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Research paper

Investigation of car surveillance using GPS and GSM system based on google maps

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Abstract

This paper initially surveys about car tracking organization and then investigate car surveillance using Global System for Mobile Communi-cation (GSM) and Geographical Positioning System (GPS). Nowadays, widespread GSM systems motivate many innovative applications such as location tracking and monitoring of car and children. These systems demonstrate the object is moving path by user cell phone or personal computer via mobile or internet networks. One of the more interesting technology is GPS which is used in many applications for tracking the vehicle monitoring and saving a possible record of all activity of driver and car services. The Google maps could support this technology by providing the online services of routing. This research includes the hardware part and comprises the GSM, GPS and Google maps with an efficient microcontroller. The software part represents the interface of the required module with web services for the proposed system and provides the platform for more enhancements in future requirements. The implementation results show that the objects are being tracked with minimum monitoring error and accurate track.

Keywords: *Car Surveillance; GSM; GPS; Google Maps.*

1. Introduction

Objects location tracking inside and outside positions have huge attention for researchers in this time due to fast growth in communications technologies. Many technologies are used for identifying and monitoring user location as in [1, 2, and 3]. Efficient, scalable GPS technology has the position of the subject in the broad public area. Though, the tracking signals sent by a specific satellite could not be exploited the indoors locations without extra supported techniques. The intelligent transportation technology such as traffic data of inquisitive car in real time congestion area could be achieved by tracking system [4]. In many emergency situations and lifesaver, a fast and automatically support for the vehicle position when the accident occurs could be achieved by the tracking systems. If a stolen accident of the car has happened, one could attach this car with the anti-theft system also. The tracking antenna could identify the device position data through periodic signals, which transmitted via close base stations of mobile networks, which are connected to the PC, and the receiver of GPS device [5]. The exacting structure has an advanced advantage where the system is fixed in the car for tracking and monitoring. The capability of this system offers another advantage by tracking the pathway along with the motion of the device, and this option will permit the user to observe the entire data from the antenna of GPS [6]. The application of view could utilize many services like locating in demand persons such as patients monitoring by doctors using the specific sensor. The implementation of tracking systems and management of cars has a good area of interest for many researchers, and contributors have introduced many investigations. Lately, the anti-theft model has been modified in real time monitoring presentation. The presented paper by [7], describes the implementation of a tracking system that provides efficient localization of cars with minimum cost via the GM862 Cellular quad band module. The GUI and monitor server in the website is developed with SQL to see the appropriate position of the car on the maps. In the same time, the suggested idea offers many data regarding the car status such as stop point and speed. By using GSM and GPS module [8], the automobile anti-theft system depends on fastest mixed chip C805IF 120 which detects the stolen by sensor chips. This system keeps contact with automobile owner via GSM modem for safety. The improvement of GPS and GSM car tracking has presented by [9]. This researcher makes the intercity transport companies track their cars in real time phase which provide more security from robbery and any accident. By using compass sensor type YAS529 from Yamaha Company, the describing of the practical model for routing and tracking the car in a significant area of outside environments has presented by [10]. Lastly, the vehicle position displayed on Google maps has been developed and introduced by [11]. The architecture of the system shown in Fig. 1 has proposed by [12] which used CMOS 8 bit microcontroller based RISC design and composed of 16k bytes of flash memory in its programs with 1k bytes internal SRAM and 512 bytes EEPROM.

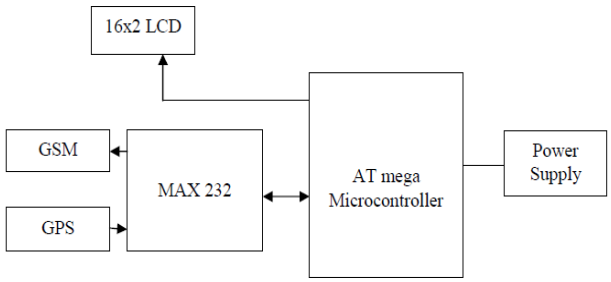


Fig. 1: Design of the Transmitter Unit Proposed by [12].

The GPS modules are commonly used for positioning, navigation and time determination and the antenna of GPS receives the posi-

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tion parameters from satellite to provide the data message of transmission time and location in that time. The GSM modem is used to transmit and receive the information between vehicles and manager point via SIM 300 based GSM train associated with frequency of 900MHz to 1900 MHz. In this proposal [12], MAX 232 and 16x2 LCD is used as a display location with 9 v storage battery to power up the systems.

The tracking system is secure, and a management's solution for many applications in this technology is used to determine the position by GPS, GSM and Google maps environments. The satellite facilities and the ground base station will support this technology in term of the navigation system. By using GPS technology to track the cars in any place on all over the world with different types of vehicle, position determination could be fitted inside the car with effective real-time implementation and data transfer [13, 14]. All collected data about the subject will store and download to the PC to use in future analysis. The tracking system is a necessary device to monitor the car at any time which becomes more popular to the user that has expensive cars. Besides, any collected information about the user car movement could be viewed by electronic map through specific software and internet network. The collection of hardware modem and software programs could help to build this system and activated in online or offline case. Base station, car unit, and software programs represent the major parts in this system. The incorporation of all these parts is hardware inside the car with GPS and GSM devices with the setup of Arduino chip [15, 16]. The system is mostly based on the modem with GPS antenna to receive the data signal from satellite and mobile network. The modem is used to convert the information from GPS to the car position via SMS to synchronize it with website pages and the server. The data will be displayed on the online or offline Google maps. The base station contains the wireless network system which receives and transfers the car information to the center of data relative to the car owner. The software and geographic maps including the base station are useful for car positioning [17]. Every city or area all over the world is available in a base station that has a built-in web server. The user will get the location of his/her car by the software and database in this system. The coordination of any visiting point will be recorded in this database to display later as needed using Google maps. Though, the location of the vehicle could be viewed when it travels by connecting the owner with the server properly [18]. The security of the vehicle is concerned with the owner which the researchers are always looking for new and upgraded systems to offer the user demand. The possibility of modern technology permits to track and intimately monitor the car in real time implementation with checking the history of car movement in every second [19], [20]. The latitude and longitude of car locations could be found by the GPS technology, and the latter is sent to the monitoring center for analysis. To track the car in real time, many software is used to monitor the subject in the monitoring center to illustrate the subject in the Google map [21]. To monitor the subject continually, a lot of facilities in these systems have become more popular in current time. The hardware of the system can be installed inside the car by hidden methods to prevent the theft from discovering these systems. Therefore, this system has a secure unit which continuously sends the exact location of a car [22]. The center of monitoring has specific software to support the owner for car location in showing car via electronic maps available in the Google maps. By using any browser, the user could connect to the server and see the car under track system association with Google facilities to save the subjects from fake calling to know the car location [23]. This system looks like big technology advancements for security case which enable the owner to keep the car under eye at any time from any place. The combination of electronic device inside the car with possible software is to permit the monitoring and collecting data from an initial position to destination place [24]. When somebody uses this system, it could be served either new replacement for conventional alarm and offer the remote control the car including door block or engine running at emergency case [25]. This system will also detect the unauthorized movement of the car by a specific alarm, and this will give the system an edge against other device technology in the same principle. The module of this device contains a communication independently with high ability to work simultaneously with different networks to offer successful real-time position determinations [26]. The surveillance system could be installed on the subjects like bus, truck, and children with high accurate task. This system has a slot of SIM which uses GSM SIM to transmit and receive special SMS from and into subjects to track them. A flat file of database could be created and saved in the PC as text file or binary file in same time. To access the text file, the software type XAMPP could use which makes a possibility of the task [27]. Therefore, one could divide the tracking system into two sections by car location tracking and car protection. In this paper, after above survey, an approach as in illustrated block diagram of Fig. 2 has been presented to develop the current design with many important options of services and easy software is used to track the vehicle and any other subjects. Fig. 3 shows the virtual flow of the proposed system.

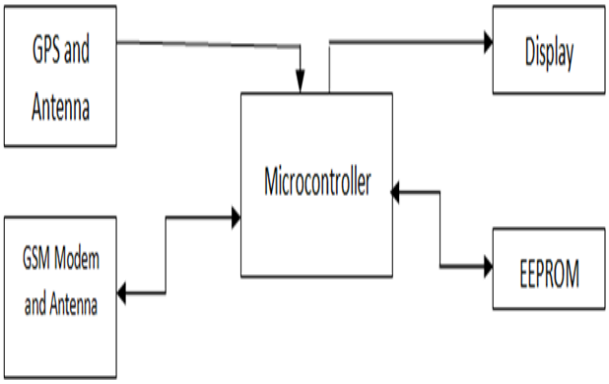


Fig. 2: Suggested Vehicle Tracking and Monitoring Algorithms.

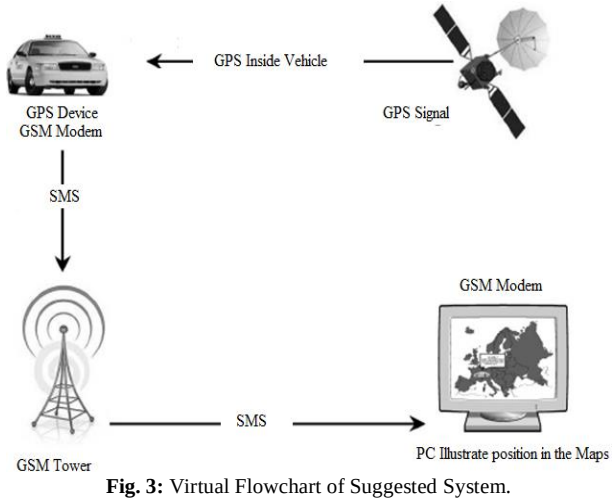


Fig. 3: Virtual Flowchart of Suggested System.

2. Software flowchart and programming

The programming of this work has implemented in C-sharp language under the flowchart shown in Fig. 4. The coordinated data received from specific satellite is definite by programs and deciphering the electronic protocol which represents the dominant principle of the developed applications. To obtain the position parameters, the handheld mobile phone number must be included in the programming. The protocol used in this work should contain a set of message in ASCII characters.

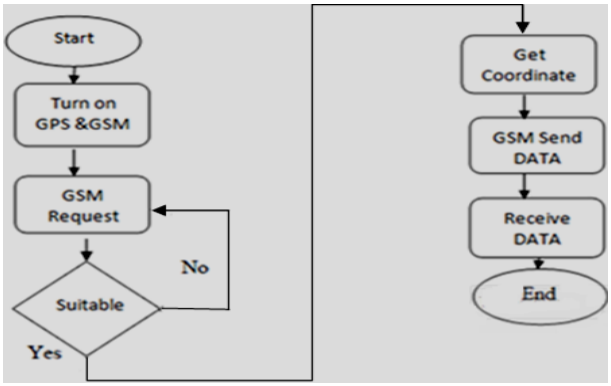


Fig. 4: Flowchart of the Tracking System Programming.

3. System architecture and analysis

The vehicle monitoring and tracking system has developed in real time and investigated as well. The monitoring and tracking device include GPS receiver to receive the data primarily latitude and longitude from specific satellite via mobile or PC device by SMS through GSM modem. This modem is connected with Arduino type R3 to control all activity. The vehicle location information is transferred to the server by hypertext protocol (HTTP). The coordinated data is stored in this server as database information. By using hypertext preprocessor, the website applications are built with C-sharp language, or hypertext markup language (HTML) associated with Google maps facilities. Through Google map application program interface (API), the programs will be running the browser and connect this data in Google map to display the car's location on the maps. The data of geographical location is updated every second and the map updates automatically in same time to achieve the tracking in real time mode. The details of all system sections could be explained in below subsections:

a) Microcontroller and google maps

Essential knowledge about much program language should be understood before system design is done to ensure the possible connection between the microcontroller and GSM/SIM module to save the car position data via Google maps. By using Arduino microcontroller and SIM module, the received data from satellite was send to database after programming the Arduino IDE software correctly. The C-Sharp language has been used to code and compiling the microcontroller with another part of proposed system. The Google Search engine has developed the maps option for mobile mapping and computer mapping to offer 2D satellite maps with high-resolution images.

b) Short message services (SMS)

The SMS has the value of latitude and longitude about the vehicle in charge will send to user according to the request of GPS with the attached link to see the coordinate in the Google maps. The vehicle path will appear in the maps according to updated data via SMS as illustrated in Fig. 5.

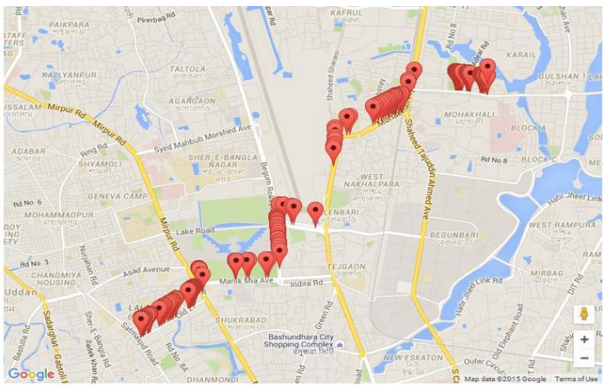


Fig. 5: Vehicle Locations on Google Map Website.

Firstly, the procedure will start with GPS module, which is connected to the microcontroller (Arduino) to receive and record the latitude and longitude of the car in charge. The software of IDE is used to program the code of this data. The collected data are about vehicle locations via SMS by using HTTP request to web server. To send this data to the controller, a command of CMGS is used in the programs, and CMGR command is for reading this SMS. The configuration of GPRS has adjusted by SAPBR command, and the internet access of HTTP services has initiated by HTTPINT command.

c) Web page synchronization

The mobile and PC device applications have been built using android studio software which is embedded with website to provide good ability of user to view the maps in the mobile or PC. The android has programming with C-Sharp language which is different from API to make the application of the design. The activity of coding was created via web-view techniques. The URL of web page has been included in the tracking mode. Fig. 6 shows the vehicle pathway in the Google maps using mobile phone applications.

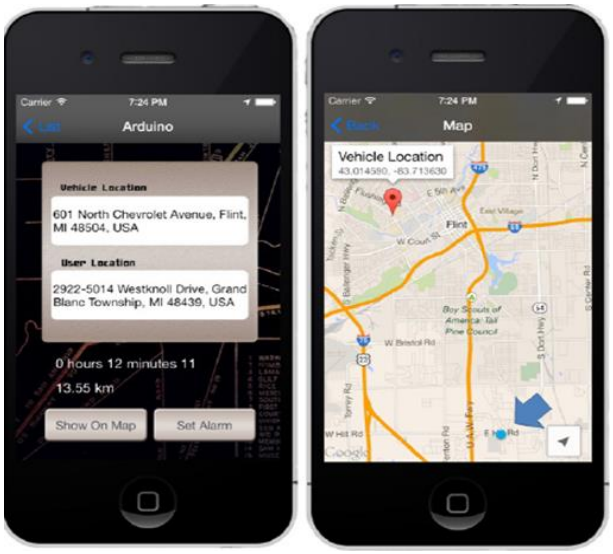


Fig. 6: Vehicle Path in the Google Maps Using Mobile Phone Applications.

To demonstrate the vehicle tracking system operation accurately, the iPhone device has been configured with a Smartphone application developer. Two locations appeared, one for car and the other was the remote position user on the map of Google, and the position of vehicle was updated. Additionally, the distance and time data between the two locations in the given route could be displayed in the device as well as the vehicle location address was updated frequently as the vehicle location is changed. More location view in Google maps is illustrated in Fig. 7 and Fig. 8.

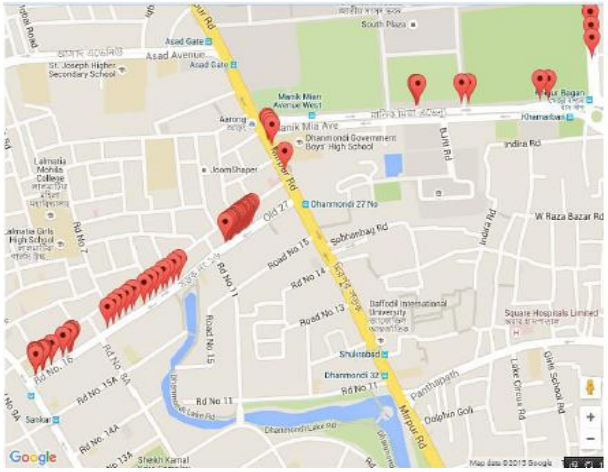


Fig. 7: Vehicle Location in Google Map.

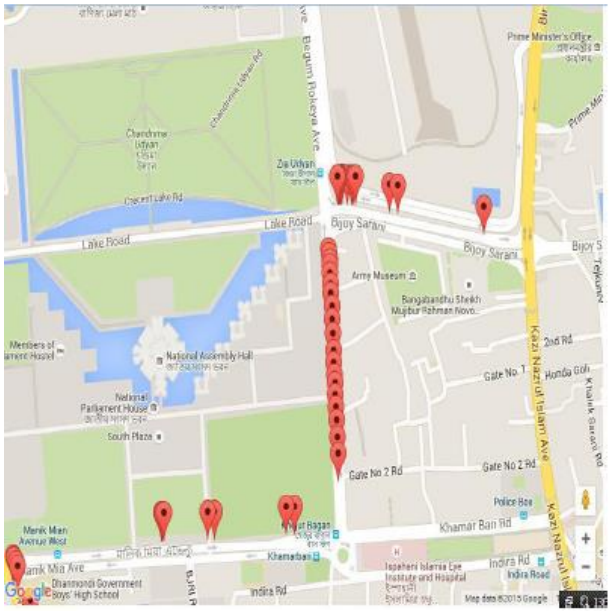


Fig. 8: Google Map Locations of Tracked Vehicle.

The delay can be found in the car tracking after testing the setup of the proposed design. The observation time delay in the vehicle device is to request or send the SMS to the user. The SIM cards of many different operators and delay recorded for every operator in pair and many data have recorded with corresponding average time considered to analyze the system behaviorally. After many experiments were done, the delay time near significant values has been found. This delay happens due to GSM network requesting in some activity when the vehicle passes through weak coverage area. In addition to the benefit of this systems, there are some limitations could appear in the real-time implementation. The poor weather condition increases the delay in transmitting and receiving the vehicle data when the GPS connection is initiated, and the clear view of sky is required in this case. The system operation inside or outside with wrong path will depend on the efficiency of the transmitting and receiving the signal from satellite. Thus, incorrect values of data about the car location result in an error being received by the user. The design is focused on providing car track and anti-theft solution with minimum cost and robust structure. The presented system and services use simple, cheap and free to implement the hardware and software requirements. Instead of GPRS, SMS is used to transfer the data from the owner and the tracked vehicle because SMS is widely used nowadays. The GPRS services are somewhat poor and undependable in some applications.

d) Results Analysis

The performance of the proposed system has been verified to prove the ability at all assumed options. Many tests were conducted to check and confirm the suggested structure in real-time mode. The test is done in an urban area with a portable kit in the car. The real-time tracking and speed record of the car has saved as active form. The received SMS is stored as a database in SD card memory which is uploaded to the GPS in online software. The location of the car in longitude and latitude has registered in table to return for future requirements. To record the trace path of the vehicle, the GPS coordinators was used which is saves as text file. The car path points shown in Fig. 9 represent the real-time implementation of the tracking systems.

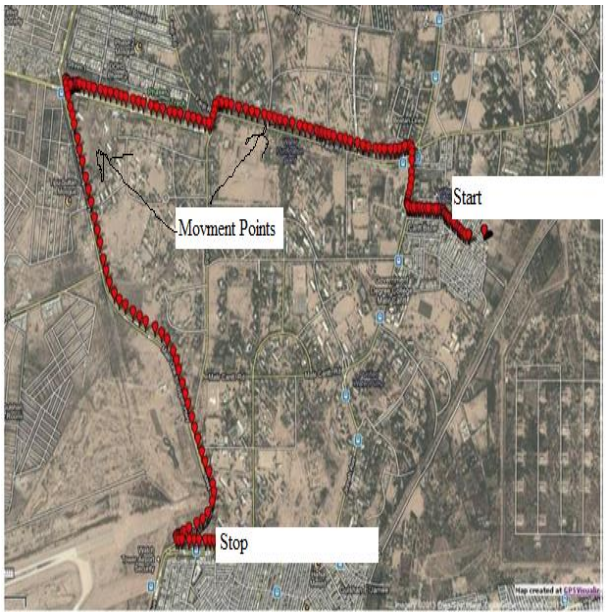


Fig. 9: Real-Time Path of Car Tracking System.

This approach has good accuracy achieved successfully with minimum error in speed by 2 seconds delay due to high building which affected the surveillance. Table 1 illustrates the recorded information of the car tracking for longitude, latitude, and speed of the car in specific points.

Table 1: Collected Data for Real-Time Tracking System

Tracking location	Time	Location in longitude	Location in latitude	Speed
1	20:50:45	2454.7611,N	06711.1590, N	20.2,K
2	20:50:47	2454.7576,N	06711.1540, N	24.5,K
3	20:50:49	2454.76 18,N	06711.1514, N	22.4,K

4. Conclusion

The literature survey and development of flexible vehicle tracking system for any subject tracking are presented in this work. This system has tested and implemented after the GSM modem has configured to track and monitor the car position through SMS, and online Google maps API options. The central part of this research is the Arduino and GSM modem as control by AT command which enables the transmission of data via GPS to provide the information of position. When the GPS receives the new data, it will be updated in the database every second to see the position of car in the maps in life case. The consideration of designing the real-time vehicle tracks the scenario of any place on all over the world. The developed device could provide high level of control and accurate data process in real time to make the possibility for the user to save subjects with early recovery if the car has stolen by anybody. The GPS implementation in the vehicle could surely transport rebellion change in the approach under very high urban every day. Many applications could be built over the suggested structure due to capability of improvement of this system in an easy way which makes it open for future necessities without rebuilding the design with efficient performance. This development can be more promising for future and current design in term of reliability to many fields such as children track, the animals track and fire services. This approach could be enhanced by using camera of mobile based applications to provide an implementation in real time form suitable for user for target tracking.

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