Vehicle Tracking System based on Arduino using GSM and GPS Technologies

[#1]Nang Noom Yein Sang

University of Computer Studies, Taunggyi

noomyeinsang@ucstgi.edu.mm

Abstract: *Among the developed technologies in day-to-day life, the vehicle tracking system is widely used to identify the vehicle location. In this paper, a tracking system is described use of GPS and GSM technologies to track the location of the vehicle. This tracking system takes the latitude and longitude data from GPS and send it through GSM module to desired mobile phone using mobile communication. When there is the vehicle stolen case, the user makes a phone call to the GSM module implemented with the microcontroller. It then sends this place information with the google map link to the user mobile phone. The microcontroller Arduino Uno is used as the main part of the system that gets the location of the vehicle from GPS. This system is implemented for the purpose of locating the stolen vehicle and supporting the taxi agency to detect the location of its vehicles and can be useful for other purposes.*

Keywords: Arduino Uno, GPS (Global Positioning System), GSM (Global System for Mobile Communication)

1. INTRODUCTION

As the increasing rate of using vehicles, the safety for private and transporting vehicle is an important role. So, the effective security system for owners is highly demanded. In this paper, the interactive tracking system is proposed using the combination of GPS and GSM technologies integrated with Arduino microcontroller.

When the vehicle is stolen, the GPS module (receiver) in the device receives information about the location (coordinates) from the GPS satellites and transmits data to the microcontroller. The signals from GPS satellites are available free of cost and these are enabled to determine the location, the time, and along with the velocity.

The GSM modem is set up with a registered SIM card and receives the GPS parameters of latitude, longitude and time from the microcontroller. The location of the vehicle is indicated in the form of latitude and longitude that are transformed into Google link navigated track on Google map. When the user makes the phone call to the GSM module, the SMS that contains Google link location of the vehicle is received. This system is user friendly, easily installable, accessible and can be used for various other purposes. It is also useful for the public transporting system to navigate the location of its vehicles.

The rest of the paper is described as follows. In section 2, we present the technology used for the system and we propose the design and implementation of the vehicle tracking system in section 3. We conclude the system with the future scope and advantages of using this system in section 4.

2. TECHNOLOGY USED

2.1. Arduino Uno

Arduino is the open source electronic prototyping platform based on flexible and easy to use hardware and software [1]. It is also low cost and programmable and compatible with all operating systems (window, Linux and mac0. The Arduino Uno as shown in Fig.1 is a microcontroller board based on the ATmega328.

Figure 1. Arduino Uno

It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or

power it with an AC-to-DC adapter or battery to get started. [2]

2.2. GSM Technology

Global System for Mobile communication (GSM) is digital cellular system used for mobile devices. It is an international standard for mobile which is widely used for long distance communication. The GSM SIM 900A is a special type of modem which operates on a subscriber's mobile number over a network like a cellular phone [7].

SIM900A module shown in Fig.2 allows users to send/receive data over GPRS, send/receive SMS and make/receive voice calls. The GSM/GPRS module uses USART communication to communicate with microcontroller or PC terminal. AT commands are used to configure the module in different modes and to perform various functions like calling, posting data to a site, and so on [3].

Figure 2. SIM 900A GSM Module

2.3. GPS Technology

The Global Positioning System (GPS) is a satellite-based navigation system that works in any weather circumstances at anywhere [4].

The NEO-6 module series is a family of stand-alone GPS receivers featuring the high-performance u-blox 6 positioning engines. These flexible and cost-effective receivers offer numerous connectivity options in a miniature 16 * 12.2 * 2.4 mm package [5, 6]. A GPS Module (NEO-6M) is shown in Fig. 3.

Figure 3. Neo 6M GPS Module

3. SYSTEM IMPLEMENTATION

The system is implemented as the embedded system which is used for knowing location of the vehicles with many purposes. The block diagram is illustrated in Fig. 4.

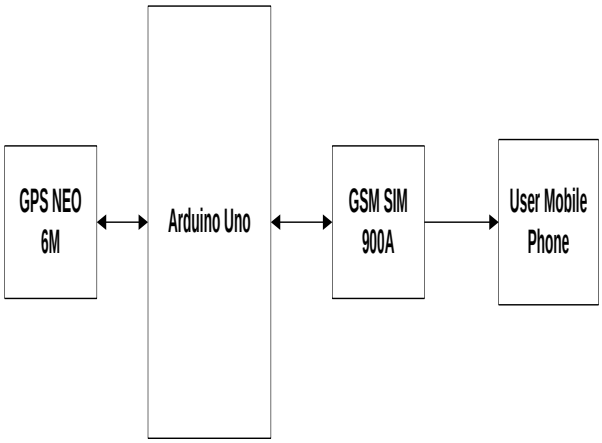

Figure 4. Block Diagram of the System

The microcontroller Arduino uno is used for controlling the whole process that is interfacing with other hardware components. There are two functions in the system in which GPS is used to retrieve the coordinates of vehicles' location and the second one is that GSM reports the status of the location by the SMS to the users on making call. After setting up the hardware components with the program, we can install it in vehicle and power up capitals.

3.1. Work Flow of the System

In this system, we have used GPS Module Neo 6M and GSM Module SIM900A described in the section 2. The system flow diagram of the system is shown in Fig. 5.

Firstly, the GPS and GSM module are power up and wait the phone call from vehicle's owner. When requested phone call is received, Arduino takes the real time data detected from GPS module. This data contains location of vehicle with respect to the latitude and longitude values. And then theses are converted to the Google link using the instruction (GPS. google) in the program. The link data is sent to the GSM.

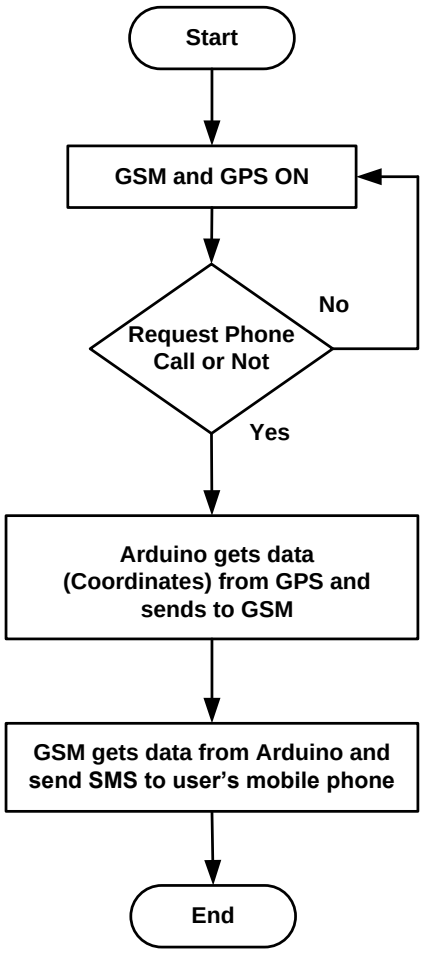

Figure 5. System Flow Diagram

As the second step, the GSM module receives the link data and sends the SMS message to the requested user. This SMS message contains the Google link of vehicle's location as shown in Fig. 6.

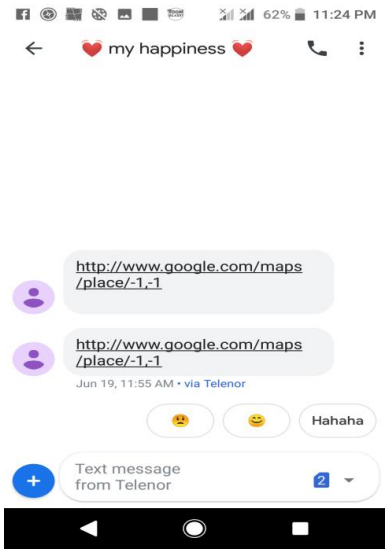

Figure 6. SMS Message in User Mobile Phone

And then, the user clicks the location link and can view easily the location of the vehicle on the google map as shown in Fig. 7

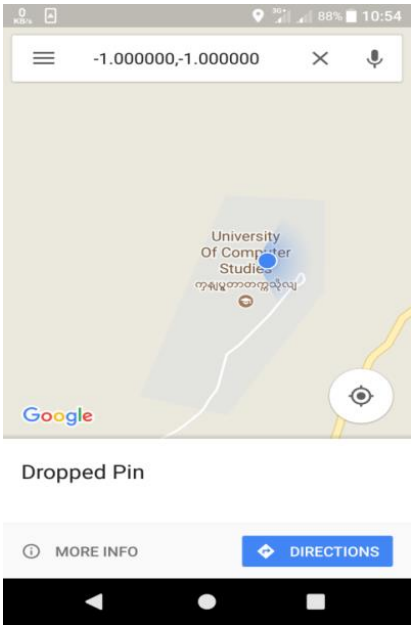

Figure 7. Vehicle Location on Google Map

3.2. Circuit Explanation

The circuit connection of the system is very simple and the hardware components that are implemented in the system are described in Table 1.

Table 1. Hardware Components List

No.	Components
1.	Arduino Uno
2.	GPS Module (NEO-6M)
3.	GSM Module (SIM900A)
4.	Power Supply(9V)
5.	Jumper Wire
6.	5V 2A Adapter

For booting the GSM module, insert the sim card to module and lock it. And then it is connected with the adapter (5V, 2A) and turns it ON. If the connection is successfully established, the status LED on module will blinks every about 2 seconds. Next step to check the connection is making phone call to

sim card in GSM module. If a ring is heard back, it is sure that the successful connection is established.

The communication between GSM and arduino is serial communication. Therefore, the PWM enabled pins 8 and 9 of arduino are connected to the TX and RX pins of GSM made with the Software Serial Library of arduino. Then, connect the ground pin of arduino to ground pin of gsm module. The diagram of these connections is shown in Fig. 8.

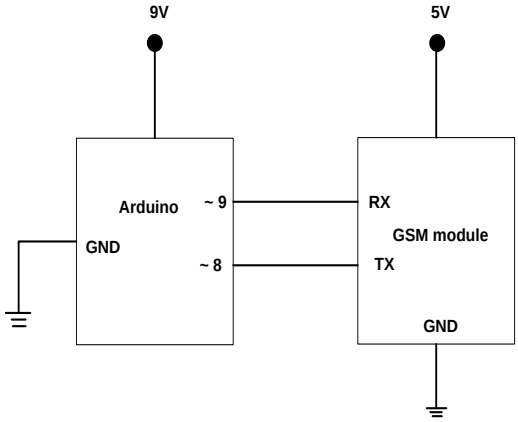

Figure 8. Connection between Arduino and GSM

A GPS receiver must be locked on to the signal of at least three satellites to estimate 2D position (latitude and longitude) and track the moment [4]. The GPS module sends the tracking position data in real time in NEMA format. In this format there are several sentences in which the only one sentence is needed that start with $GPGGA. It contains coordinate, time and other useful information. The latitude can be found after two commas and longitude can be found after four commas and these are stored in arrays.

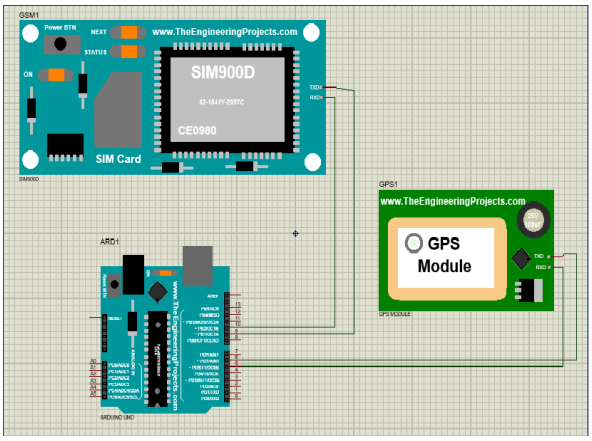

Figure 9. Schematic Diagram of the System

In the system, the RX and TX pin of GPS are connected to pins 5 and 6 of the Arduino. The schematic diagram of the system simulated on Porteous is shown in Fig. 9.

4.CONCLUSIONS

The system is designed with a GPS modem which tracks the location of a vehicle in terms of its longitude and latitude. This information is fed to the microcontroller which is connected with a GSM module and it is converted to google link and. Microcontroller saves the location details and sends it to the worried authority in the form of an SMS over GSM. Therefore, the proposed system can be highly useful for inti-theft of stooling vehicles. This system is also useful for transport companies to keep trace their vehicles and fleet management. It can be enhanced in the future by developing the web application which is continuously monitoring the track of the vehicle.

5. REFERENCES

[1] R. P. Suman, “Celebrating Arduino Day 2014,” 2014.

[2] https://www.arduino.cc

[3] https://www.electronicwings.com

[4] K. Saif, S. Junaid, S. R. Abbas, and R. Nabbel, “Vehicle Tracking System using GPS and GSM Technology,” 2017.

[5] http://www.waveshare.com

[6] B. Wukkadada, and A. Ferbabdes, “Vehicle Tracking System using GSM and GPS Technologies,” IOSR Journal of Computer Engineering (IOSR-JCE), pp05–08.

[7] B. Hari Kumar, S. F. Tehseen, S.Thanveer,G. V. Krishna, and S. M. Akram, “Vehicle Monitoring and Tracking System using GPS and GSM Technologies,” vol 03, issue 04, April 2016.