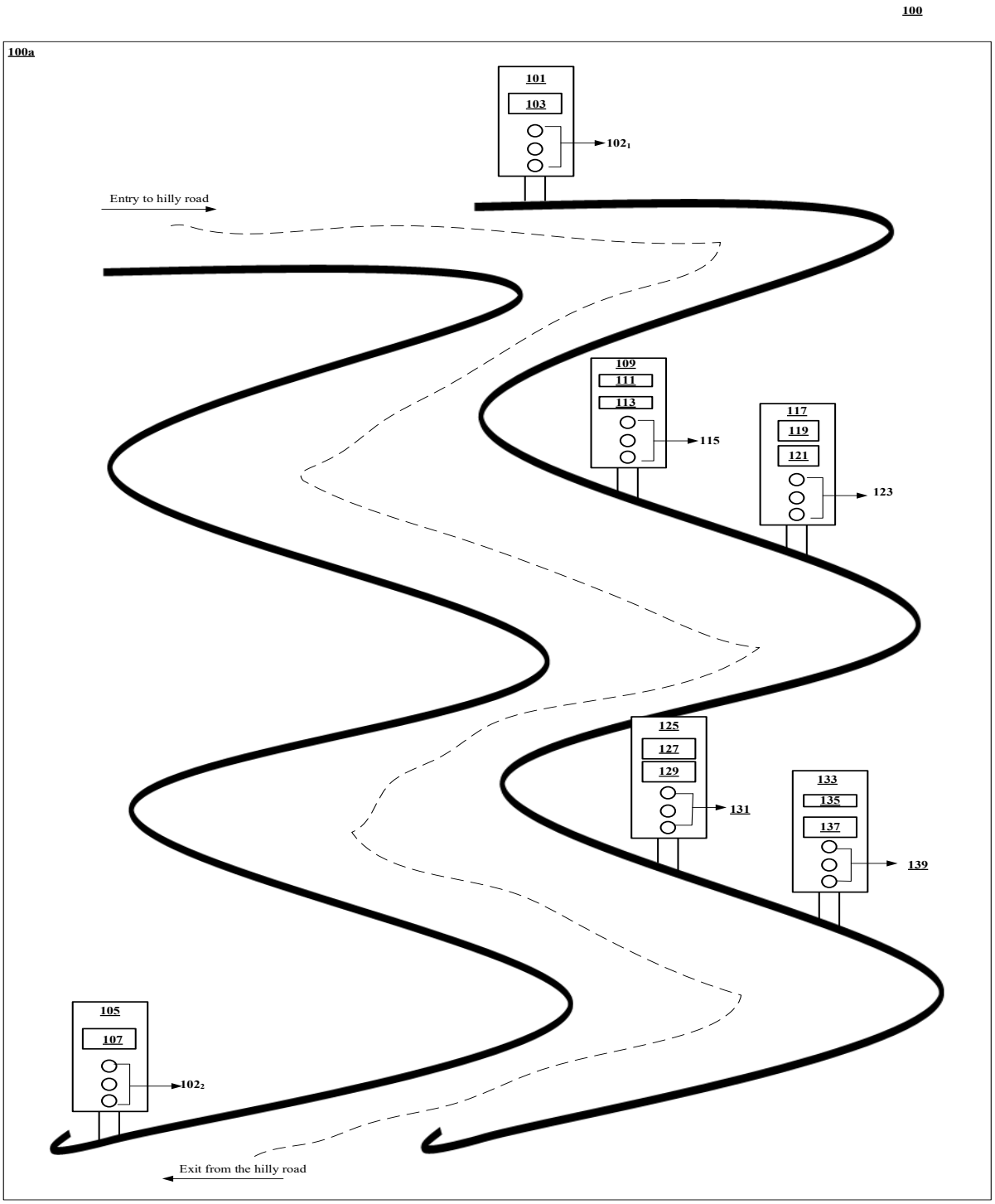

Figure 1A

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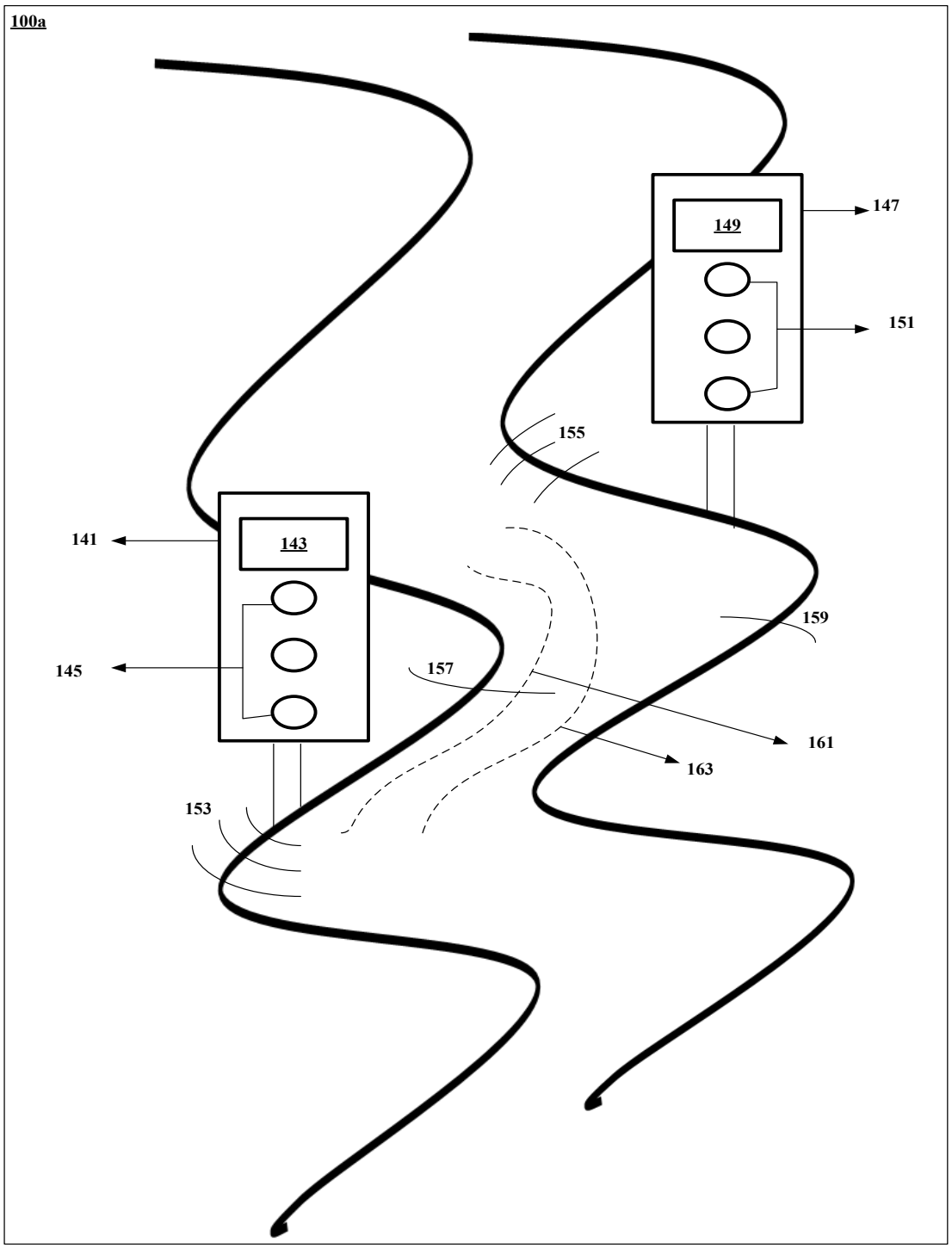

Figure 1B

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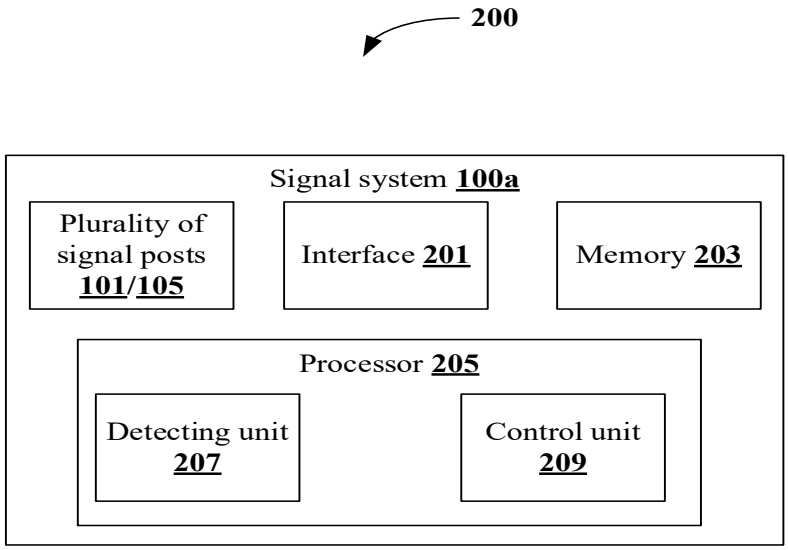

Figure 2

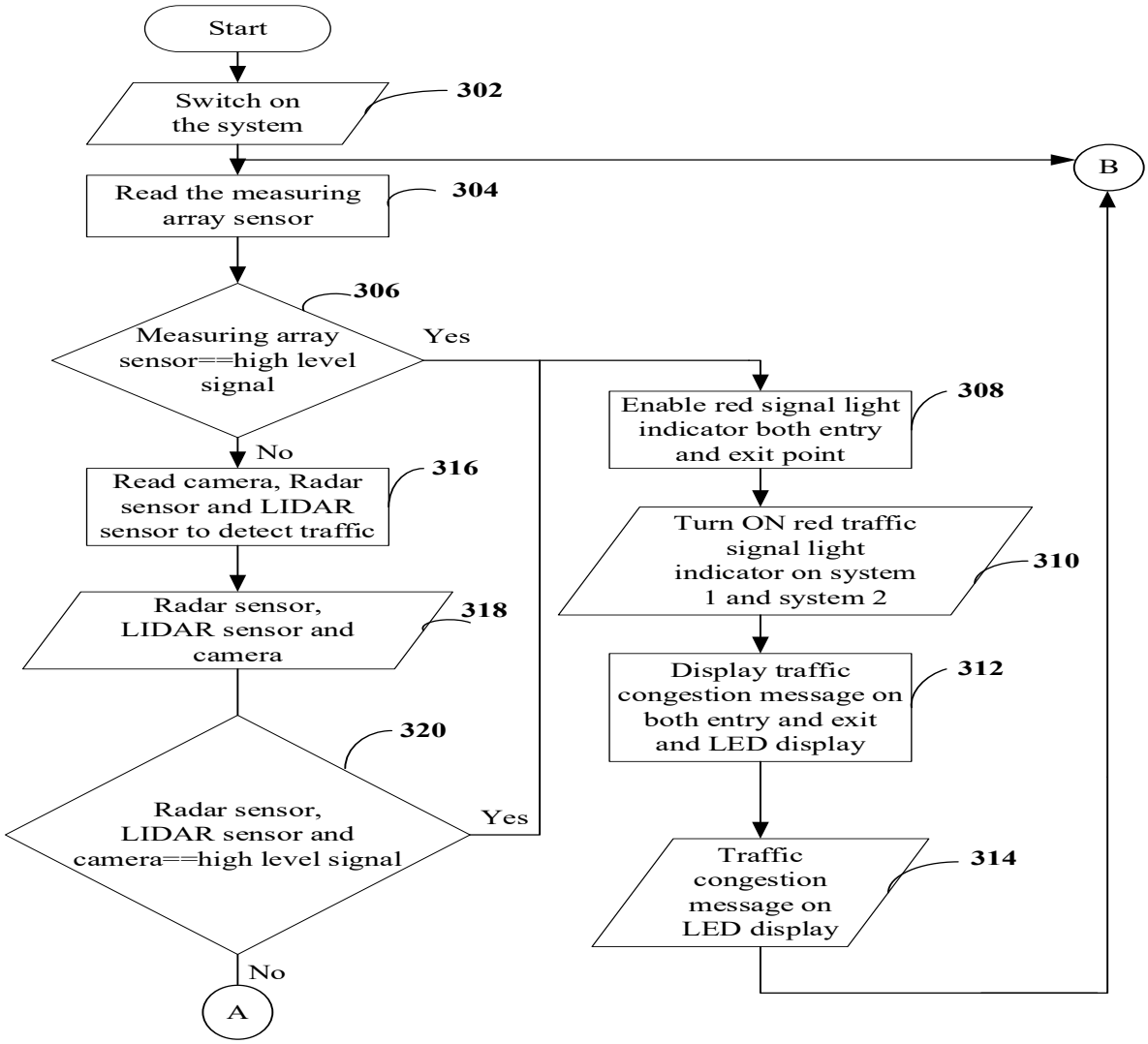

Figure 3A

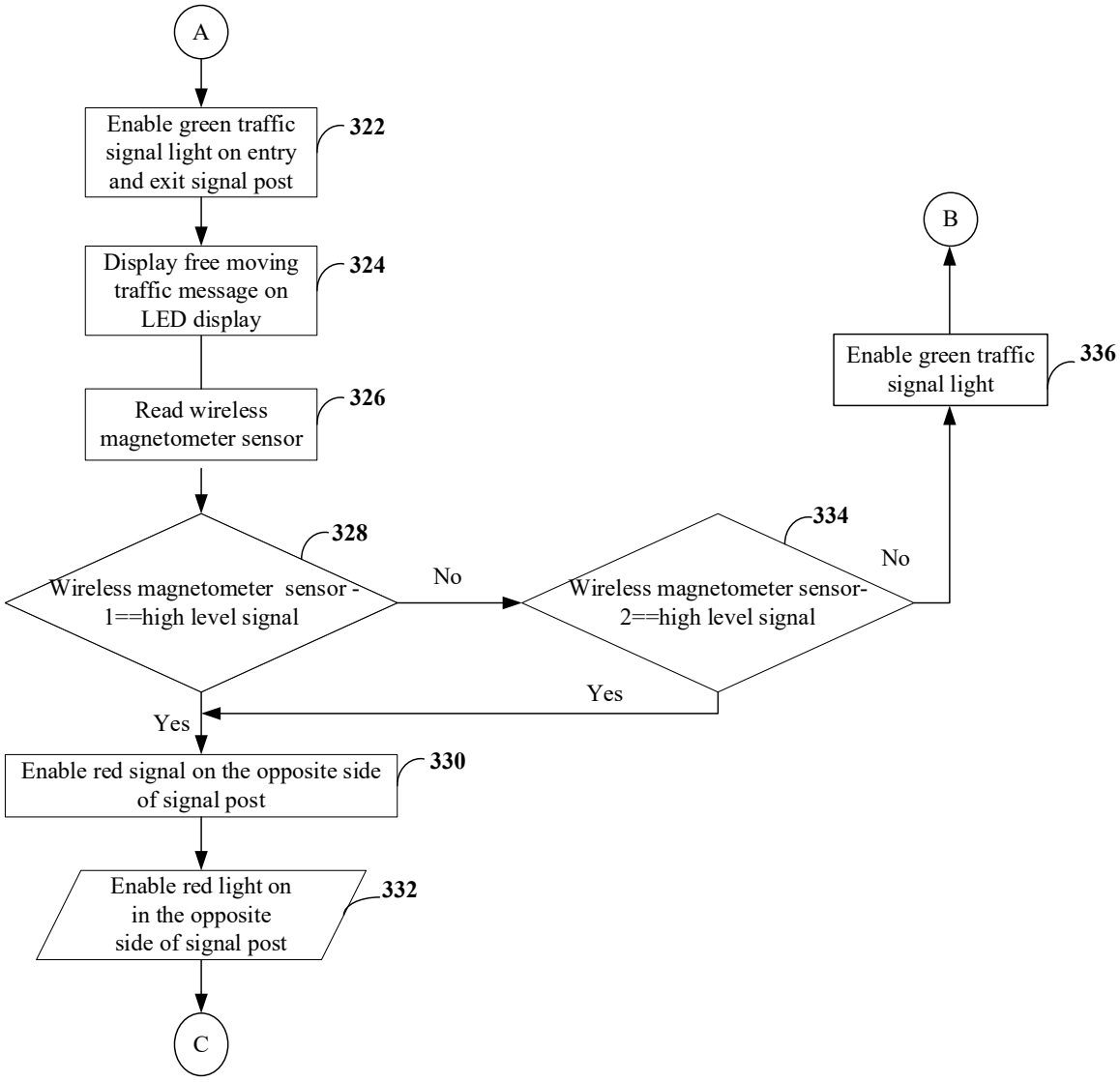

Figure 3B

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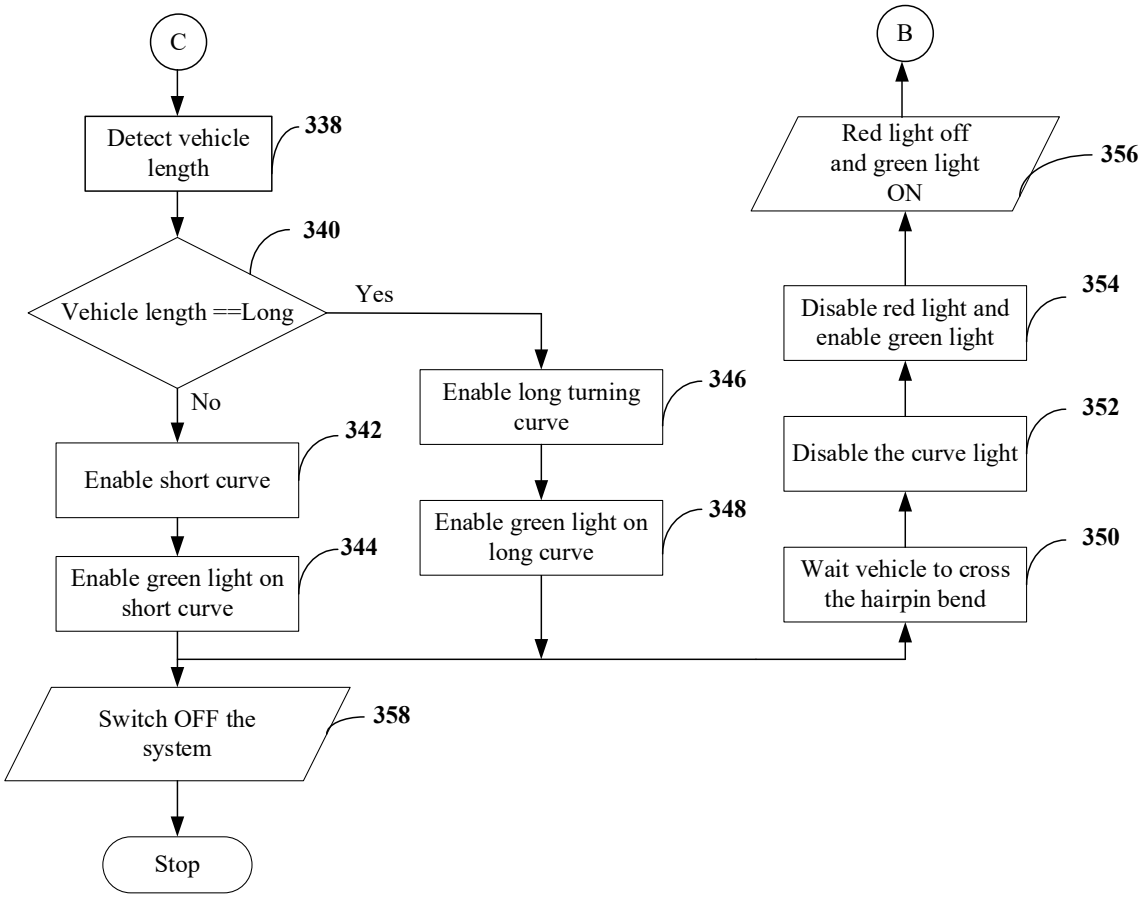

Figure 3C

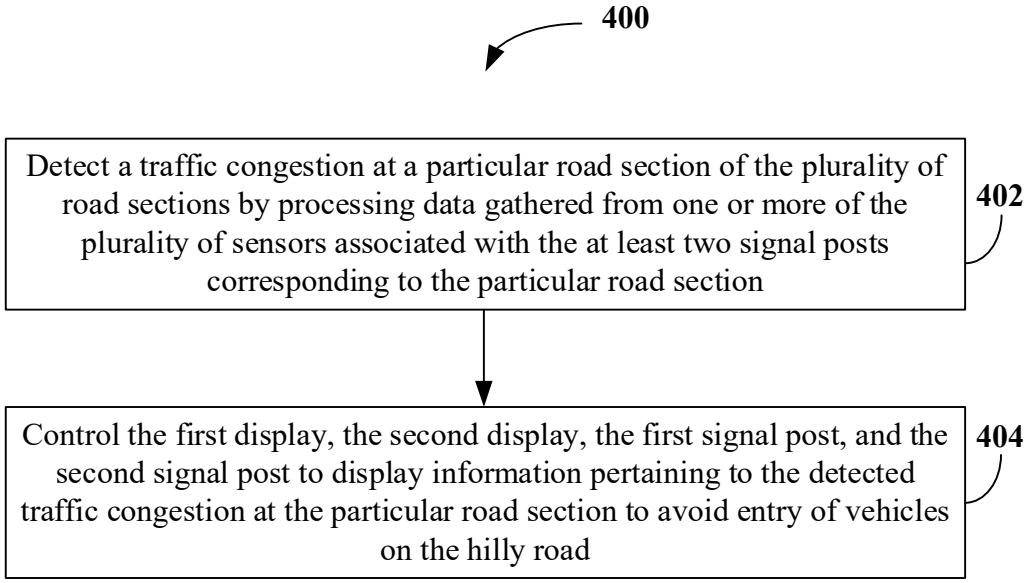

Figure 4