

Implementing Dijkstra's algorithm for vehicle tracking in adverse geographical condition.

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Abstract

Nowadays vehicle tracking is an important topic in research and development. A vehicle tracking system is an electronic device installed in a vehicle to enable the owner or a third party to track the vehicle's location. The main objective of this paper is to create a system for a particular company or school to keep track of their vehicle and even see the route of the vehicle for a particular cluster on their own maps. This paper is proposed to design a vehicle tracking system that works using GPS and GSM technology. It will keep track of the employee and driver of the company. And also gives shortest path to the driver using Dijkstra's algorithm. This is often used to quickly respond on events in the field such as emergency cases like accident, system faults. This design will continuously monitor a moving Vehicle and report the status of the Vehicle on demand. A GSM modem is used to send the position (Latitude and Longitude) of the vehicle from a remote place. The GPS modem will continuously give the data i.e. the latitude and longitude indicating the position of the vehicle.

Keywords: GPS, GSM, Dijkstra's

Introduction

Nowadays transportation plays a vital role and it's safety measures are also considered. So having GPS vehicle tracking system ensures their safety while travelling. The latest like GPS are highly useful now a day, this system enables the owner to observe and track his vehicle and find out vehicle movement and its past activities of vehicle. When the vehicle is stolen, the location data from tracking system can be used to find the location and can be informed to police for further action. Some Vehicle tracking System can even detect unauthorized movements of the vehicle and then alert the owner. When a request by user is sent to the number at the modem, the system automatically sends a return reply to that particular mobile indicating the position of the vehicle in terms of latitude and longitude. A program has been developed which is used to locate the exact position of the vehicle and also to navigated track of the moving vehicle on Google Map.

Dijkstra's algorithm is often used in routing and other network related protocols. For a given source in the graph, the algorithm finds the costs of shortest paths from a single node to a single destination node by stopping the algorithm once the shortest path to the destination node has been determined. For example, if the vertices of the graph represent cities and edge path costs represent driving distances between pairs of cities connected by a direct road, Dijkstra's algorithm can be used to find the shortest route between one city and all other cities.

This system is not limited to find the location of the target but also calculates the distance travelled between two stations. This system is user friendly, easily installable, easily accessible and can be used for various other purposes. After installation system will locate target by the use of a Web application (HTML based application) in Google map. The system allows to track the target anytime and anywhere in any weather conditions.

GPS Technology:

The **Global Positioning System (GPS)** is a space-based radio navigation system owned by the United States Government (USG) and operated by the United States Air Force (USAF)."

The GPS concept is based on time and the known position of specialized satellites. The satellites carry very stable atomic clocks that are synchronized with one another and to ground clocks.

GPS satellites continuously transmit their current time and position. A GPS receiver monitors multiple satellites and solves equations to determine the precise position of the receiver and its deviation from true time. At a minimum, four satellites must be in view of the receiver for it to compute four unknown quantities (three position coordinates and clock deviation from satellite time).

A GPS receiver receives the signals from at least three satellites to calculate distance and uses a triangulation technique to compute its two dimension (latitude and longitude) position or at least four satellites to compute its three dimension (latitude, longitude and altitude) position.

GPS is considered a *dual-use* technology, meaning it has significant military and civilian applications. GPS has become a widely deployed and useful tool for commerce, scientific uses, tracking, and surveillance. GPS's accurate time facilitates everyday activities such as banking, mobile phone operations, and even the control of power grids by allowing well synchronized hand-off switching.

GSM Technology

GSM, which stands for Global System for Mobile communications, reigns as the world's most widely used cell phone technology. Cell phones use a cell phone service carrier's GSM network by searching for cell phone towers in the nearby area. A GSM modem is a specialized type of modem which accepts a SIM card, and operates over a subscription to a mobile operator, just like a mobile phone. A GSM modem can be a dedicated modem device with a serial, USB or Bluetooth connection, or it can be a mobile phone that provides GSM modem capabilities.

What is GSM Technology?

GSM or global system for mobile communication is a digital cellular system. It was originated in Finland Europe .however now it is throughout the world. GSM (Global System for Mobile Communication) accounts for 80% of total mobile phone technologies market.

The letters GSM originally stood for the words Groupe Speciale Mobile, but as it became clear this cellular technology was being used worldwide the meaning of GSM was changed to Global System for Mobile Communications. Since this cellular technology was first deployed in 1991, the use of GSM has grown steadily, and it is now the most widely cell phone system in the world. GSM reached the 1 billion subscriber point in February 2004, and is now well over the 3 billion subscriber mark and still steadily increasing.

Advantages of GSM:

Improved spectrum efficiency.

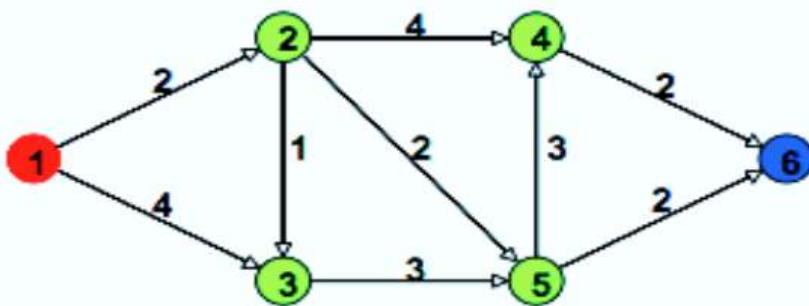
International roaming.

Low-cost mobile sets and base stations (BSs).

High-quality speech.

Compatibility with Integrated Services Digital Network (ISDN) and other telephone company services.

Dijkstra's algorithm



Dijkstra's algorithm will assign some initial distance values and will try to improve them step by step.

1. Assign to every node a tentative distance value: set it to zero for our initial node and to infinity for all other nodes.

2. Set the initial node as current. Mark all other nodes unvisited. Create a set of all the unvisited nodes called the *unvisited set*.
3. For the current node, consider all of its unvisited neighbors and calculate their *tentative* distances. Compare the newly calculated *tentative* distance to the current assigned value and assign the smaller one. For example, if the current node *A* is marked with a distance of 6, and the edge connecting it with a neighbor *B* has length 2, then the distance to *B* (through *A*) will be $6 + 2 = 8$. If *B* was previously marked with a distance greater than 8 then change it to 8. Otherwise, keep the current value.
4. When we are done considering all of the neighbors of the current node, mark the current node as visited and remove it from the *unvisited set*. A visited node will never be checked again.
5. If the destination node has been marked visited (when planning a route between two specific nodes) or if the smallest tentative distance among the nodes in the *unvisited set* is infinity (when planning a complete traversal; occurs when there is no connection between the initial node and remaining unvisited nodes), then stop. The algorithm has finished.
6. Otherwise, select the unvisited node that is marked with the smallest tentative distance, set it as the new "current node", and go back to step 3.

What is GMap?

GMap is an algorithm for visualizing graphs as maps. Information visualization can be invaluable in making sense out of large data sets. However, traditional graph visualization methods often fail to capture the underlying structural information, clustering, and neighborhoods. GMap, provides a way to overcome some of the shortcomings with the help of the geographic map metaphor. While graphs, charts, and tables often require considerable effort to comprehend, a map representation is more intuitive, as most people are very familiar with maps and even enjoy carefully examining maps. The effectiveness of GMap is illustrated with examples from several domains, namely TV shows, Amazon books, and last.fm music.

Literature Review

Pankaj Verma, J.S Bhatia, 2013[1], the system is about making vehicle more secure by the use of GPS, GSM technology and a web application. It can also be beneficial for:

- Parental control to look after their children.
- To track animals in jungles
- Shipping services
- Cops department and fire services

Amol Dhumal, Amol Naikoji, Yutika Patwa, Manali Shilimkar, Prof. M. K. Nighot, 2014[2], this system allows individual and organizations to track their vehicles and to get exact location of vehicle. The system allows them to monitor the travelled routes through a user that uses the Google Maps and shows if the devices on route.

Kunal Maurya, Mandeep Singh, Neelu Jain [3], other applications include monitoring driving behavior, such as an employer of an employee, or a parent with a teen driver.

Proposed System

The proposed system is used for positioning and navigating the vehicle. The exact location is indicated in the form of latitude and longitude along with the exact Navigated track on Google map. The system tracks the location of particular vehicle and sends to users. They arrived data, in the form of latitude and longitude issued to locate the Vehicle on the Google maps and also we can see the output on the LCD. Admin also has record of the fuel, maintenance and service of each and every vehicle. Admin can even see the approximate time, distance and directions followed by the driver according to his cluster.

System Design

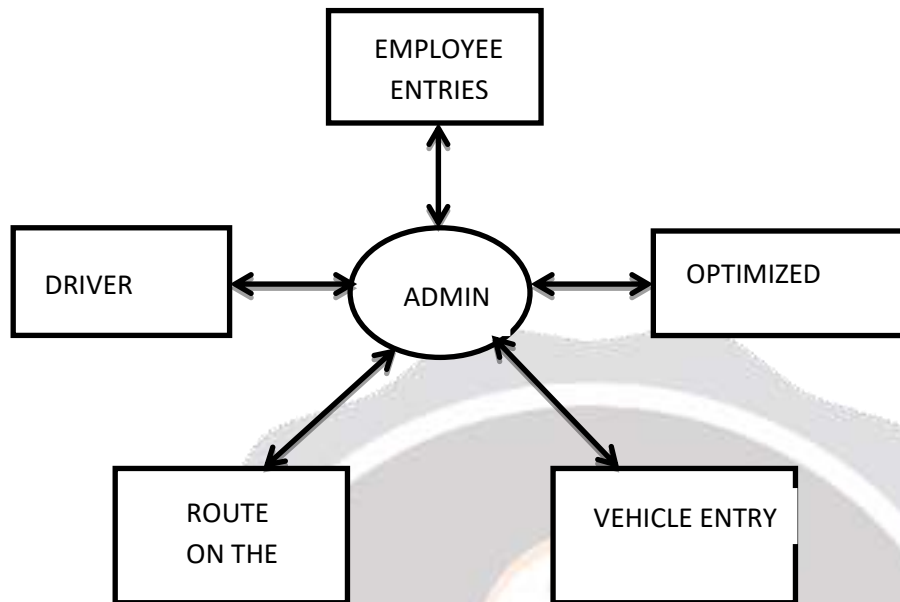


Fig.1

Fig.1 shows, a centralized system design at information flow levels, all communications between the different modules are channeled through a Admin. In employee entries module entries and updates are made in the database. Route of vehicle is shown on the map. Optimized module is used to give the optimized path to the driver about the destination. It uses the GMap Directions to calculate the shortest path to reach to a particular destination. Driver entry is used to enter the Driver Information in the database. Vehicle Information is stored in the database by vehicle entry module.

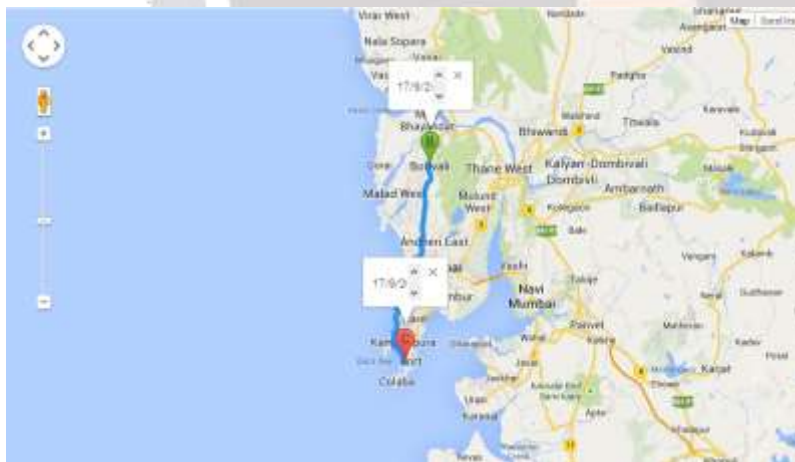


Fig.2

The fig.2 shows, a flag B and C indicates the route to be travelled by the vehicle. Where B is the beginning point and C is the end point.

 National Park - Kanheri Caves Road, Sanjay Gandhi National Park, Kulupwadi, Borivali East, Mumbai, Maharashtra 400066, India		
39.8 km - about 50 mins		
1.	Head west on National Park - Kanheri Caves Rd	0.4 km
2.	Turn left toward Western Express Hwy	0.2 km
3.	Take the ramp onto Western Express Hwy	21.5 km
4.	Continue onto Bandra Reclamation Flyover	1.6 km
5.	Continue onto Bandra - Worli Sea Link Partial toll road	4.6 km
6.	Slight left onto Worli Seaface Rd	0.3 km
7.	At the roundabout, take the 4th exit and stay on Worli Seaface Rd Pass by Worli Dugdhalay (on the left in 2.1 km)	2.8 km
8.	Turn right onto Dr Annie Besant Rd Pass by Atria (on the left)	0.7 km
9.	Continue onto Lala Lajpatrai Marg Drive along Haji Ali Bay (on the right for 1.1 km)	1.2 km
10.	Turn right onto Pedder Rd Pass by Heera Panna (on the left)	1.6 km
11.	Continue onto Kemps Corner Flyover Pass by Petrol Pump (on the left in 350 m)	0.9 km
12.	Turn right after Reliance Jewels (on the left)	0.2 km
13.	Take the 2nd left onto Netaji Subhash Chandra Bose Rd Pass by the park (on the right in 350 m)	3.4 km



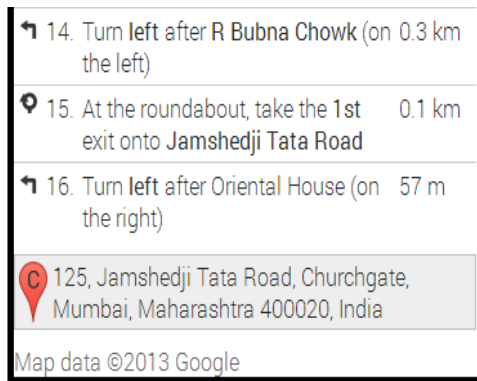


Fig.3

Fig.3 shows, indications, diversions, traffic updates, hospitals etc. which helps to navigate the vehicle and undertake safety measures. It shows distance and approximate time taken to reach the destination.



Fig.4

Fig.4 shows, the vehicle move on it get notification about the distance covered and the shortest route to reach the destination.

Conclusion

The project is all about the tracking the vehicle's location. This project is use to calculate shortest path using algorithm also use to maintain the record of fuel, distance travelled by the vehicle etc. By using GPS, GSM technology and web application we can make vehicle more secure. It can also be beneficial for:

1. Parents to look after their children.
2. Employee should be on or before time of bus departure.
3. Delivery services.

In the development of the system we interacted with each and every modules and we came to known things get displayed in the GMap. Learning and to knowing things about GMap thought us many things.

To display things on the GMap through database interaction was shown. Even the optimized route that is the shortest route to travel through different points using Dijkstra's algorithm. Learning Dijkstra's was also a great experience how the lower bound and upper bound limits are calculated is shown.

Even the employee can update his or her entries and even the cluster can have the same effect.

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