Real-Time Simulation of Traffic Monitoring System in Smart City

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Abstract
Traffic monitoring process has become the essential element in the smart with a combined power stream of cars, including cars and bicycles. A visitor's stream changes in daylight, thus the adoption of this Traffic monitoring system to get a flexible charge of the traffic lighting time is quite crucial. Internet of Things is implemented almost in every field of life, which is an extension of Wireless Sensor Networks (WSNs). A smart city is a new concept, and it is implemented through smart nodes in the real world like smart parking, healthcare centers, smart transport, and banking. In this paper, we have proposed an intelligent traffic monitoring system using a wireless sensor network for the smart city. Our system has various nodes in the whole city, including roads, objects, and traffic signals, and each node is connected, and each node is sharing the data of the vehicle, traffic rate. When a vehicle enters the smart city, initially, vehicles are verified through the registration system, whereas all the vehicles and persons must be registered. Whereas when the new vehicle enters the city, it notifies the sensors and gives information about the new vehicle. They are also providing the facility of the shortest and traffic-free path in terms of distance and time.

Key words:
cup carbon; XBee; sensor; microcontroller; smart city; internet of things; intelligent traffic monitoring system.

1. Introduction

A smart city can be an integration of various constituents of the metropolis automated in ways to create a smart natural environment and so are interconnected in just a system. A smart city can be a group of smart items deployed at various places in just a metropolis that feel info at unique spots, save and translate it to produce favorable conclusions [1]. Smart cities have been employed in most areas of a lifestyle involving health associations, hospitals, industry, and places of work, transportations, sewerage process, parking, along sensible grids. Bright cities have been mimicked with the sophisticated engineering of Wireless Sensor Networks (WSNs) these as cloud calculating, client-server version, and necessary database administration procedures [2]. Even a smart city can be a necessity of contemporary calculating to earn natural environment electronic, responsive, efficient, more dependable, and more efficient. Even though we can find several advantages of smart cities that there are only a few challenges and issues that are of attention for the investigators. The research workers also have now focused on indicating various remedies for smart cities. However, there is a requirement to handle different problems [3]. We can find only a few strategies suggested by investigators. However, that does not include speech in-fact that the traffic observation and direction methods. Parallel transport control and management devices (PTMS) are suggested by writers to expand intelligent city transport approaches and enlarge brand new production approaches for prospective users [4]. PTMS has quite a few components that can be focused, for example, societal signal traffic, ITS clouds, transport, products and services, comprehension automation, and agent-based traffic control. In reliant computerized surveillance-broadcast are shared that will be useful for broadcast traffic methods [5]. The observation of traffic can be a fundamental portion of networking administration. It has been broadly utilized in system control, intrusion tracking, and protocol investigation. Also, the system traffic tracking might effortlessly fix the vulnerabilities of their platform applications users' glitches along with also other security dilemmas to defend the system safety [6]. In any case, the device, the foundation for system traffic, includes outline and community protection appraisal, which may encourage additional top-level security procedures and calculations [7].

The car business has improved increase, also because of its arrival; it has attained many improvements due to both mechanical and electric technology. Now, engineers are operating on smart automobiles, e.g., Google has generated a smart vehicle. Thus, a requirement of this afternoon to indeed have a smart observation program for differentiating the visitor's density and to automatic path variety [8]. Different potential methods of executing so, as an instance, the newest technology named VANET vehicular ad-hoc system is just one among its examples. Also, it performs on the ITS smart transport method. The other method will be to plot a digital surveillance camera and track just about every motor vehicle in real life; however, its drawback is we cannot obtain a distinct perspective of this car if there is just a substantial quantity of autos [9]. To work out this

Manuscript received November 5, 2019
Manuscript revised November 20, 2019

matter, engineers left a remedy to shoot images of every car and employ a camera on all sides of the chock. But for tracking of their automated motor vehicle, this procedure isn't suitable since there's a gap when managing automatic and manual, therefore we are in need of an automatic platform to get automatic autos by which every single car or truck can interact together with additional and may swap information and upgrade its memory [10]. XBee-Module is popularly properly used because its range is better compared to RF modules and blue tooth or even wi-fi. Still another critical benefit is the fact that XBee ensures 100% information transport in its range. XBee is configured manually using XCTU applications, which gives an easy and simple user interface; we now have two selections to manually configure XBee via controls or choose the desirable control in GUI [11].

Present a simulator named CupCarbon, which is based on multi-agent and discrete event simulation. The current version belongs to the second family of simulators that are described above. It can be used to generate networks for OMNET++. It offers a friendly and straightforward graphical user interface for the modeling of the networks using the OpenStreetMap (OSM) framework [12]. Each node is designed to be as close as possible to the real one. It is composed of four modules: micro-controller, the radio antenna, the capture unit, and a battery [13]. The current version of CupCarbon includes simulation of mobiles, and it allows us to represent the detailed energy diagram for each node versus the simulation time. This version can also be considered as a kernel that can be used to integrate different algorithms and modules, making use of its advantages. It can simulate mobile tracking scenarios [14]. Even the CupCarbon simulation lets the user look, picture, debug, and confirm distributed algorithms for tracking ecological data sets of their radio detector system. It generates ecological conditions such as gas, fires, phones, and broadly speaking within scientific and educational endeavors. It supplies two separate simulation surroundings. First can be a multi-agent surrounding that helps the look of freedom scenarios and the creation of incidents, including gas and fires, in addition to the simulation of cellular nodes [15]. The 2nd surroundings reflect a different event simulation of wireless sensor networks that likewise believes that the scenario intended around the grounds of their original atmosphere. Interference versions dependent on the spontaneous character of outdoor and noise propagation versions are inserted over the Cup-Carbon to supply a more significant realistic investigation of WSNs for smart-city software. All these models have been related to plasma screen zones in line with this obvious connection [16].

2. Literature Review

With all the accelerated development of traffic and the rising productive procedures of system strikes, conventional community traffic tracking strategy cannot meet specific needs of info storage and question in an actual moment. So, the way to track the big scale network site visitors has come to be an essential struggle for community stability administration [17]. Aiming in it, author suggest that a brand-new system tracking platform at which NetFlow whilst the tracking thing predicated on big-data technological innovation, that contains four chief purposes: it may utilize File overcome to amass NetFlow in real-time; it moves the info based on Logstash; it also keeps the info from Elasticsearch, it assesses and screens the info in real period by way of Kabana. The experimental results demonstrate that our strategy will be effective at fulfilling responses to 100 million of NetFlow's. It might satisfy the demands of real-time tracking to get a largescale system targeted traffic and offer the foundation for system security controller [18].

At a system, we will find just two or maybe more than just two apparatus; just about every apparatus can speak with each other depending on the topology utilized. For example, at a straightforward point to point topology, just two products will talk to one another, as well as at a net topology, every single apparatus can speak together product [19]. When a new device combines the system, it informs the planner working with the handshake mechanism. The exact very same strategy is put in a manner that if an automobile (symbolized using a node) enters a system, it will become part of it. The same as autos have diverse enrollment amounts, just about every node in a system using a unique MAC address [20]. Whenever there is a current device connecting the system, or at an instance, the vehicle enters the scope of different vehicles, then then the telling is established to see the different members of their system. Traffic-jam has been due owing to some high numbers of autos in the street, and the variety of autos in the trail is rising every day. It will become crucial to organize the visitor’s stream in the way in a scientific method. The nodes from the system require sensible conclusions to get around the path using a traffic jam. This paper is around the targeted traffic tracking system utilizing social media to effectively restrain the visitor’s roads and steer clear of any mishap or additional accidents [21].

Real-time traffic protection is crucial in now smart transport techniques and certainly will perform a crucial part in tomorrow's sensible metropolitan areas. The task detailed in this paper reports on the evolution and execution of the publication sensible wireless detector for targeted traffic tracking. Computationally effective and dependable calculations such as automobile detection, length, and speed estimation, dimension, and period synchronization proved entirely created, incorporated, and assessed.

Detailed procedure investigation and considerable statistics investigation were conducted with both songs and confirm the platform to get a trusted and powerful performance [22]. Some area studies ran over the street and urban streets for various cases, and below various traffic requirements led in 99.98% detection precision, 97.11% rate estimate precision, and 97% length-based auto-classification precision. The produced process is mobile, trusted, and economical. The machine may likewise be used appropriately for temporary or long-term setup on the outside of the street, roadway, along with also roadside. Implementation expense of one node, for example, congestion would be the USA $50 [23]. The amount of attached apparatus is steadily climbing, and at the not too distant foreseeable future, it is forecast to come to be exceptionally substantial in metropolitan areas. As a result, they are employing simulators to prepare and study a job of putting in new programs until their correct installation is of fantastic worth. They can help predict a few information, such as an indication of the feasibility of this installation in conditions of position, interferences, communicating, and cost. Provide a brand-new structure for its stage CupCarbon, formulated over the investigation endeavor PRESENTER. The principal aim with this stage would be to create and mimic Wireless Sensor Networks specialized in smart city and IoT software. It enables deploying distributed algorithms within a 2D/3D ecosystem, due to their metropolis buildings to set up the system, both the phones and using exact types of wireless propagation and interferences in these surroundings [24].

This paper offers the very first variant of the Wireless Sensor Network Simulator, referred to as CupCarbon. Networks are available and prototyped within a user interface working with the Open Street Map (OSM) frame by deploying detectors right about the map. It may be utilized to review the behavior of the system, along with its costs [25]. The principal targets of CupCarbon are the two scientific and educational. It helps coaches to spell out the fundamental theories and the way that detector systems also operate it might enable experts to check their wireless topologies and protocols. The existing variant may be used appropriately to research the ability plan of every detector along with the total system [26]. The diagrams might also be computed and shown as being the use of the simulated moment. Prototyping systems are somewhat more realistic in contrast to existing simulators.

IoT is short to get Online of matters that are thought of as an inter-communication of heterogeneous wise apparatus behaving as one system. Back in IoT, every single gadget is attached using the world wide web with various apparatus using different capacities within a system. IoT is employed nearly in every single area of daily life that is an expansion of Wireless Sensor Networks (WSNs) [27]. Even a wise metropolis is employed through nodes that are smart in real cases to create an electronic environment. In all areas of lifestyle, for example, bright parking, banking, sewerage method, waste control, ecological tracking, wise transportation, and health care centers. However, there is an exact minimal practical utilization of IoT and smart metropolitan areas infrastructure in-real-life. In this paper, we have centered on a smart traffic tracking platform utilizing chart theory and appropriate procedures [28]. Our advanced version has many different nodes which can be supposed in just a metropolis, for example, roadways, traffic, and objects signs to earn a collective smart, targeted traffic monitoring and guidance platform. Many surgeries, including locating the shortest route regarding time and space, uncovering an area in town and locating the safest and most very low rush manners towards our vacation destination. Even the graph-based version is changed into an official version with Vienna advancement Method-Specification Language (VDM-SL). The evidence of correctness is offered by different facilities out there from the VDM-SL toolbox, as shown in Fig.1.

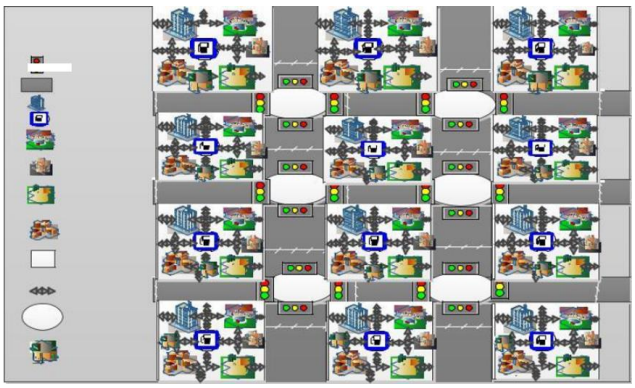

Fig. 1 An abstract representation of an intelligent traffic system [28]

The significance of efficient and effective solutions to auto visitor's protection is extensively known so as allow innovative methods for targeted traffic direction, e.g., dependent on adaptive and decentralized visitors lighting direction. However, most linked services from the literature, even depending around the potent enabler of combined vehicular communications, presume that the comprehensive penetration pace of connectivity/communication technology (and openness to take part within the collaborative surveillance agency) on the focused automobile inhabitants, thereby generating them not so appropriate now [29]. The paper proposes an advanced method for combined traffic protection predicated on vehicular communications competent of (i) dealing using low conversion levels of their projected tech and (ii) of gathering a massive collection of observation info about car freedom in focused aspects of attention rates. The paper introduces lessons and insights learned by the plan and execution job of this suggested answer. What is more, it stories extensive operation evaluation outcome accumulated on sensible simulation events dependent on

the use of both iTETRIS with genuine traces of vehicular visitors of this town of Bologna. The claimed effects present the capacity for our proposition to always gauge the genuine life traffic despite low conversion levels of their remedy (just 10%) [30].

3. Traffic Monitoring System in Smart City

In the Traffic Monitoring System in Smart City (TMS-SC), we have used different sensors like mobile sensors, remote sensors, collective sensors, and traffic sensors; these sensors are connected to micro-controller. Xbee technology is used in this system for wireless communication. Mobile sensors are used for the ubiquitous measurements and disaster management like mobility patterns, transportation, and context-estimation., remote technical sensors, and remote sensors are used for satellite-based terrestrial. Whereas traffic congestion sensors are used for the monitoring of vehicles and pedestrian levels to optimize driving and walking routes and smart road sensor is providing the warning messages and diversions according to change in climate and unexpected events like accidents or traffic jams. Communication technologies have a significant role in the smart city because of the feasibility and cost-effectiveness; priority is given to communication technologies that are deployed in our system like Xbee. Our system is deployed in the whole with some distance in each device, and each device is interconnected with each other, and they are also sharing their data, as shown in Fig.2.

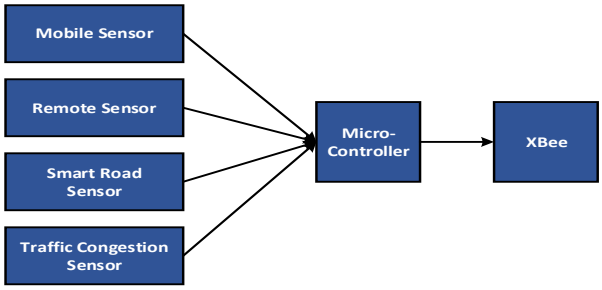

Fig. 2 Working Diagram of the smart traffic monitoring System (TMS-SC)

About our sensors that each sensor node contains mote and sensors that are deployed in different areas like road1 and road2. These sensors are sending the data to the base station. These sensors are collecting the data from buildings, cars, and then making the decisions about transport movement and assigning the shortest rush-free path to vehicles, as shown in Fig.3.

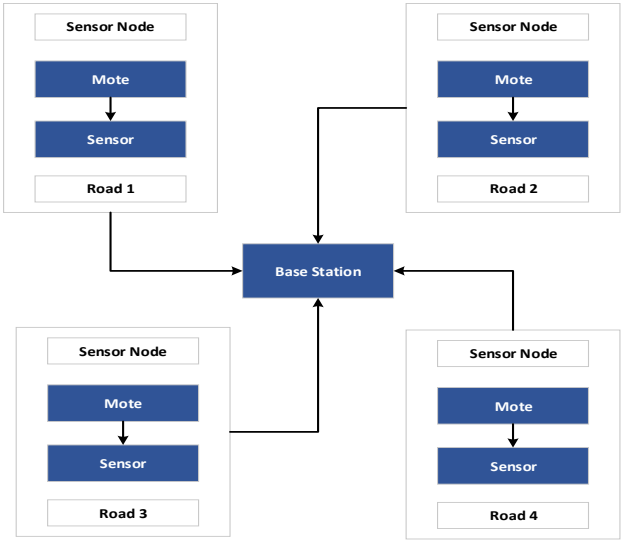

Fig. 3 Deployment of sensor nodes in TMS-SC

4. Real-Time Simulation of TMS-SC using CupCarbon Simulator

Even an intelligent metropolis is employed in real-life scenarios using bright structures, sensors, and actuators. Most models have been shown by investigators to deal with bright metropolis components; however, nonetheless, we will find several flaws which are not resolved by most investigators. Intelligent, targeted traffic observation and direction process is just a significant element of the wise metropolis. We have suggested a version for smart traffic observation and guidance techniques utilizing wireless sensor systems. We have offered a true instance of this system from that detectors are set up in roadways to spot items, visitors signs, and to feel the compulsory facts. While an automobile passes into the wise metropolis, to begin with, motor vehicles have been verified via the registration procedure, whereas all the vehicles along with persons need to be enrolled. Each of the roads and objects are all interconnected to Recognize a Particular place and Discover the shortest route into our destination by simply averting traffic jams. The smart city Intelligent traffic monitoring system is shown in Fig.4 (a). Sensors nodes are deployed in the whole city that monitors the behavior of the vehicle. XBee wireless technology is used for communication between sensors. When a vehicle enters in smart city and gives his destination, these sensors then communicate with each other and give the shortest path according to the traffic rate in the city, as shown in Fig.4 (b).

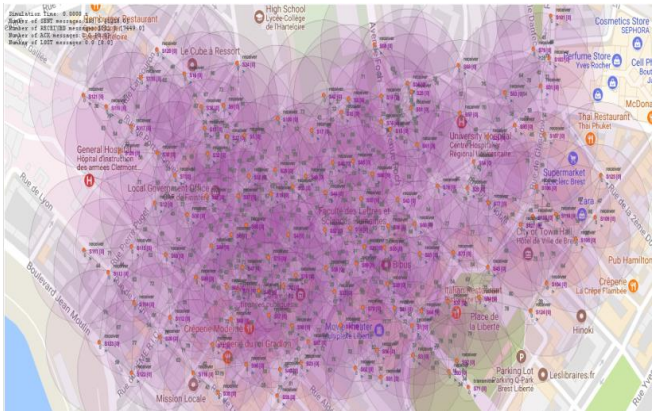

Fig. 4 (a). Smart city Intelligent traffic monitoring system in TMS-SC

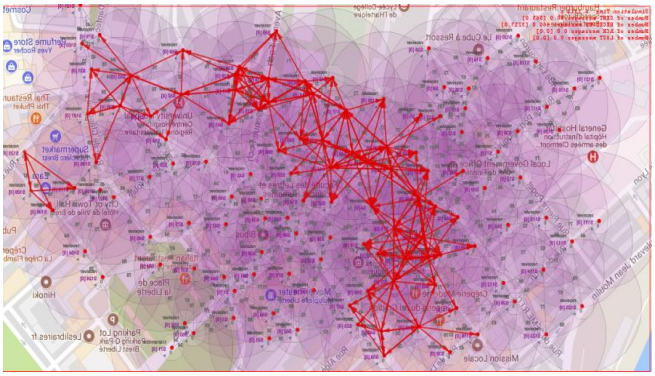

Fig. 4 (b). Finding the shortest path for the vehicle in TMS-SC

This shortest-path helps the vehicle to reach its destination in the very shortest time and a rush free environment. Now in Fig.5, the technology has calculated every distance to the node and has sensed all the environments of nodes. The shortest path to reach the destination is achieved and assigned to the vehicle in Fig.6 as it is highlighted with yellow.

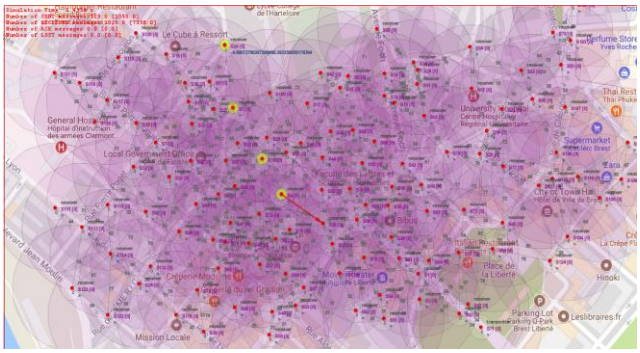

Fig. 5 Returning the shortest path to the vehicle in TMS-SC

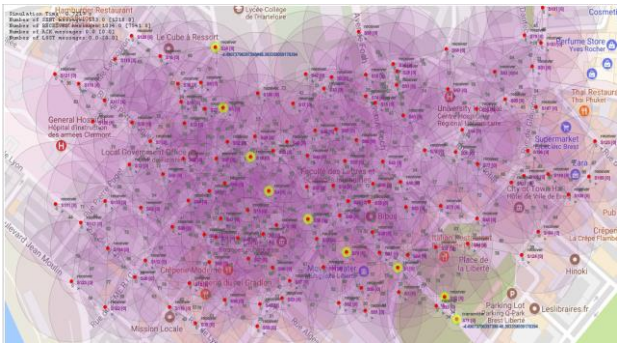

Fig. 6 Shortest path assigned to the vehicle in TMS-SC

A satellite view of the smart city is shown in Fig.7 (a) where many wireless sensors are deployed in the whole city, and every sensor is connected, and these sensors are connected to the base station. Each sensor is sending the vehicle and traffic information to the base station. All the process of sensing vehicle data and transferring to other node is performed in Fig.7 (b). When every node sends the data and distance, the sensors monitor the short and best path. Then the traffic-free path is assigned to the vehicle, as shown in Fig.7 (c).

Fig. 7 (a). A Satellite view of the smart city in TMS-SC

Fig. 7 (b). Sensing every node within TMS-SC

Fig. 7 (c). Assigning the shortest and rush free path to vehicle

There is still another instance which in case a vehicle is not yet enrolled, and enrollment procedure registers person or vehicle afterward confirmation. Every car or man should have consented to input the intelligent metropolis. In the entry, entrance time, range plate, and automobile identifier are stored in the database network. After an automobile exit, it is own departing the time together side the additional mandatory details have been listed. The machine will be automatic using detectors that sense the updates and traffic central database. When a vehicle enters the smart city, all the sensors sense the presence of a vehicle and notify all stations. If that vehicle is already registered, then these sensors will not add the data, but if there is a new vehicle in the city, they will add the information. This process is shown in Fig.8 (c) when the new vehicle enters the smart city; the sensors become yellow as they are gathering the information of that vehicle and the information to the base station. However, if the already registered vehicle enters the city, sensors send the data as "A" shown in Fig.8 (b). Fig.8 (a) is showing that there is no vehicle, and sensors are not sending any data as they have not sensed a vehicle.

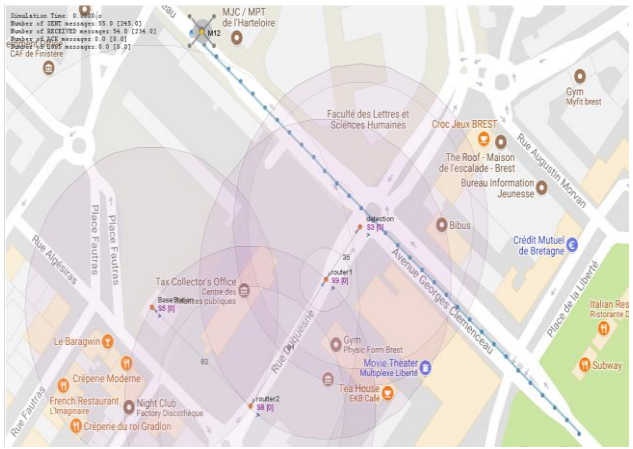

Fig. 8 (a). Sensors are not sensing any vehicle in TMS-SC simulation

Fig. 8 (b). Already registered vehicle passing through sensors in TMS-SC simulation

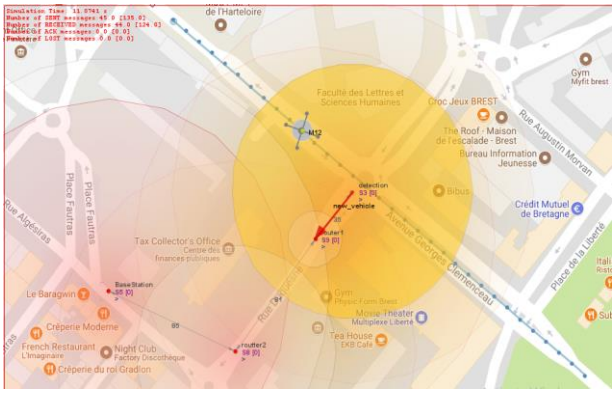

Fig. 8 (c). New vehicle sensed by wireless sensors in TMS-SC simulation

5. Conclusion and Future Work

Internet of things will be the interconnection of true cases together with actuators, sensible nodes, detectors, networks, and software that empower communicating, interpretation, accumulate and swap the exact info. A smart city is the automation of certain life scenarios to the smart atmosphere for city progress and to manage public resources. We have suggested an approach of a traffic tracking platform utilizing a wireless detector system. All these detectors are located in the entire city, comprising buildings, roads, and schools, and healthcare facilities. Insects are amassing the specific advice of traffic that is heavy, advice of every car, and subsequently sharing this advice with each node. The technique is currently seeing just about every node and locates that the shortest and most rush-free route to give center to human beings. Our strategy works a lot more efficiently in significant traffic because the manual strategy does not aid in an emergency position to manually restrain traffic.

The motorists of all car or truck are advised together with all the rush-free road to attaining our location. The technique is functioning extremely economically and

delivers the exact outcome shown in preceding graphics. Since the simulator has been done thus, this is sometimes put into place from the real universe situations.

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