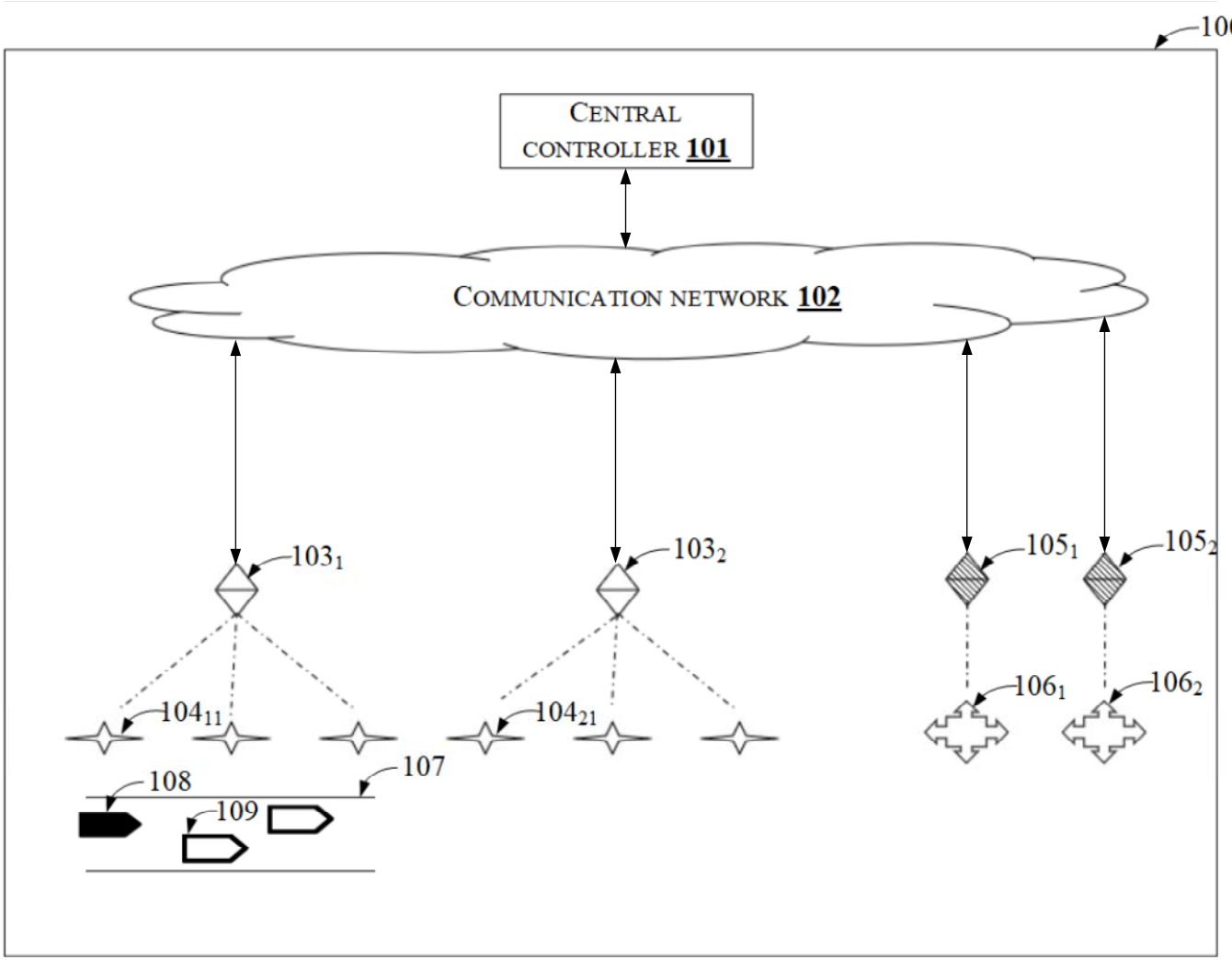

FIGURE 1A

R. RAMYA RAO
OF K&S PARTNERS
AGENT FOR THE APPLICANT(S)
IN/PA- 1607

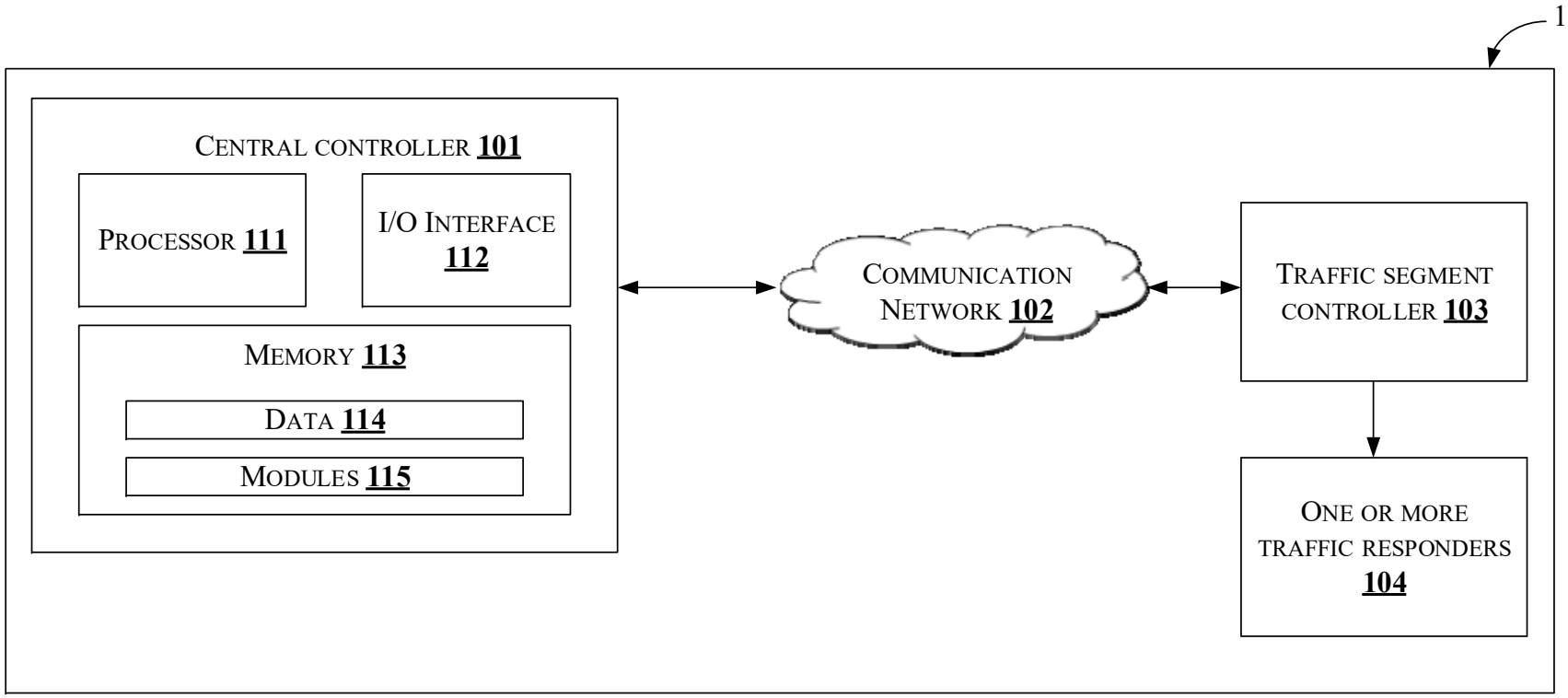

FIGURE 1B

R. RAMYA RAO
OF K&S PARTNERS
AGENT FOR THE APPLICANT(S)
IN/PA- 1607

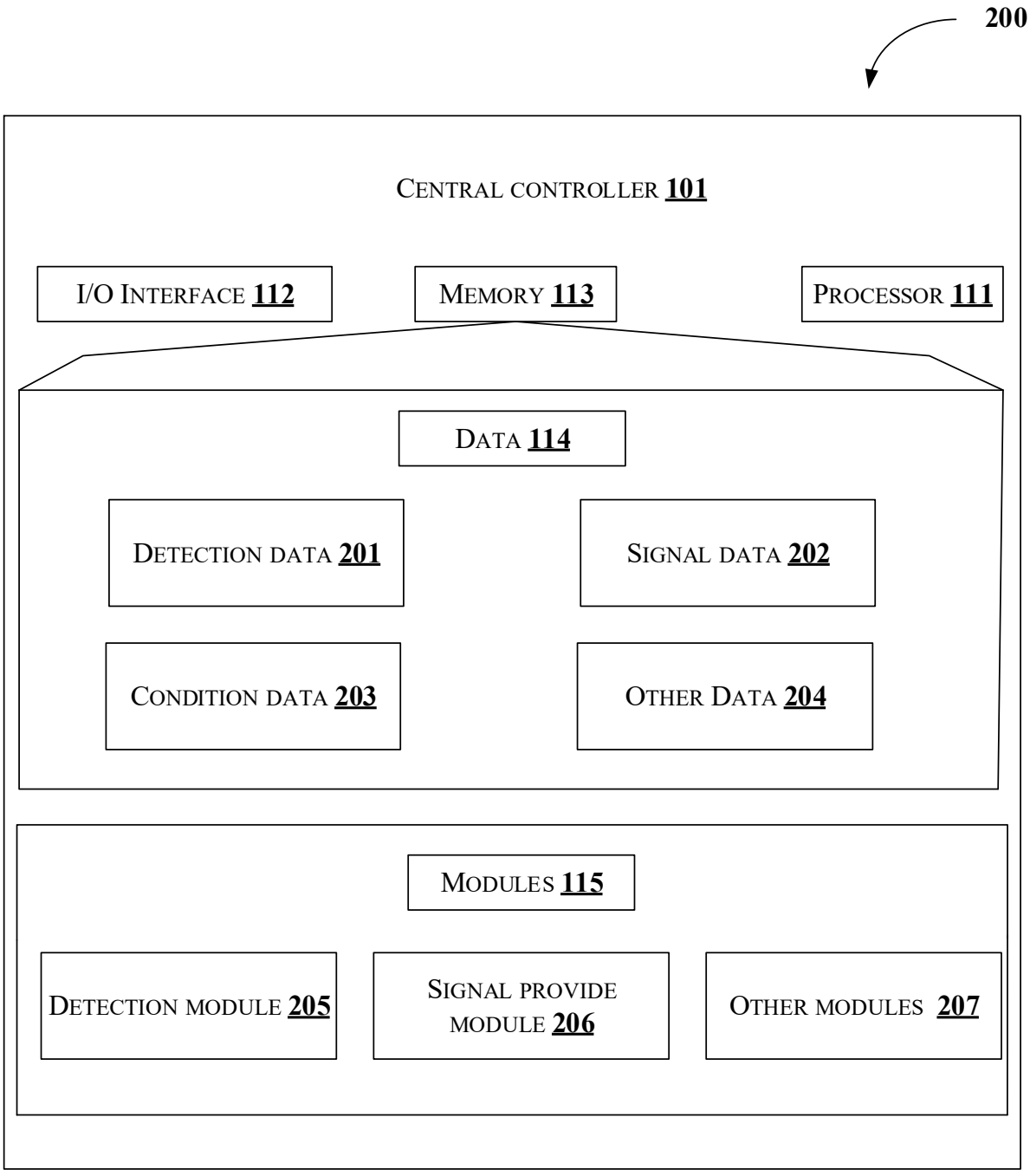

FIGURE 2

R. RAMYA RAO
OF K&S PARTNERS
AGENT FOR THE APPLICANT(S)
IN/PA- 1607

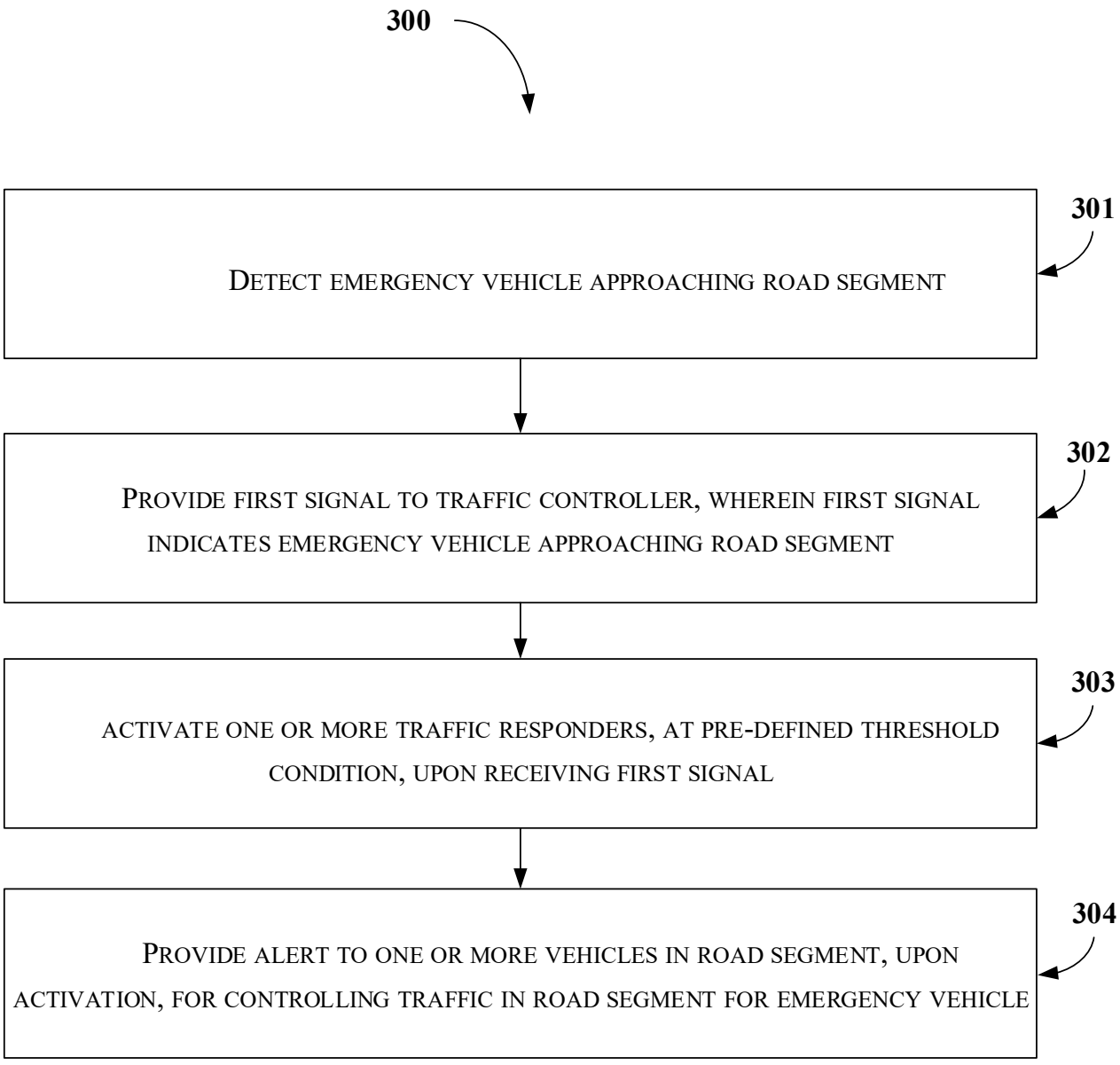

FIGURE 3



R. RAMYA RAO
OF K&S PARTNERS
AGENT FOR THE APPLICANT(S)
IN/PA- 1607

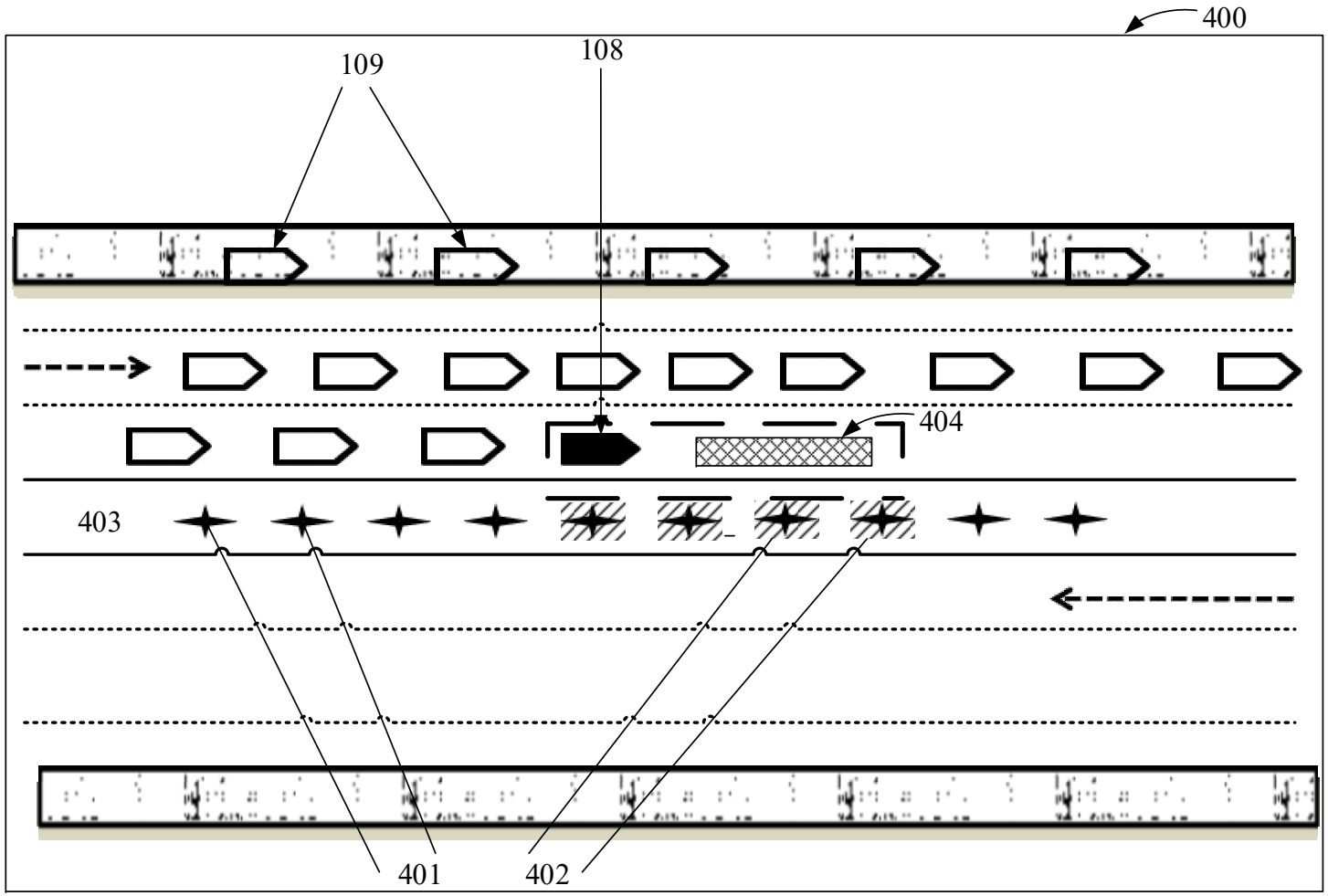

FIGURE 4

R. RAMYA RAO
OF K&S PARTNERS
AGENT FOR THE APPLICANT(S)
IN/PA- 1607



FIGURE 5A

R. RAMYA RAO
OF K&S PARTNERS
AGENT FOR THE APPLICANT(S)
IN/PA- 1607

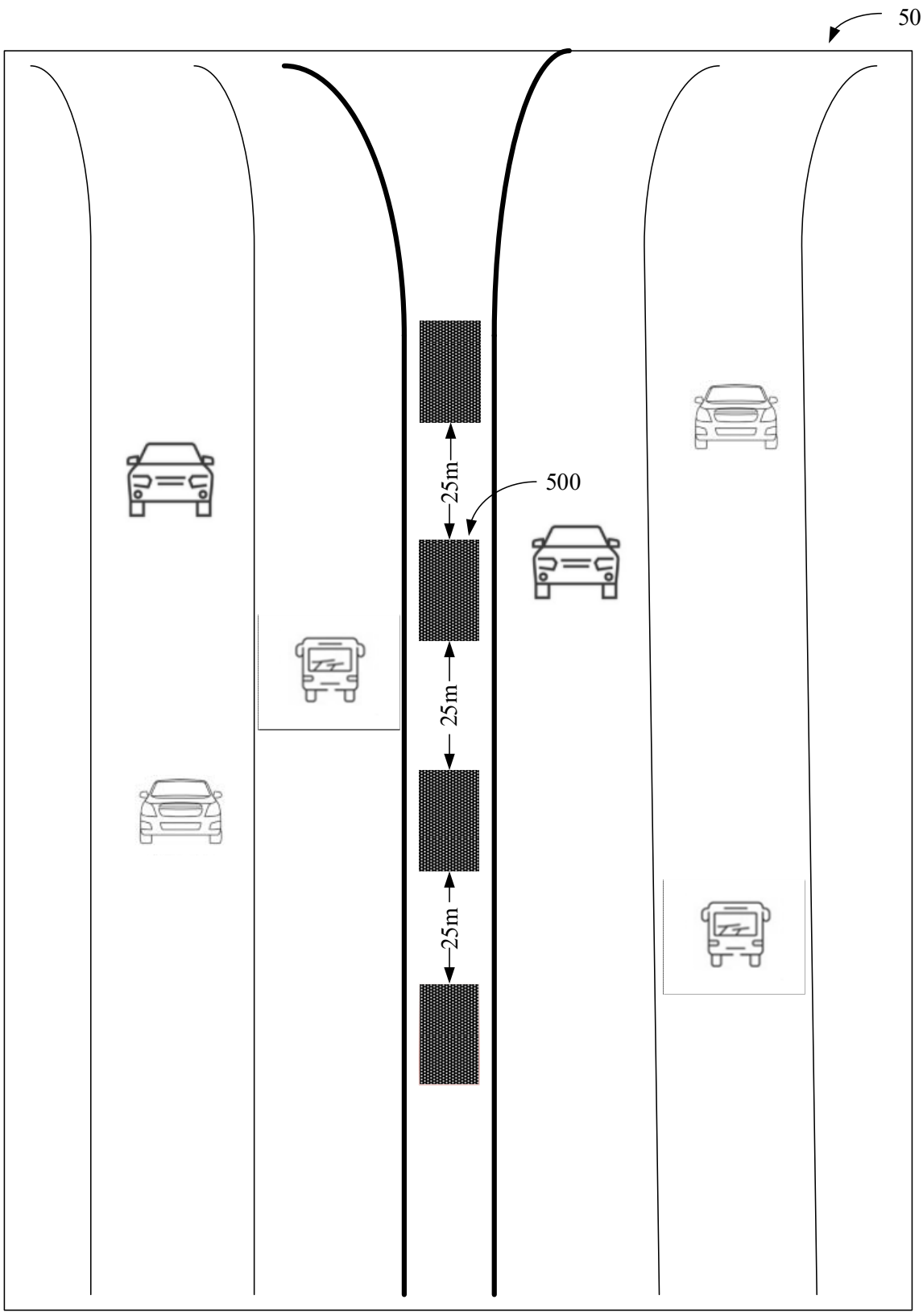

FIGURE 5B

R. RAMYA RAO
OF K&S PARTNERS
AGENT FOR THE APPLICANT(S)
IN/PA- 1607

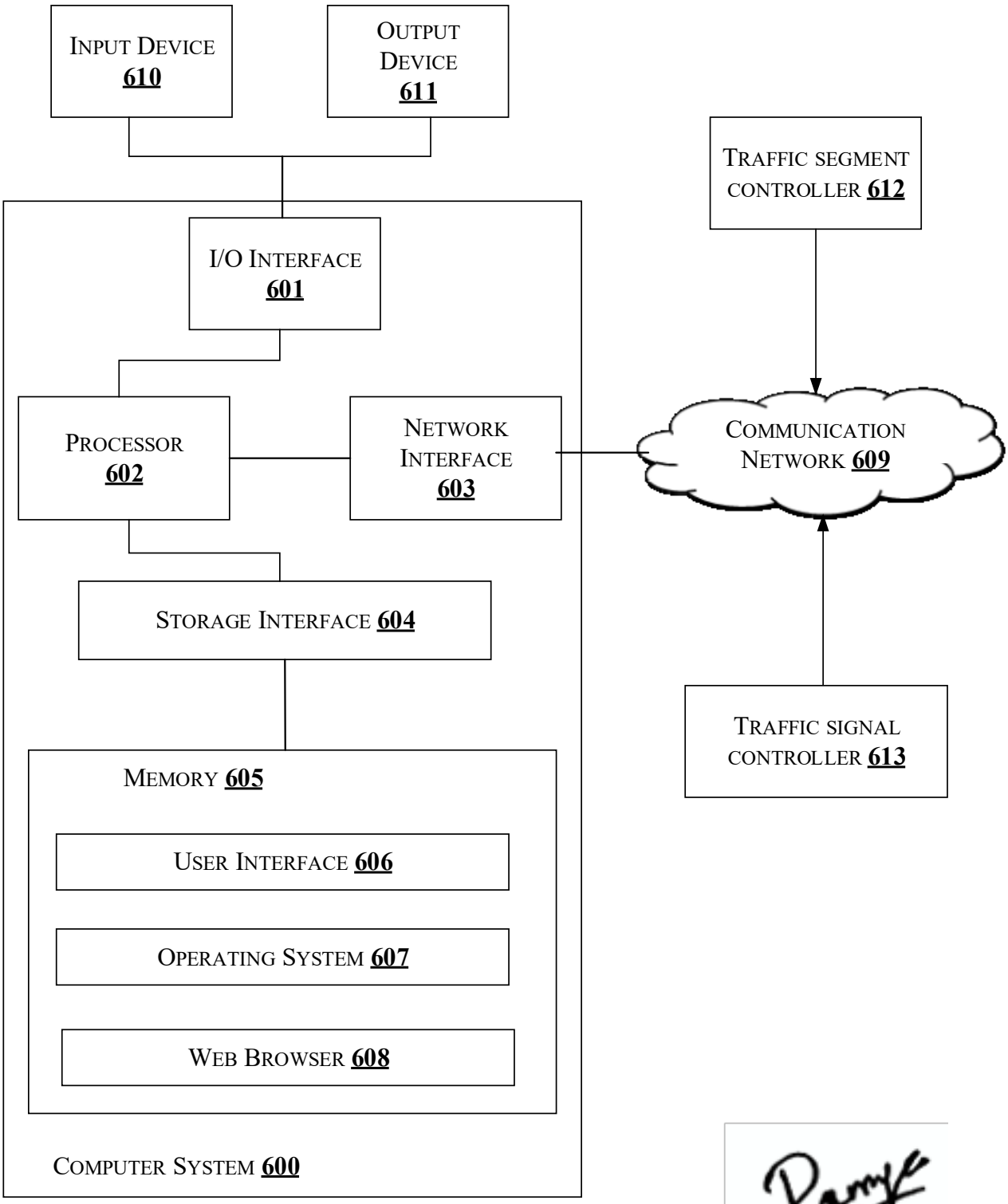

FIGURE 6

R. RAMYA RAO
OF K&S PARTNERS
AGENT FOR THE APPLICANT(S)
IN/PA- 1607

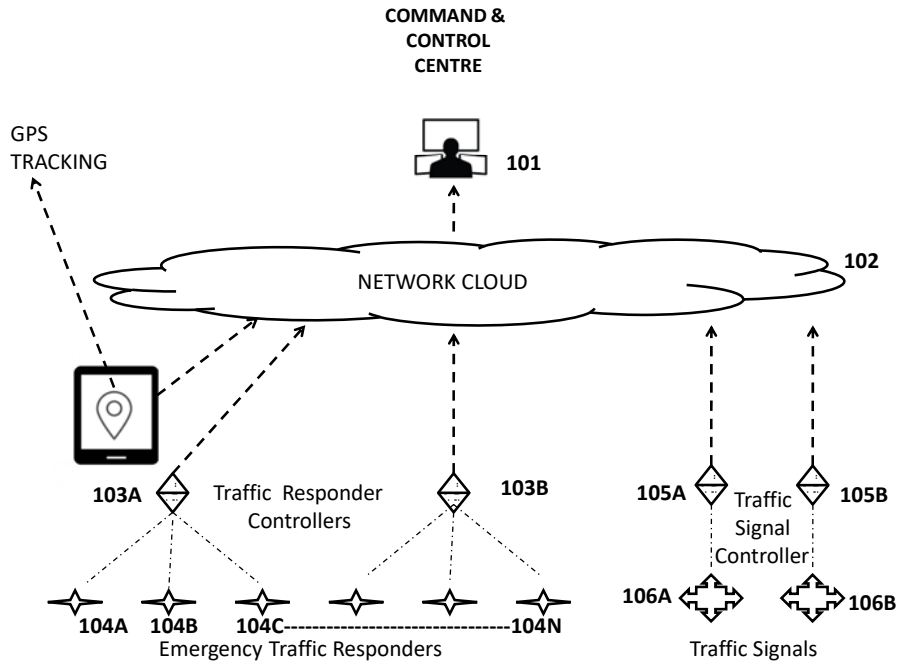

FIGURE 1

R. RAMYA RAO
OF K&S PARTNERS
AGENT FOR THE APPLICANT(S)
IN/PA- 1607

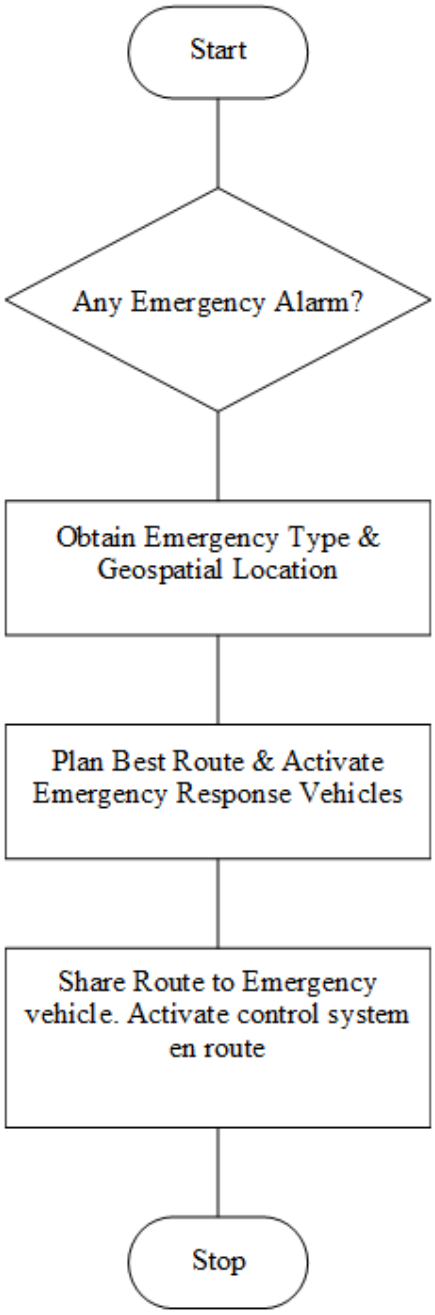

FIGURE 2

R. RAMYA RAO
OF K&S PARTNERS
AGENT FOR THE APPLICANT(S)
IN/PA- 1607

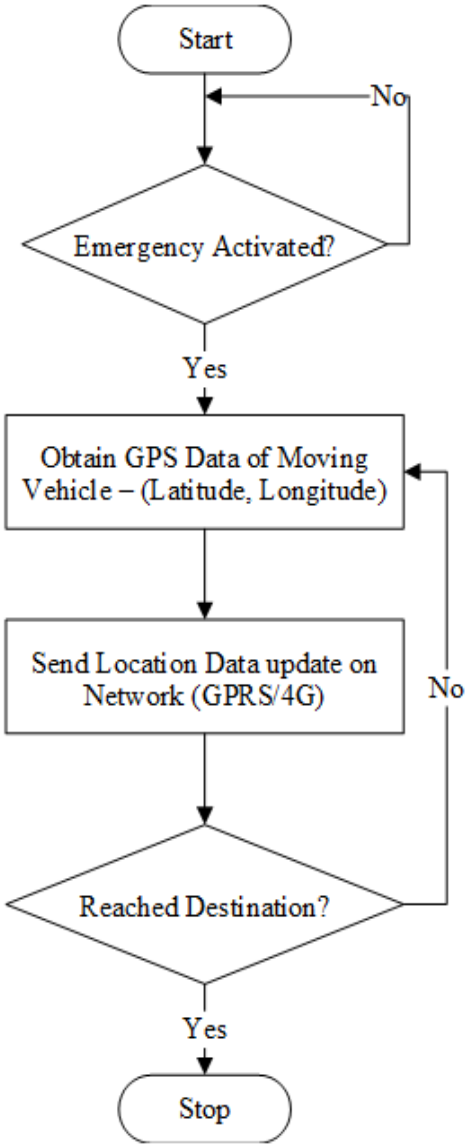

FIGURE 3

R. RAMYA RAO
OF K&S PARTNERS
AGENT FOR THE APPLICANT(S)
IN/PA- 1607

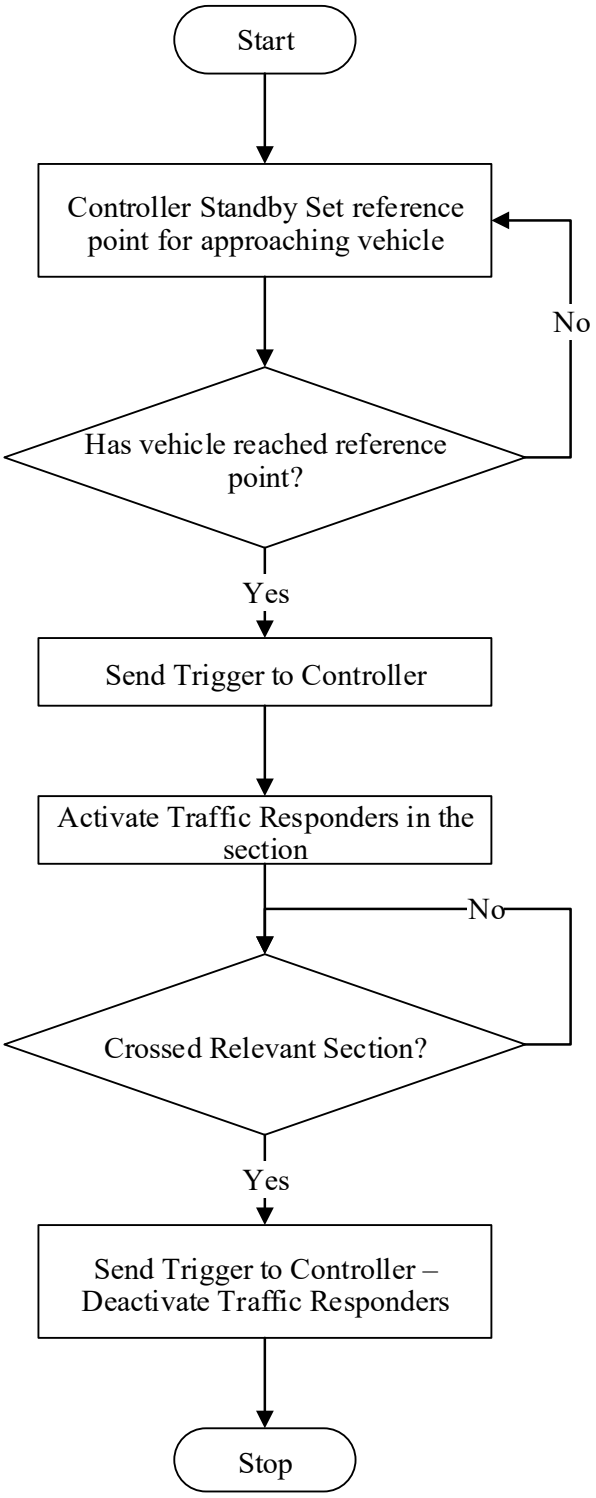

FIGURE 4

R. RAMYA RAO
OF K&S PARTNERS
AGENT FOR THE APPLICANT(S)
IN/PA- 1607



FIGURE 5

R. RAMYA RAO
OF K&S PARTNERS
AGENT FOR THE APPLICANT(S)
IN/PA- 1607

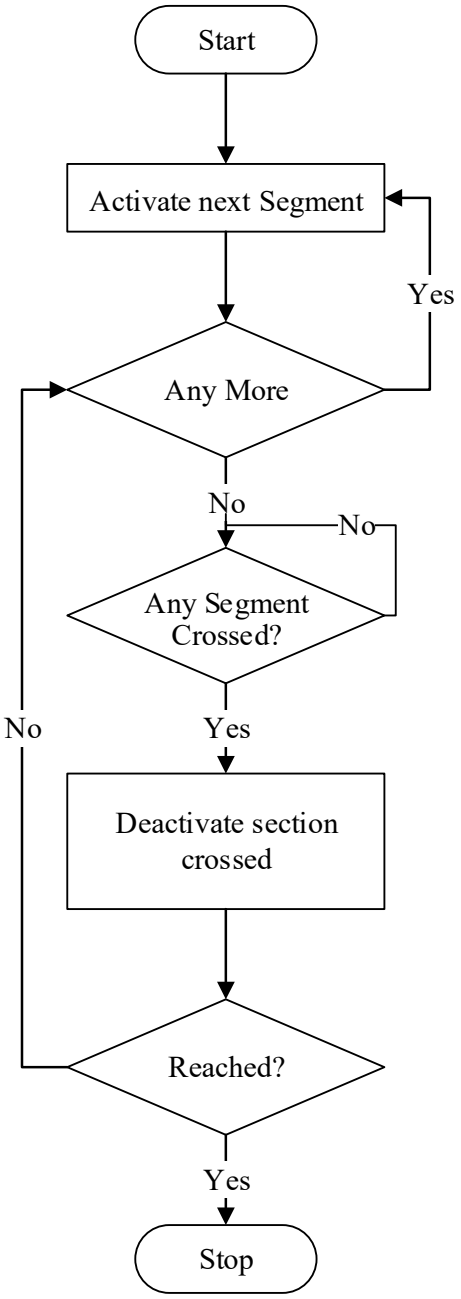

FIGURE 6

R. RAMYA RAO
OF K&S PARTNERS
AGENT FOR THE APPLICANT(S)
IN/PA- 1607



FIGURE 7A

R. RAMYA RAO
OF K&S PARTNERS
AGENT FOR THE APPLICANT(S)
IN/PA- 1607

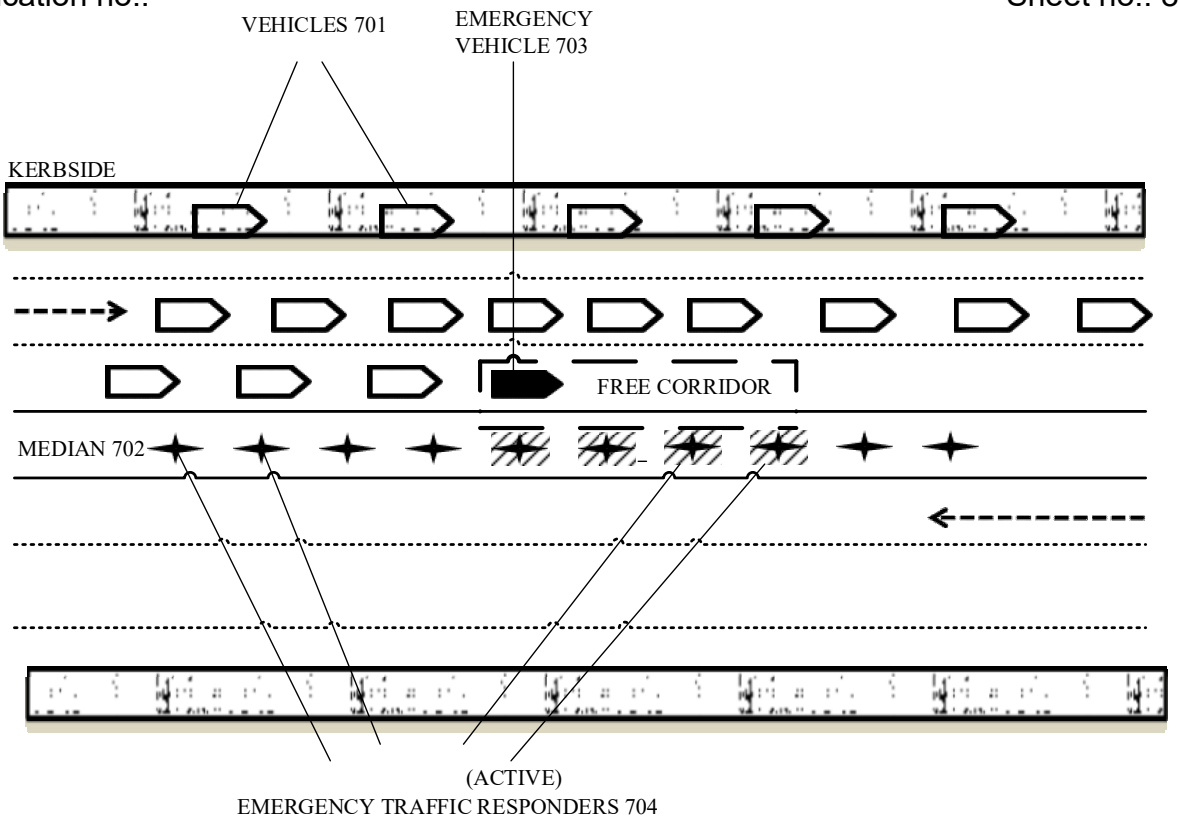

FIGURE 7B

R. RAMYA RAO
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AGENT FOR THE APPLICANT(S)
IN/PA- 1607

FORM 2

THE PATENTS ACT 1970
[39 OF 1970]
&
THE PATENTS RULES, 2003

COMPLETE SPECIFICATION

[See section 10 and Rule 13]

TITLE: **"A METHOD AND A SYSTEM FOR CONTROLLING TRAFFIC IN ROAD SEGMENT FOR AN EMERGENCY VEHICLE"**

Name and Address of the Applicant: **BNA TECHNOLOGY CONSULTING LTD,**
J P Royale Building, 218, Sampige Road, Malleshwaram, Bangalore, Karnataka, India

Nationality: Indian

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 road traffic control. More particularly, the present disclosure relates to a system and a method for controlling traffic in a road segment for an emergency vehicle.

BACKGROUND

[002] Different types of emergency vehicles provide emergency services such as police, medical services, fire and rescue services, and the like. The emergency vehicles comprise ambulances, fire fighter vehicles, police vehicles and the like. The emergency vehicles have to reach required emergency location within a specified time. However, as the city grows and the traffic increases, there is an overload on roads that prevents the emergency vehicles from reaching the required emergency location within the specified time, which may be in minutes. In emergency situations, damage increases exponentially with delays of arrival of the emergency vehicles. Many lives and properties are lost due to the delays in timely response. One of the main reasons for the delays of arrival of the emergency vehicles is due to traffic congestion. The emergency vehicles are unable to move unhindered through the congested traffic even though the emergency vehicles are fitted with sirens and lights. The traffic congestion makes it impossible for other vehicle drivers to move to one side to allow the emergency vehicles to move on, even if desired by the vehicle drivers.

[003] Existing techniques deploy traffic police to coordinate with the vehicle drivers to make way for the emergency vehicles. In severe traffic conditions, making way for the emergency vehicles is challenging. An alternative method used by the traffic police is by posting policemen along a route of an emergency vehicle to clear the traffic. Further, the traffic police controls traffic signals to allow movement of the emergency vehicle. However, this requires a huge deployment of policemen which may not be possible in the emergency situations. Further, such manual systems to clear the traffic may lead to further congested traffic all along the city due to traffic being held up for long period of time. This may cause inconvenience to public. Hence, there is a need for a system to control the traffic without the need for deployment of the large number of policemen and is convenient to the public.

[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 system for controlling traffic in a road segment for an emergency vehicle. The system comprises a central controller associated with a plurality of road segments. The central controller is configured to detect an emergency vehicle approaching a road segment from the plurality of road segments. Further, the central controller is configured to provide a first signal to a traffic segment controller associated with the road segment. The first signal indicates the emergency vehicle approaching the road segment. Furthermore, the system comprises the traffic segment controller. The traffic segment controller is configured to activate one or more traffic responders associated with the traffic segment controller, upon receiving the first signal, at a pre-defined threshold condition. The one or more traffic responders are installed along the road segment. Further, the system comprises the one or more traffic responders configured to provide an alert to one or more vehicles in the road segment, upon the activation. The alert is provided for controlling traffic in the road segment for the emergency vehicle.

[006] In an embodiment, the present disclosure discloses a method for controlling traffic in a road segment for an emergency vehicle using a system. The system comprises a central controller associated with a plurality of road segments, a traffic segment controller associated with a road segment from the plurality of road segments, and one or more traffic responders associated with the traffic segment controller. The one or more traffic responders are installed along the road segment. The method comprises detecting, by the central controller, an emergency vehicle approaching the road segment. Further, the method comprises providing, by the central controller, a first signal to the traffic segment controller. The first signal indicates the emergency vehicle approaching the road segment. Furthermore, the method comprises activating, by the traffic segment controller, the one or more traffic responders, at a pre-defined threshold condition, upon receiving the first signal. Thereafter, the method comprises providing, by the one or more traffic responders, an alert to one or more vehicles in the road segment, upon the activation. The alert is provided for controlling traffic in the road segment for the emergency vehicle.

[007] In an embodiment, the present disclosure discloses a central controller for controlling traffic in a road segment for an emergency vehicle. The central controller is configured to detect

an emergency vehicle approaching a road segment from a plurality of road segments associated with the central controller. Further, the central controller is configured to generate a first signal indicating the emergency vehicle approaching the road segment. Furthermore, the central controller is configured to provide the first signal to a traffic control system comprising a traffic segment controller and one or more traffic responders. The traffic control system may be associated with the road segment. The traffic control system provides an alert to one or more vehicles, upon receiving the first signal, at a pre-defined threshold condition. The alert is provided for controlling traffic in the road segment for the emergency vehicle.

[008] 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

[009] 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:

[0010] Figure 1A illustrates exemplary environment for controlling traffic in a road segment for an emergency vehicle, in accordance with some embodiments of the present disclosure;

[0011] Figure 1B illustrates an exemplary system for controlling traffic in a road segment for an emergency vehicle, in accordance with some embodiments of the present disclosure;

[0012] Figure 2 illustrates an internal architecture of a central controller, in accordance with some embodiments of the present disclosure;

[0013] Figure 3 shows an exemplary flow chart illustrating method steps for controlling traffic in a road segment for an emergency vehicle, in accordance with some embodiments of the present disclosure;

[0014] Figure 4 shows exemplary illustrations for controlling traffic in a road segment for an emergency vehicle, in accordance with some embodiments of the present disclosure;

[0015] Figure 5A shows exemplary structure of a traffic responder, in accordance with some embodiments of the present disclosure;

[0016] Figure 5B shows exemplary locations for installing a traffic responder, in accordance with some embodiments of the present disclosure; and

[0017] Figure 6 shows a block diagram of a general-purpose computing system for controlling traffic in a road segment for an emergency vehicle, in accordance with embodiments of the present disclosure.

[0018] 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 substantially represented in computer readable medium and executed by a computer or processor, whether or not such computer or processor is explicitly shown.

DETAILED DESCRIPTION

[0019] 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.

[0020] 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.

[0021] 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.

[0022] Embodiments of the present disclosure relate to a system for controlling traffic in a road segment for an emergency vehicle. The system comprises a central controller. The central controller detects an emergency vehicle approaching a road segment. The central controller provides a first signal to a traffic segment controller associated with the road segment. The first signal indicates that the emergency vehicle is approaching the road segment. Further, the system comprises the traffic segment controller and traffic responders. The traffic responders are installed along the road segment. The traffic segment controller activates traffic responders upon receiving the first signal from the central controller. The traffic segment controller activates the traffic responders at a pre-defined threshold condition. The pre-defined threshold condition may be associated with either a pre-defined distance or a pre-determined time period. The traffic responders provide an alert to other vehicles in the road segment. The alert is provided for controlling traffic in the road segment for the emergency vehicle. The traffic responders are activated to provide alert when the emergency vehicle is at a pre-defined distance from the road segment or a pre-determined time period prior to arrival of the emergency vehicle. Hence, advance notifications are provided to the other vehicles about the approaching emergency vehicle so that the vehicles may make way for the emergency vehicle in advance.

[0023] Figure 1A illustrates exemplary environment 100 for controlling traffic in a road segment for an emergency vehicle, in accordance with some embodiments of the present disclosure. The exemplary environment 100 comprises a central controller 101, a communication network 102, traffic segment controllers 103_1, 103_2, one or more traffic responders 104_{11}, 104_{21}, one or more traffic signal controllers 105_1, 105_2, one or more traffic signals 106_1, 106_2, a road segment 107, an emergency vehicle 108, and one or more vehicles 109. The traffic segment controllers 103_1, 103_2 are hereafter referred as the traffic segment controller 103, in the present description. The one or more traffic responders 104_{11}, 104_{21} are referred as the one or more traffic responders 104 in general, in the present description. The one or more traffic signal controllers 105_1, 105_2 are referred as the one or more traffic signal controllers 105 in general, in the present description. The one or more traffic signals 106_1, 106_2 are referred as the one or more traffic signals 106 in general, in the present description. The

traffic segment controller 103 and the one or more traffic responders 104 may be together referred as a traffic control system. The traffic control system may be associated with each road segment from the plurality of road segments. The emergency vehicle 108 may be a vehicle which has to reach a destination location at a critical time. For example, the emergency vehicle 108 may be an ambulance, a fire fighter vehicle, a police vehicle, Very Important Person (VIP) escort vehicle and the like. The emergency vehicle 108 may be a vehicle used for disaster management activity. The emergency vehicle 108 may be any vehicle that has been declared as a priority vehicle. The emergency vehicle 108 may have to reach the destination location in a minimum time. For example, the emergency may be a medical emergency. The ambulance must reach the destination time in the minimum time. The emergency vehicle 108 may be advancing from a source location to the destination location through a plurality of road segments. The road segment 107 is shown in Figure 1A. The one or more vehicles 109 may be advancing on the road segment 107. The one or more vehicles 109 may be a car, a truck, a bus, and the like. A system 110 may be configured to controlling traffic in the road segment 107 for the emergency vehicle 108. The system 110 is shown in Figure 1B. The system 110 may comprise the central controller 101, the traffic segment controller 103, and the one or more traffic responders 104.

[0024] The central controller 101 may be associated with the plurality of road segments. The central controller 101 may be configured to detect the emergency vehicle 108 approaching the road segment 107 from the plurality of road segments. Further, the central controller 101 may be configured to provide a first signal to the traffic segment controller 103 associated with the road segment 107. The first signal may indicate the emergency vehicle 108 approaching the road segment 107. The traffic segment controller 103 may be configured to receive the first signal from the central controller 101. The central controller 101 and the traffic segment controller 103 may communicate over the communication network 102. In an embodiment, the central controller 101 may be connected to the communication network 102 via wired interface. In an embodiment, the central controller 101 may be connected to the communication network 102 via wireless interface. The traffic segment controller 103 may be configured to activate the one or more traffic responders 104, at a pre-defined threshold condition. The traffic segment controller 103 may be deployed at the road segment 107. The one or more traffic responders 104 may be associated with the traffic segment controller 103. In an embodiment, the traffic segment controller 103 may control a predefined number of traffic responders 104. The one or more traffic responders 104 may be configured to provide an alert to the one or more vehicles

109 in the road segment 107, upon the activation. The alert may be provided for controlling traffic in the road segment 107 for the emergency vehicle. The alert may be in form of at least one of text, audio, video, and the like. In an embodiment, the one or more traffic responders 104 may comprise a display unit to display the text. The text may be “free a lane”. An emergency symbol may be displayed. In an embodiment, the one or more traffic responders 104 may comprise a speaker to provide audio. The audio may be an announcement to free a lane. The one or more traffic responders 104 may be installed along the road segment 107 at predefined distances. For example, the one or more traffic responders 104 may be installed for 200m – 500m stretch. Further referring to the example, each stretch of the one or more traffic responders 104 may be separated by 100m – 200m. In an embodiment, in a road segment having multiple lanes, the one or more traffic responders 104 may be installed adjacent to a lane which is dedicated to the emergency vehicle 108 during emergency situations. During normal conditions, the one or more vehicles 109 may use the dedicated lane. During the emergency situations, upon receiving the alert from the one or more traffic responders 104, the one or more vehicles 109 in the dedicated lane may clear the dedicated lane and make way for the emergency vehicle 108. In an embodiment, in a road segment where there are no multiple lanes, the one or more traffic responders 104 may be installed on either side or both sides of the road. Upon receiving the alert, the one or more vehicles 109 may move aside to make way for the emergency vehicle 108. Further, the system 110 may comprise the one or more traffic signal controllers 105. The one or more traffic signal controllers 105 may be implemented in one or more traffic signals 106 at the road segment 107. The one or more traffic signal controllers 105 may be configured to receive the first signal from the central controller 101. The one or more traffic signal controllers 105 may control the one or more traffic signals 106 at the road segment 107 to provide an alert for clearing the traffic in the road segment 107. For example, the alert may be in form of display of a green light, a text, and the like. The one or more traffic signal controllers 105 may communicate with the central controller 101 over the communication network 102.

[0025] In an embodiment, the traffic segment controller 103 is configured to receive a second signal from the central controller 101. The second signal may indicate the emergency vehicle 108 exiting the road segment 107. The one or more traffic responders 104 may be deactivated upon receiving the second signal. In an embodiment, the traffic segment controller 103 is configured to deactivate the one or more traffic signal controllers 105 upon receiving the second signal from the central controller 101.

[0026] The central controller 101 may include Central Processing Units 111 (also referred as "CPUs" or "one or more processors 111"), Input/ Output (I/O) interface 112, and a memory 113. In some embodiments, the memory 113 may be communicatively coupled to the processor 111. The memory 113 stores instructions executable by the one or more processors 111. The one or more processors 111 may comprise at least one data processor for executing program components for executing user or system-generated requests. The memory 113 may be communicatively coupled to the one or more processors 111. The memory 113 stores instructions, executable by the one or more processors 111, which, on execution, may cause the one or more processors 111 to detect the emergency vehicle 108 approaching the road segment 107 and provide the first signal to the traffic segment controller 103. In an embodiment, the memory 113 may include one or more modules 115 and data 114. The one or more modules 115 may be configured to perform the steps of the present disclosure using the data 114, to detect the emergency vehicle 108 approaching the road segment 107 and provide the first signal to the traffic segment controller 103. In an embodiment, each of the one or more modules 115 may be implemented as a hardware unit which may be outside the memory 113 and coupled with the central controller 101. As used herein, the term modules 115 refers to an Application Specific Integrated Circuit (ASIC), an electronic circuit, a Field-Programmable Gate Arrays (FPGA), Programmable System-on-Chip (PSoC), a combinational logic circuit, and/or other suitable components that provide described functionality. The one or more modules 115 when configured with the described functionality defined in the present disclosure will result in a novel hardware. Further, the I/O interface 112 is coupled with the one or more processors 111 through which an input signal or/and an output signal is communicated. For example, the central controller 101 may provide the first signal to the traffic segment controller 103, via the I/O interface 112. In an embodiment, the central controller 101, to detect the emergency vehicle 108 approaching the road segment 107 and provide the first signal to the traffic segment controller 103, may be implemented in a variety of computing systems, such as a laptop computer, a desktop computer, a Personal Computer (PC), a notebook, a smartphone, a tablet, e-book readers, a server, a network server, a cloud-based server and the like.

[0027] Figure 2 illustrates an internal architecture 200 of the central controller 101 to detect the emergency vehicle 108 approaching the road segment 107 and provide the first signal to the traffic segment controller 103, in accordance with some embodiments of the present disclosure.

The central controller 101 may include the one or more processors 111, the memory 113 and the I/O interface 112.

[0028] In one implementation, the modules 115 may include, for example, a detection module 205, a signal provide module 206, and other modules 207. It will be appreciated that such aforementioned modules 115 may be represented as a single module or a combination of different modules. In one implementation, the data 114 may include, for example, detection data 201, signal data 202, condition data 203, and other data 204.

[0029] In an embodiment, the detection module 205 may be configured to receive a current location condition from at least one of, the emergency vehicle 108 and a detector. The current location condition may indicate at least one of, a normal mode and an emergency mode. The normal mode may indicate non necessity of traffic control in the road segment 107. The traffic may be a routine traffic in the normal mode. The emergency mode may indicate need of traffic control in the road segment 107. In an embodiment, the detector may be configured in the traffic segment controller 103. In another embodiment, the detector may be configured in the one or more traffic responders 104. Further, the detection module 205 may be configured to track a current location of the emergency vehicle 108 from a source location to a destination location, based on the current location condition of emergency vehicle 108. The emergency vehicle 108 may be installed with Global Positioning System (GPS) transmitter to publish location data to the central controller 101. The detection module 205 is configured to detect the emergency vehicle 108 to be approaching the road segment 107 based on the current location. The current location of the emergency vehicle 108 and data related to the detection of the emergency vehicle 108 may be stored as the detection data 201 in the memory 113. The current location condition may be stored as the condition data 203 in the memory 113.

[0030] In an embodiment, the signal provide module 206 may be configured to receive the detection data 201 from the detection module 205. The signal provide module 206 may be configured to provide a first signal to the traffic segment controller 103 associated with the road segment 107. The first signal indicates that the emergency vehicle 108 is approaching the road segment 107. In an embodiment, the first signal may be a control signal with a value 1. A person skilled in the art will appreciate that any kind of control data may be transmitted from the signal provide module 206 to the traffic segment controller 103 and is not limited to binary values. Further, the signal provide module 206 may be configured to provide the first signal to the one or more traffic signal controllers 105. The traffic signal controllers 105 may control the one or

more traffic signals 106 at the road segment 107 to provide an alert. The alert may be provided for clearing the traffic in the road segment 107. The values of the first signal may be stored as the signal data 202 in the memory 113.

[0031] The other data 204 may store data, including temporary data and temporary files, generated by the one or more modules 115 for performing the various functions of the central controller 101. The one or more modules 115 may also include the other modules 207 to perform various miscellaneous functionalities of the central controller 101. For example, the other modules 207 may comprise an optimal route provide module (not shown in figure). The optimal route provide module may be configured to retrieve information from a database associated with the central controller 101. The information may comprise at least one of road conditions at an area, traffic conditions at the area, rerouting information, and locations of each of the one or more traffic responders 104. The optimal route provide module may be configured to provide an optimal route for the emergency vehicle 108 to a destination, based on the information. For example, the optimal route may be provided such that congested road segments are avoided. In another example, the optimal route may be provided such that poor road conditions are avoided. The optimal route may be provided based on the rerouting information. For example, the fastest way to reach the destination location based on historical data may be used to provide the optimal route. The optimal route may be stored as the other data 204 in the memory 113. It will be appreciated that the one or more modules 115 may be represented as a single module or a combination of different modules.

[0032] Figure 3 shows an exemplary flow chart illustrating method steps to control the traffic in the road segment 107 for the emergency vehicle 108, in accordance with some embodiments of the present disclosure. As illustrated in Figure 3, the method 300 may comprise one or more steps. The method 300 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.

[0033] The order in which the method 300 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.

[0034] At step 301, the central controller 101 detects the emergency vehicle 108 approaching the road segment 107 from the plurality of road segments. The central controller 101 may be configured to receive the current location condition from at least one of, the emergency vehicle 108 and the detector. The current location condition may indicate at least one of, the normal mode and the emergency mode. The normal mode may indicate non necessity of traffic control in the road segment 107. The emergency mode may indicate need of traffic control in the road segment 107. For example, a driver of the emergency vehicle 108 may provide the current location condition as the emergency mode when there is a need to control the traffic. In an example, the emergency vehicle 108 may not be able to communicate with the central controller 101 due to network issues. The detectors may provide the current location condition. The detector may use segmentation algorithms to identify number of vehicles on the road segment 107 to determine the current location condition. A person skilled in the art will appreciate that any other known methods may be used to determine the current location condition by the detector. Further, the central controller 101 may be configured to track the location of the emergency vehicle 108 from the source location to the destination location, based on the current location condition of emergency vehicle 108. The emergency vehicle 108 may be publishing the location data via GPS signals to the central controller 101. The central controller 101 is configured to detect the emergency vehicle 108 to be approaching the road segment 107 based on the location.

[0035] At step 302, the central controller 101 provides the first signal to the traffic segment controller 103 associated with the road segment 107. The first signal indicates the emergency vehicle 108 approaching the road segment 107. In an embodiment, the first signal may be a control signal with a value 1. A person skilled in the art will appreciate that any kind of control data may be transmitted from the central controller 101 to the traffic segment controller 103 and is not limited to binary values. Further, the central controller 101 may be configured to provide the first signal to the one or more traffic signal controllers 105. The traffic signal controllers 105 may control the one or more traffic signals 106 at the road segment 107 to provide an alert. The alert may be provided for clearing the traffic in the road segment 107.

[0036] At step 303, the traffic segment controller 103 activates the one or more traffic responders 104 at the pre-defined threshold condition. The traffic segment controller 103 may be configured to receive the first signal from the central controller 101. In an embodiment, the traffic segment controller 103 may activate the one or more traffic responders 104 when the emergency vehicle 108 is at a pre-defined distance from the road segment 107. For example, the one or more traffic responders 104 may be activated when the emergency vehicle 108 is 1 km behind the road segment 107. In an embodiment, the traffic segment controller 103 may activate the one or more traffic responders 104 at a pre-determined time interval prior to arrival of the emergency vehicle 108 at the road segment 107. For example, the one or more traffic responders 104 may be activated 1 minute before the emergency vehicle 108 approaches the road segment 107. It should be noted that the terms like "1 minute" and "1 km" are considered as examples and such examples do not limit the scope of the present disclosure.

[0037] At step 304, the one or more traffic responders 104 provides the alert to the one or more vehicles 109 in the road segment 107. The alert may be a display, text, audio, and the like. For example, the alert may in form of a blinking light. In another example, the alert may be in form of a siren, announcement through speakers, and the like. The alert may be a display such that the one or more vehicles 109 may see the display and make way for the emergency vehicle 108. The one or more traffic responders 104 may be installed along the road segment 107. Referring to example 400 of Figure 4, the one or more traffic responders 401 are installed on a median 403. The one or more traffic responders 104 are activated by the traffic segment controller 103 in the road segment 107 and are represented as active traffic responders 402 in Figure 4. The active traffic responders 402 are configured to provide the alert to the one or more vehicles 109. The one or more vehicles 109 may make way to the emergency vehicle 108 upon receiving the alert. As shown in Figure 4, a free lane 404 is created by the one or more vehicles 109. Thus, the emergency vehicle 108 can move seamlessly on the free lane 404. Similarly, free lanes may be created in each road segment 107 from the plurality of road segments throughout a path of the emergency vehicle 108 to enable the emergency vehicle 108 to reach the destination location in least time possible.

[0038] Reference is now made to Figure 5A illustrating an exemplary structure of a traffic responder 500 for providing the alert to the one or more vehicles 109. The traffic responder 500 may comprise one or more units to provide alert, supporting electronics, batteries, and packaging for outdoor conditions, and maximum resilience while providing adequate coverage.

The one or more units may be a display unit, a speaker, and the like. In an embodiment, the traffic responder 500 may be solar powered. In an embodiment, different options for packaging the one or more units and the supporting electronics may be employed. In an embodiment, a first packaging may be an integrated grouted block. The integrated grouted block may be a ruggedized block, built from weathering steel alloy and transparent polymer plastic. The block may be ruggedized to protect from weather, water and shock. In an example, the integrated grouted block is a container for signalling lights used to provide the alert to the one or more vehicles 109. The integrated grouted block may be integrated at least on, a kerbside and a median, seamlessly along with other bricks. In an embodiment, a second packaging may be a protection wall or a grill integration. The supporting electronics and the one or more units may be integrated on to the footpath protection grills or walls. In an embodiment, a third packaging may be a pedestal mounting. The traffic responder 500 may be fitted separately on a pedestal. In an embodiment, the traffic responder 500 may comprise of a battery powered Light Emitting Diode (LED) and a controller to activate blinking of the LED when required. The battery powered LED may remain in standby mode when not required. In an example, the traffic responder 500 may provide announcements through a public address system. Example 501 of Figure 5B illustrates the one or more traffic responders 500 installed in the median. In the example 501, the one or more traffic responders 500 are separated by a pre-defined distance of 25m.

[0039] The central controller 101 of the present disclosure may be based on a centralized architecture. The central controller 101 may be associated with the plurality of road segments. The central controller 101 may manage controlling the traffic for a plurality of emergency vehicles. Further, the central controller 101 may provide optimal routes to the plurality of emergency vehicles. The central controller 101 may manage the one or more traffic signal controllers 105 in a centralized manner. In an embodiment, the central controller 101 may be incorporated with appropriate defence mechanisms against cyber threats.

COMPUTER SYSTEM

[0040] Figure 6 illustrates a block diagram of an exemplary computer system 600 for implementing embodiments consistent with the present disclosure. In an embodiment, the computer system 600 may be used to implement the central controller 101. Thus, the computer system 600 may be used to provide the first signal to the traffic segment controller 612 and the traffic signal controller 613 for controlling the traffic in the road segment for the emergency

vehicle 108. The computer system 600 may comprise a Central Processing Unit 602 (also referred as "CPU" or "processor"). The processor 602 may comprise at least one data processor. The processor 602 may include specialized processing units such as integrated system (bus) controllers, memory management control units, floating point units, graphics processing units, digital signal processing units, etc.

[0041] The processor 602 may be disposed in communication with one or more input/output (I/O) devices (not shown) via I/O interface 601. The I/O interface 601 may employ communication protocols/methods such as, without limitation, audio, analog, digital, monoaural, RCA, stereo, IEEE (Institute of Electrical and Electronics Engineers) -1394, serial bus, universal serial bus (USB), infrared, PS/2, BNC, coaxial, component, composite, digital visual interface (DVI), high-definition multimedia interface (HDMI), Radio Frequency (RF) antennas, S-Video, VGA, IEEE 802.n /b/g/n/x, Bluetooth, cellular (e.g., code-division multiple access (CDMA), high-speed packet access (HSPA+), global system for mobile communications (GSM), long-term evolution (LTE), WiMax, or the like), etc.

[0042] Using the I/O interface 601, the computer system 600 may communicate with one or more I/O devices. For example, the input device 610 may be an antenna, keyboard, mouse, joystick, (infrared) remote control, camera, card reader, fax machine, dongle, biometric reader, microphone, touch screen, touchpad, trackball, stylus, scanner, storage device, transceiver, video device/source, etc. The output device 611 may be a printer, fax machine, video display (e.g., cathode ray tube (CRT), liquid crystal display (LCD), light-emitting diode (LED), plasma, Plasma display panel (PDP), Organic light-emitting diode display (OLED) or the like), audio speaker, etc.

[0043] The computer system 600 may be connected to the traffic segment controller 612 and the traffic signal controller 613 through a communication network 609. The processor 602 may be disposed in communication with the communication network 609 via a network interface 603. The network interface 603 may communicate with the communication network 609. The network interface 603 may employ connection protocols including, without limitation, direct connect, Ethernet (e.g., twisted pair 10/100/1000 Base T), transmission control protocol/internet protocol (TCP/IP), token ring, IEEE 802.11a/b/g/n/x, etc. The communication network 609 may include, without limitation, a direct interconnection, local area network (LAN), wide area network (WAN), wireless network (e.g., using Wireless Application Protocol), the Internet, etc. The network interface 603 may employ connection protocols

include, but not limited to, direct connect, Ethernet (e.g., twisted pair 10/100/1000 Base T), transmission control protocol/internet protocol (TCP/IP), token ring, IEEE 802.11a/b/g/n/x, etc.

[0044] The communication network 609 includes, but is not limited to, a direct interconnection, an e-commerce network, a peer to peer (P2P) network, local area network (LAN), wide area network (WAN), wireless network (e.g., using Wireless Application Protocol), the Internet, Wi-Fi, and such. The first network and the second network may either be a dedicated network or a shared network, which represents an association of the different types of networks that use a variety of protocols, for example, Hypertext Transfer Protocol (HTTP), Transmission Control Protocol/Internet Protocol (TCP/IP), Wireless Application Protocol (WAP), etc., to communicate with each other. Further, the first network and the second network may include a variety of network devices, including routers, bridges, servers, computing devices, storage devices, etc.

[0045] In some embodiments, the processor 602 may be disposed in communication with a memory 605 (e.g., RAM, ROM, etc. not shown in Figure 6) via a storage interface 604. The storage interface 604 may connect to memory 605 including, without limitation, memory drives, removable disc drives, etc., employing connection protocols such as serial advanced technology attachment (SATA), Integrated Drive Electronics (IDE), IEEE-1394, Universal Serial Bus (USB), fiber channel, Small Computer Systems Interface (SCSI), etc. The memory drives may further include a drum, magnetic disc drive, magneto-optical drive, optical drive, Redundant Array of Independent Discs (RAID), solid-state memory devices, solid-state drives, etc.

[0046] The memory 605 may store a collection of program or database components, including, without limitation, user interface 606, an operating system 607, web browser 608 etc. In some embodiments, computer system 600 may store user/application data, such as, the data, variables, records, etc., as described in this disclosure. Such databases may be implemented as fault-tolerant, relational, scalable, secure databases such as Oracle ® or Sybase®.

[0047] The operating system 607 may facilitate resource management and operation of the computer system 600. Examples of operating systems include, without limitation, APPLE MACINTOSH^{R} OS X, UNIX^{R}, UNIX-like system distributions (E.G., BERKELEY SOFTWARE DISTRIBUTION^{TM} (BSD), FREEBSD^{TM}, NETBSD^{TM}, OPENBSD^{TM}, etc.),

LINUX DISTRIBUTIONS™ (E.G., RED HAT™, UBUNTU™, KUBUNTU™, etc.), IBM™ OS/2, MICROSOFT™ WINDOWS™ (XP™, VISTA™/7/8, 10 etc.), APPLE® IOS™, GOOGLE® ANDROID™, BLACKBERRY® OS, or the like.

[0048] In some embodiments, the computer system 600 may implement the web browser 608 stored program component. The web browser 608 may be a hypertext viewing application, for example MICROSOFT® INTERNET EXPLORER™, GOOGLE® CHROME™0, MOZILLA® FIREFOX™, APPLE® SAFARI™, etc. Secure web browsing may be provided using Secure Hypertext Transport Protocol (HTTPS), Secure Sockets Layer (SSL), Transport Layer Security (TLS), etc. Web browsers 608 may utilize facilities such as AJAX™, DHTML™, ADOBE® FLASH™, JAVASCRIPT™, JAVA™, Application Programming Interfaces (APIs), etc. In some embodiments, the computer system 600 may implement a mail server (not shown in Figure) stored program component. The mail server may be an Internet mail server such as Microsoft Exchange, or the like. The mail server may utilize facilities such as ASP™, ACTIVEX™, ANSI™ C++/C#, MICROSOFT®, .NET™, CGI SCRIPTS™, JAVA™, JAVASCRIPT™, PERL™, PHP™, PYTHON™, WEBOBJECTS™, etc. The mail server may utilize communication protocols such as Internet Message Access Protocol (IMAP), Messaging Application Programming Interface (MAPI), MICROSOFT® exchange, Post Office Protocol (POP), Simple Mail Transfer Protocol (SMTP), or the like. In some embodiments, the computer system 600 may implement a mail client stored program component. The mail client (not shown in Figure) may be a mail viewing application, such as APPLE® MAIL™, MICROSOFT® ENTOURAGE™, MICROSOFT® OUTLOOK™, MOZILLA® THUNDERBIRD™, etc.

[0049] Furthermore, one or more computer-readable storage media may be utilized in implementing embodiments consistent with the present disclosure. A computer-readable storage medium refers to any type of physical memory on which information or data readable by a processor may be stored. Thus, a computer-readable storage medium may store instructions for execution by one or more processors, including instructions for causing the processor(s) to perform steps or stages consistent with the embodiments described herein. The term “computer-readable medium” should be understood to include tangible items and exclude carrier waves and transient signals, i.e., be non-transitory. Examples include Random Access Memory (RAM), Read-Only Memory (ROM), volatile memory, non-volatile memory, hard

drives, Compact Disc Read-Only Memory (CD ROMs), Digital Video Disc (DVDs), flash drives, disks, and any other known physical storage media.

[0050] In the embodiments of the present disclosure, the traffic responders are activated to provide alert when the emergency vehicle is at a pre-defined distance from the road segment or a pre-determined time period prior to arrival of the emergency vehicle. Hence, advance notifications are provided to the other vehicles about the approaching emergency vehicle so that the vehicles may make way for the emergency vehicle in advance.

[0051] The free lanes can be created in each road segment throughout a path of the emergency vehicle, to enable the emergency vehicle to reach the destination location in least time possible.

[0052] The central controller of the present disclosure provides optimal route for the emergency vehicle. Hence, the time required by the emergency vehicle to reach the destination location is further reduced.

[0053] Embodiments of the present disclosure provides automatic controlling of the one or more traffic signals when the emergency vehicle is approaching. Thus, need for manual change in the one or more traffic signals is eliminated.

[0054] The terms "an embodiment", "embodiment", "embodiments", "the embodiment", "the embodiments", "one or more embodiments", "some embodiments", and "one embodiment" mean "one or more (but not all) embodiments of the invention(s)" unless expressly specified otherwise.

[0055] The terms "including", "comprising", “having” and variations thereof mean "including but not limited to", unless expressly specified otherwise.

[0056] 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.

[0057] A description of an embodiment with several components in communication with each other does not imply that all such components are required. On the contrary a variety of optional components are described to illustrate the wide variety of possible embodiments of the invention.

[0058] When a single device or article is described herein, it will be readily apparent that more than one device/article (whether or not they cooperate) may be used in place of a single device/article. Similarly, where more than one device or article is described herein (whether or not they cooperate), it will be readily apparent that a single device/article may be used in place of the more than one device or article or a different number of devices/articles may be used instead of the shown number of devices or programs. The functionality and/or the features of a device may be alternatively embodied by one or more other devices which are not explicitly described as having such functionality/features. Thus, other embodiments of the invention need not include the device itself.

[0059] The illustrated operations of Figure 3 show certain events occurring in a certain order. 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.

[0060] 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.

[0061] While various aspects and embodiments have been disclosed herein, other aspects and embodiments will be apparent to those skilled in the art. The various aspects and embodiments disclosed herein are for purposes of illustration and are not intended to be limiting, with the true scope being indicated by the following claims.

Referral Numerals:

Referral Number	Description
100	Exemplary environment

101	Central controller
102	Communication network
103	Traffic segment controller
104	One or more traffic responders
105	One or more traffic signal controllers
106	Traffic signals
107	Road segment
108	Emergency vehicle
109	One or more vehicles
110	System
111	Processor
112	I/O interface
113	Memory
114	Data
115	Modules
200	Internal architecture
201	Detection data
202	Signal data
203	Condition data
204	Other data
205	Detection module
206	Signal provide module
207	Other modules
400	Example
401	One or more traffic responders
402	Active traffic responders
403	Road median
404	Free passage
500	exemplary structure of a traffic responder
501	Example
502	Determination of second road boundary
503	Plurality of cells

504	Intersection
600	Computer system
601	I/O interface
602	Processor
603	Network interface
604	Storage interface
605	Memory
606	User interface
607	Operating system
608	Web browser
609	Communication network
610	Input device
611	Output device
612	Traffic segment controller
613	Traffic signal controller

We claim:

1. A system (110) for controlling traffic in a road segment (107) for an emergency vehicle (108), the system (110) comprising:

a central controller (101) associated with a plurality of road segments, configured to:

detect an emergency vehicle (108) approaching a road segment (107) from the plurality of road segments; and

provide a first signal to a traffic segment controller (103) associated with the road segment (107), wherein the first signal indicates the emergency vehicle (108) approaching the road segment (107);

the traffic segment controller (103), upon receiving the first signal, configured to:

activate one or more traffic responders (104) associated with the traffic segment controller (103), installed along the road segment (107), at a pre-defined threshold condition; and

the one or more traffic responders (104), configured to:

provide an alert to one or more vehicles (109) in the road segment (107), upon the activation, for controlling traffic in the road segment (107) for the emergency vehicle (108).

2. The system (110) as claimed in claim 1, wherein the central controller (101), is configured to detect the emergency vehicle (108) approaching the road segment (107) by:

receiving a current location condition from at least one of, the emergency vehicle (108) and a detector;

tracking a current location of the emergency vehicle (108) from a source location to a destination location, based on the current location condition of emergency vehicle (108); and

detecting the emergency vehicle (108) to be approaching the road segment (107) based on the current location.

3. The system (110) as claimed in claim 2, wherein the current location condition received from the emergency vehicle (108) indicates at least one of, a normal mode and an emergency mode, wherein the normal mode indicates non necessity of traffic control in the road segment (107), wherein the emergency mode indicates need of traffic control in the road segment (107).

4. The system (110) as claimed in claim 1, further comprises one or more traffic signal controllers (105) implemented in one or more traffic signals (106) at the road segment (107), configured to:

receive the first signal from the central controller (101); and

control one or more traffic signals (106) at the road segment (107), to provide an alert for clearing the traffic in the road segment (107).

5. The system (110) as claimed in claim 1, wherein, activating the one or more traffic responders (104) at the pre-defined threshold condition, comprises at least one of:

activating the one or more traffic responders (104) when the emergency vehicle (108) is at a pre-defined distance from the road segment (107); and

activating the one or more traffic responders (104) at a pre-determined time interval prior to arrival of the emergency vehicle (108) at the road segment (107).

6. The system (110) as claimed in claim 1, wherein the traffic segment controller (103) is further configured to:

receive a second signal from the central controller (101) indicating the emergency vehicle (108) exiting the road segment (107); and

deactivating the one or more traffic responders (104) and one or more traffic signal controllers (105) implemented in one or more traffic signals (106) at the road segment (107), upon receiving the second signal.

7. The system (110) as claimed in claim 1, wherein the central controller (101) comprises a database storing information, wherein the information comprises at least one of road conditions at an area, traffic conditions at the area, rerouting information, and locations of each of the one or more traffic responders (104).

8. The system (110) as claimed in claim 7, wherein the central controller (101) is configured to provide an optimal route for the emergency vehicle (108) to a destination location, based on the information.

9. A method for controlling traffic in a road segment (107) for an emergency vehicle (108) using a system (110), the system (110) comprising a central controller (101) associated with a plurality of road segments, a traffic segment controller associated with a road segment (107) from the plurality of road segments, one or more traffic responders (104)

associated with the traffic segment controller, installed along the plurality of road segments, the method comprising:

detecting, by the central controller (101), an emergency vehicle (108) approaching the road segment (107);

providing, by the central controller (101), a first signal to the traffic segment controller in that road segment (107), wherein the first signal indicates the emergency vehicle (108) approaching the road segment (107);

activating the one or more traffic responders (104), by the traffic segment controller, at a pre-defined threshold condition, upon receiving the first signal; and

providing, by the one or more traffic responders (104), an alert to one or more vehicles (109) in the road segment (107), upon the activation, for controlling traffic in the road segment (107) for the emergency vehicle (108).

10. The method as claimed in claim 9, wherein detecting the emergency vehicle (108) approaching the road segment (107) further comprises:

receiving a current location condition from at least one of, the emergency vehicle (108) and a detector;

tracking a current location of the emergency vehicle (108) from a source location to a destination location, based on the current location condition of emergency vehicle (108); and

detecting the emergency vehicle (108) to be approaching the road segment (107) based on the current location.

11. The method as claimed in claim 10, wherein the current location condition received from the emergency vehicle (108) indicates at least one of, a normal mode and an emergency mode, wherein the normal mode indicates non necessity of traffic control traffic in the road segment (107), wherein the emergency mode indicates need of traffic control in the road segment (107).

12. The method as claimed in claim 9, further comprises:

receiving, by one or more traffic signal controllers (105) implemented in one or more traffic signals (106) at the road segment (107), the first signal from the central controller (101); and

controlling, by the one or more traffic signal controllers (105), one or more traffic signals (106) at the road segment (107), to provide an alert for clearing the traffic in the road segment (107).

13. The method as claimed in claim 9, wherein, activating the one or more traffic responders (104) at the pre-defined threshold condition, comprises at least one of:

activating the one or more traffic responders (104) when the emergency vehicle (108) is at a pre-defined distance from the road segment (107); and

activating the one or more traffic responders (104) at a pre-determined time interval prior to arrival of the emergency vehicle (108) at the road segment (107).

14. The method as claimed in claim 9, further comprises:

receiving, by the traffic segment controller, a second signal from the central controller (101) indicating the emergency vehicle (108) exiting the road segment (107); and

deactivating, by the traffic segment controller, the one or more traffic responders (104) and one or more traffic signal controllers (105) implemented in one or more traffic signals (106) at the road segment (107), upon receiving the second signal.

15. The method as claimed in claim 9, further comprises storing information in a database associated with the central controller (101), wherein the information comprises at least one of road conditions at an area, traffic conditions at the area, rerouting information, and locations of each of the one or more traffic responders (104).

16. The method (110) as claimed in claim 15, further comprises:

providing, by the central controller (101), an optimal route for the emergency vehicle (108) to a destination location, based on the information.

17. A central controller (101) for controlling traffic in a road segment (107) for an emergency vehicle (108), configured to:

detect an emergency vehicle (108) approaching a road segment (107) from a plurality of road segments associated with the central controller (101);

generate a first signal indicating the emergency vehicle (108) approaching the road segment (107); and

provide the first signal to a traffic control system comprising a traffic segment controller (103) and one or more traffic responders (104), associated with the road segment (107), wherein the traffic control system provides an alert to one or more vehicles (109), upon receiving the first signal, at a pre-defined threshold condition, for controlling traffic in the road segment (107) for the emergency vehicle (108).

18. The central controller (101) as claimed in claim 17, is configured to detect the emergency vehicle (108) approaching the road segment (107) by:

receiving a current location condition from at least one of, the emergency vehicle (108) and a detector;

tracking a current location of the emergency vehicle (108) from a source location to a destination location, based on the current location condition of emergency vehicle (108); and

detecting the emergency vehicle (108) to be approaching the road segment (107) based on the current location.

19. The central controller (101) as claimed in claim 18, wherein the current location condition received from the emergency vehicle (108) indicates at least one of, a normal mode and an emergency mode, wherein the normal mode indicates non necessity of traffic control in the road segment (107), wherein the emergency mode indicates need of traffic control in the road segment (107).

20. The central controller (101) as claimed in claim 17, wherein upon receiving the first signal from the central controller (101), one or more traffic signal controllers (105) controls one or more traffic signals (106) at the road segment (107), to provide an alert for clearing the traffic in the road segment (107).

21. The central controller (101) as claimed in claim 17, wherein the central controller (101) is further configured to:

provide a second signal to the traffic segment controller (103), wherein the second signal indicates receding of the emergency vehicle (108) from the road segment (107).

22. The central controller (101) as claimed in claim 17, comprises a database storing information, wherein the information comprises at least one of road conditions at an area,

traffic conditions at the area, rerouting information, and locations of the one or more traffic responders (104).

23. The central controller (101) as claimed in claim 22, is configured to provide an optimal route to the emergency vehicle (108) based on the information.

Dated this on January 8th, 2021



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A METHOD AND A SYSTEM FOR CONTROLLING TRAFFIC IN ROAD SEGMENT FOR AN EMERGENCY VEHICLE

ABSTRACT

The present disclosure relates to system (110) for controlling traffic in road segment (107) for emergency vehicle (108). The system (110) comprises central controller (101) configured to detect the emergency vehicle (108) approaching the road segment (107). The central controller (101) provides first signal to traffic segment controller (103) associated with the road segment (107). The first signal indicates the emergency vehicle (108) approaching the road segment (107). The traffic segment controller (103) is configured to activate one or more traffic responders (104) associated with the traffic segment controller (103), at pre-defined threshold condition. The one or more traffic responders (104) are installed along the road segment (107). The one or more traffic responders (104) are configured to provide an alert to one or more vehicles (109) in the road segment (107). The alert is provided for controlling the traffic in the road segment (107) for the emergency vehicle (108).

FIGURE 1A