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Real Time Vehicle Tracking Using Arduino Mega

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ABSTRACT

Automobiles are necessary for the movement of goods from one location to another. Consumers may face several problems as a result of delays in the delivery of goods. This delay may be due to drivers choosing incorrect or longer routes when delivering. To avoid these challenges, the Global Positioning System (GPS) is increasingly being used for management of vehicle fleets, recovery of stolen vehicles, mapping and surveillance. This paper outlines the design and implementation of a real time GPS tracker system using Arduino. When a user makes a call on the number that is registered on the GPS-GSM shield attached to Arduino, the user receives the location coordinates with data being stored continuously on an SD card simultaneously. This proposal has significant application for vehicle security, salesman tracking and private drivers.

Keywords*: Arduino, Adafruit FONA 808 Shield, GSM, GPS, Storage Card.*

1.INTRODUCTION

With advancements in technology, there has been an increase in the usage of vehicle tracking systems. The design of vehicle tracking systems enable the display of a vehicle's position on Google Maps. The GPS, GSM/GPRS modules controlled by Arduino MEGA are placed inside the vehicle. In this way, the vehicle position is updated every 10 seconds as the vehicle is moving. Vehicle tracking systems are very useful nowadays. This system enables the owner to observe and track the vehicle and find out about vehicle movement and past activities of automobile. This technology popularly called real time Vehicle Tracking Systems has proved useful in ensuring the security of vehicles. This hardware is fitted onto the vehicle in such a manner that persons who are in or outside of the vehicle cannot see it. Thus, it is used as a covert unit which continuously, or as a result of interruptions to the system, sends location data to the monitoring unit. When a vehicle is stolen, the location data from the tracking system can be used to find the location and so inform the police for further action. When users make a request, the GPS coordinates of the vehicle are sent to a specified mobile. The user will be provided with the position of the vehicle in terms of latitude and longitude which can be viewed using Google Maps. Additionally, the system has an SOS feature whereby the driver can press a button to get help for an emergency. This service is typically provided at a low cost. This information is available to authorized users of the system via internet websites [1].

2.RELATED WORK

The hardware and software of the GPS and GSM network have already been developed. The proposed GPS/GSM based System has two parts. The first is a mobile unit and the second is a controlling station. All system processes including the various interfaces for transmission of data have worked successfully. These results are compatible with current GPS technologies [2].

A Vehicle Tracking System is a device that is fitted in a vehicle, to enable the vehicle owner to identify the vehicle's location. This paper proposes the design of a vehicle tracking system that utilizes GPS and GSM technology. This system built based on an embedded system, can be used for tracking and any car through GPS - Global Positioning System and GSM - Global System for Mobile Communication. This design will continuously monitor the location of a moving vehicle and report the status of the vehicle on demand [3].

Face Detection System will be used to detect the face of the driver, and compare with a predefined face. If for example a car owner is sleeping while an individual steals the car, the Face Detection System will obtain images via a tiny web camera that is hidden in the car. The Face Detection System will compare the obtained images with the stored images. If the images do not match, then the information is sent to the owner through MMS. The owners will receive the images of the thief on their mobile phone, and will be able to trace the vehicle location through GPS. The location of the car and its speed can also be displayed to the owner through SMS. The owner will be able to see images of the thief, as well as the vehicle location. As can be seen, this system can be utilized in our day-to-day life [4].

This system provides vehicle cabin safety and security based on the embedded system, by modifying the existing modules. In this way, the system is able to monitor the level of the toxic gases such as CO, LPG and alcohol within the vehicle, and provides alerts through an alarm in dangerous situations. An SMS will be sent to an authorized person through the GSM. In this method, the IR Sensor is used to detect the static obstacle in front of the vehicle and the vehicle will stop if any obstacle is detected. This mechanism will aid in avoiding collisions with obstacles [5].
Kai-Tai Song and Chih-Chieh Yang created a real-time, visual, vehicle safety tracking system. This paper outlines a novel feature-filled vehicle-tracking algorithm, able to automatically

detect and track several moving objects such as cars and motorcycles, ahead of the tracking vehicle. In conjunction with the concept of focus of expansion (FOE) and view analysis, the system can isolate features of moving objects from moving background and offer a collision word of warning in real-time. The proposed visual tracking system has been validated in real road tests. The results provide collision warning information in urban areas, with speeds of about 60 km/hour both at night and day times [6].

A remote monitoring system based on SMS and GSM was implemented, inclusive of the hardware and software designs. This paper notes that remote signals can be transmitted through the GSM network. This includes two parts: the monitoring center and the remote monitoring station. First, the monitoring center is made up of a computer and the GSM communication module. The software-monitoring center and the remote monitoring station were implemented using VB. The result of this demonstration shows that the system can control communication between the monitoring center and the remote monitoring station [7].

The proposed system uses cloud computing infrastructure as its basis. Sensors are used to monitor the driving conditions including the speed at which the vehicle is travelling, and even fuel level. All the data is transferred to cloud server using a GSM enabled device. All vehicles can be equipped with GPS antenna to identify locations. To avoid drunk driving, an alcohol sensor can be installed to monitor the driver's status. The proposed technology can therefore significantly reduce frequency of accidents on highways [8].

3.PROPOSED METHOD

This paper proposes a vehicle tracking system for tracking vehicle theft using GPS and GSM technology. The GPS receiver and GSM modem utilizes Arduino MEGA2560. The system is affixed to the vehicle. A GSM mobile phone can be used to send and receive the information. Therefore, the GPS system will send the longitudinal and latitudinal values corresponding to the position of vehicle to the GSM Modem. If for example, an individual forgets where their vehicle is parked, an SMS can be sent to the vehicle GPS, The SMS sent would be transmitted through the GSM service provider, thereby reaching the vehicle. The vehicle will have a GSM device installed, which includes a SIM card. Through the GMS modem, the SMS will be received and sent to the Arduino MEGA2560 in the vehicle. Upon receipt of the message, the Arduino MEGA2560 checks the password and the request. If everything matches then it will perform the request required by the owner by sending a link that has longitude & latitude through Google Maps, showing the location of the vehicle.

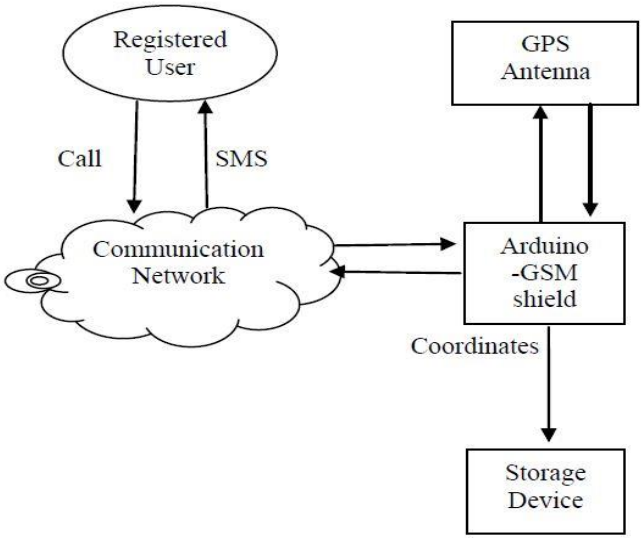

Figure 1: Architecture of Real-time GPS tracking system

A. Block Diagram

Fig. 2 shows a Block diagram of a tracking system that is built on a GSM and GPS platform. It consists of an Arduino MEGA2560 with power supply, Adafruit FONA 808 Shield - Mini Cellular GSM + GPS for Arduino, Lithium Ion Polymer Battery, Passive GPS Antenna uFL - 15mm x 15mm 1 dBi gain, Slim Sticker-type GSM/Cellular Quad-Band Antenna - 3dBi uFL, Ethernet Shield, SIM Card (2G network), micro SD card (2GB)

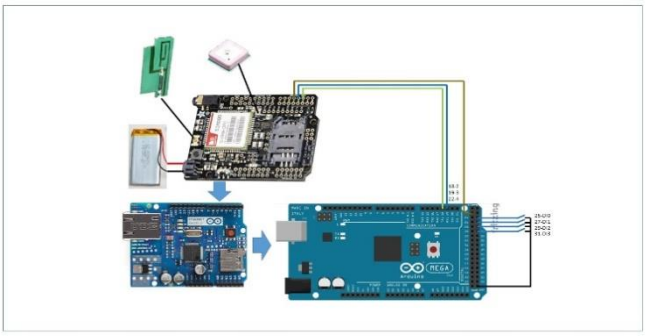

Figure 2: Block diagram of the GSM/GPS-based Vehicle Tracking System

B. Circuit Descriptions

An Arduino MEGA2560 is used for interfacing to various hardware components. The proposed design will allow for the continuous monitoring of vehicle status, and provision of reports as requested. To enable this reporting, an Arduino MEGA2560 is interfaced with a GSM Modem and a GPS Receiver. The modem is used to send the location of the vehicle from a remote place. The GPS modem will continuously provide data showing the position of the vehicle. The GPS modem gives many parameters in its output, such as whether the vehicle is moving or is parked. This data will be sent to the user mobile upon demand. This vehicle tracking system takes input from GPS and sends data through the GSM module to the desired mobile. Vehicle Tracking Systems are among the biggest technological advancements for monitoring vehicle

activity. The security system utilizes GPS to find the location of the vehicle being tracked or monitored. Subsequently, satellite systems are used to send the coordinates and the location data to the monitoring center. At the monitoring center, various software is used to locate the car on a map. In this way the vehicle owners are able to monitor their automobile in real time. Due to this real-time tracking facility, owners of expensive cars have become increasingly interested in vehicle tracking technology.

C. GPS Technology

The Adafruit FONA 808 GSM + GPS Shield is an all-in-one cellular phone module that allows an individual to add location-tracking, voice, text, SMS and data to the Arduino shield format for easy use. This shield fits right over the Arduino or compatible devices. At the heart of the Shield is a powerful GSM cellular module with the GPS integrated into it. This module offers a Quad-band 850/900/1800/1900MHz, and can therefore connect to any global GSM network with any 2G SIM. With a fully-integrated GPS a headset and electric microphone can be used to make and receive calls, send and receive SMS messages, and send and receive GPRS data (TCP/IP, HTTP, etc.) [9].

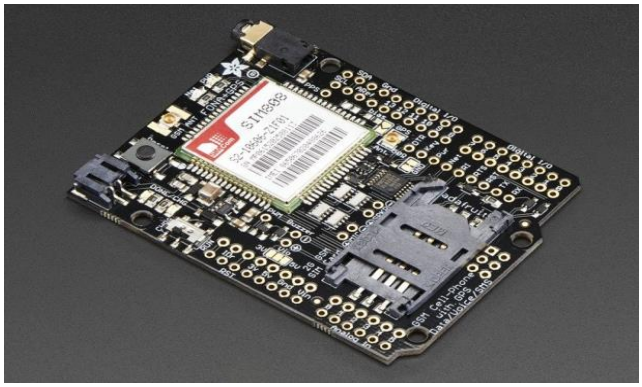

Figure 3: GPS module

D. GSM Modem (3dBi GSM)

This 3dBi GSM antenna is slim, compact and highly sensitive. The antenna juts out from its base with a stick-on back, so you attach it to an enclosure if you're making something such as a DIY phone. It has a tiny uFL connector on the end - which is perfect for the 1946 - but can also be used on other frequencies on the 850/900/1800/1900/2100 bands [10].

Some features of the GSM mechanism are:

(A) 38mm long antenna, (B) 2mm thickness, (C) adhesive backing.

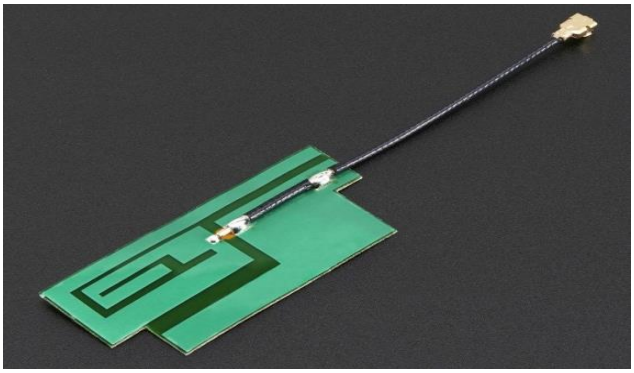

Figure 4: GSM module

4.WORKFLOW

The flowchart in Fig. 4 shows how the GPS tracking system runs in real time.

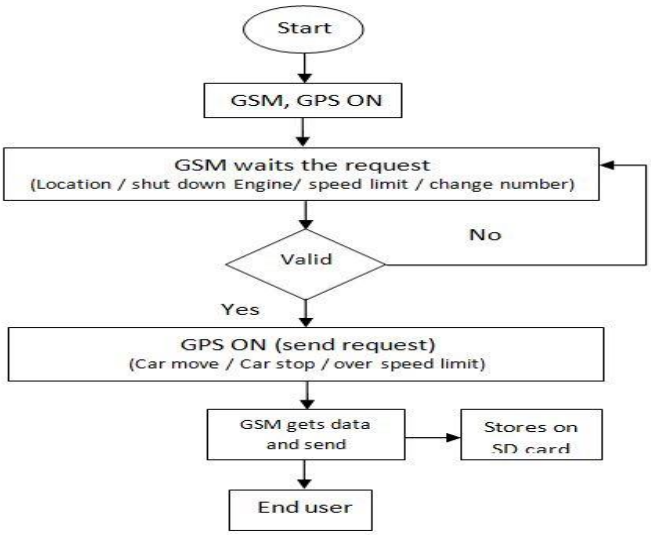

Figure 5: Flow chart GPS tracking system

When the GPS tracking system is insulated in a car, the system will run automatically and provide data updates on the move by sending SMS massages. The features of this design include:

- Users can set their own speed limit. If the car goes over the speed limit, the user will get alert message saying, "The car has exceeded the speed limit of …miles";
- When the vehicle begins to move, or comes to a stop, the user will receive an alert indicating the location. This will aid in ensuring the driver does not take loner routes, or stop in locations that is not the final destination.
- The user can shut down the car engine. Therefore, if the car begins to move without the user's knowledge or consent, they can stop the engine by sending a SMS.

5.CONCLUSION

This paper notes the increased demand for vehicle tracking systems for tracking the theft of vehicles through GPS and GSM technology. This system can be used for both personal and business purposes to improve safety and security, communication, and performance monitoring. Vehicle tracking systems have become increasingly important in large cities and are more secured than many other systems. Nowadays, vehicle theft is rapidly increasing. With this technology however, vehicle theft can be better controlled. This technology can also help to advance transportation systems, and can be used in many organizations for security and tracking purposes. Also, the proposed system is more useful, as a result of the addition of different types of sensors which help to protect the owner and other users of the vehicle by reducing the possibility of collisions. In the event of an accident, the system will send the location to designated numbers so assistance can be provided as soon as possible. This will be particularly useful in instances where accidents occur in deserted places and midnights. In the future, this vehicle tracking and accident alert feature will play an important role in day-to-day life.

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