HARAMAYA UNIVERSITY

COLLEGE OF COMPUTING AND INFORMATICS

DEPARTMENT OF COMPUTER SCIENCE

Embedded System Project

Arduino based tracking system using GPS and GSM for Monitoring Public Transportation

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1. INTRODUCTION

Global System for Mobile Communication (GSM) and Global Positioning System (GPS) based vehicle location and tracking system provided effective, real time vehicle location, mapping and reporting this information value and add by improving this level of service provided. The GPS based vehicle tracking system is designed to find out the exact location of any vehicle and intimate the position to the concerned authority about through an HTTP client Request. The system includes a GPS modem that it retrieves the location of a vehicle in terms of its longitude and latitude. The system uses geographic position and time information from the GPS.

The system has an onboard module that it resides in the vehicle to be tracked and a based station that monitors data from the various vehicles. The onboard module consists of GPS receiver, a GSM modem. This hardware is fitted on to the vehicle in such a manner that it was not visible to anyone. That system sends the location data to the monitoring unit continuously therefore it is used as a covert unit. The location data from tracking system uses to find the location and to give the information to public transport management when the vehicle is needed by them. This gives an edge over other pieces of technology for the same purpose. The system automatically sends a return reply to that particular mobile indicating the position of the vehicle in terms of latitude and longitude when a request by user is sent to the number at the modem. A program has been developed that it is used to locate the exact position of the vehicle and also to navigated track of the moving vehicle.

Hardware Requirement

In this project, we will simply send data to local website using Arduino and GPRS, from where you can see that data from anywhere in the world through internet. This data sending technique is very useful in IoT projects where you want to monitor things from anywhere in the world like Monitoring Temperature & Humidity, Monitor Vehicle Location, Monitor Heart Beat, Monitor Air pollution level etc.

Components Required:

Arduino

GSM Module SIM900A

16x2 LCD

GPS Module

Connecting jumper wire

Power supply 12v

System Block Diagram

The current design is an embedded application. It is continuously monitor a moving vehicle and report the status of vehicle on demand. For doing an Arduino is interfaced serially to a GSM modem and GPS receiver. A GSM modem is used to send latitude and longitude of the vehicle from a remote place. The GPS modem gives the data i.e., the latitude and longitude indicating the position of the vehicle. The GPS modem gives many parameters as the output, but only the National Marine Electronics Association NMEA data coming out is read and displayed on to the LCD. The same data is sent to the mobile at the other end from the place of the vehicle's position is demanded. An EEPROM is used to store the data received by GPS receiver. That is used for detecting coordinates of the vehicle, GSM module is used for sending the coordinates to user by HTTP client Request. And an optional 16x2 LCD is also used for displaying status messages or coordinates. It has used GPS module GY-NEO6MV2 and GSM module SIM900A.The hardware interfaces to microcontroller are LCD display, GSM modem and GPS receiver. In order to interface GSM modem and GPS receiver to the controller, a MUX is used. The system automatically sends a return reply to that particular mobile indicating the position of the vehicle in terms of latitude and longitude when a request by user is sent to the number at the modem. A program has been developed that it is used to locate the exact position of the vehicle and also true navigated track of the moving vehicle on Google map.

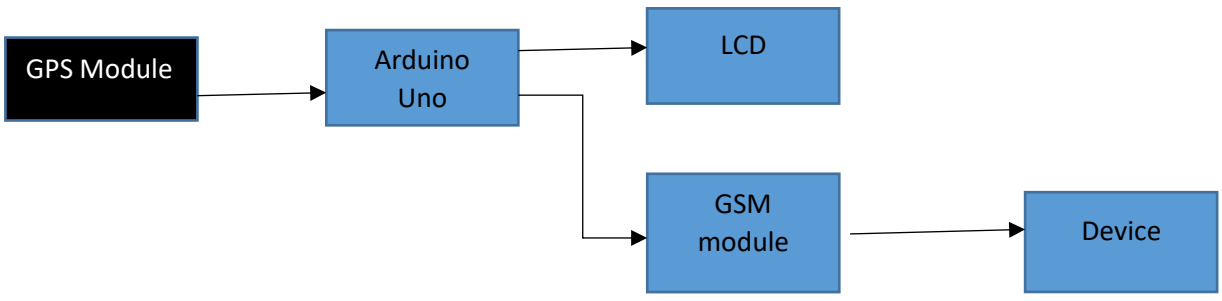


Fig. 1: Block diagram of GPS and GSM based vehicle tracking system

Liquid Crystal Display (LCD)

LCD modules that display characters such as text and numbers are the most inexpensive and simplest to use of all LCDs. They can be purchased in various sizes, which are measured by the number of rows and columns of characters, they can display. Some include a backlight and allow to choose the color of the character and the background color. Any LCD with an HD44780 or compatible interface should work with Arduino. The LCD used is a 16-character-by-4-row LCD with a backlight.

GPS Module

GPS module consists of U-blox NEO 6M module and GPS antenna. The NEO-6 module series is a family of stand-alone GPS receivers featuring the high-performance U-blox 6 positioning engine. The I2C compatible Display Data Channel (DDC) interface can be used either to access external devices with serial interface EEPROM or to interface with a host CPU. Its maximum bandwidth is 100kbit/s. NEO-6 modules are designed for use with passive and active antennas. The minimum gain and maximum gain are 15dB and 50 dB respectively and maximum noise figure is 1.5dB. GPS receivers use a constellation of satellites and ground stations to compute position and time almost anywhere on earth. The positions of the satellites are constructed in a way that the sky above your location will always contain at most 12 satellites. The primary purpose of the 12 visible satellites is to transmit information back to earth over radio frequency (ranging from 1.1 to 1.5 GHz). With this information and some math, a based receiver or GPS module can calculate its position and time.

GSM 900

GSM/GPRS modem is a digital mobile network that is widely used by mobile users. It is used to establish communication between a computer and a GSM system. The modem is coming RS232 interface, which allows to connect PC as well as microcontroller with RS232 chip. The baud rate is configurable from 9600-115200 through AT command. The GSM modem is having internal

TCP/IP stack to enable you to connect with internet via GPRS. It is suitable for SMS, voice as well as DATA transfer application in M2M interface. The onboard Regulate Power Supply allows us to connect wide range unregulated power supply. Using this modem, one can make audio calls, SMS, Read SMS, attend the incoming calls and internet through simple AT commands. Every command starts with “AT”. That’s why these are called as AT commands. AT stands for “attention". When a ten-digit mobile number is provided, the program instructs the modem to send the text message using a sequence of AT commands.

Using GPRS in GSM Module:

Here we have used a normal GSM Module with a SIM card for GPRS connection. In this project, GPRS is responsible for sending data to the local server. GPRS stands for General Packet Radio Services which is a packet based wireless communication service that works with data rate of 56-114kbps and provides a connection to the internet.

For GPRS, we do not need to buy any special module or hardware because GSM already has GPRS facilities inbuilt. We only need to access it by using the same method or AT commands that we used for GSM interfacing in our previous projects. There are many AT commands already mentioned in the datasheet of SIMCOM SIM900A GSM module.

Now for sending data to server by using GPRS, first we need to initialize GSM module.

Commands for initializing GSM:

AT :- this command is used to check whether GSM module is responding or not.

AT+CPIN? :- this command is used to check whether SIM card is inserted in GSM Module or not.

ATE0 :- is used for disabling echo

ATE1 :- is used for enabling echo

Commands for initializing GPRS internet connection:

AT+CIPSHUT :- to close TCP Port Explicitly means disconnect connection if any

AT+CGATT? :- Checking SIM card has internet connection or not

AT+CSTT = "APN","userName","Pass" :- connect to internet

(ex; AT+CSTT="localhost","","")

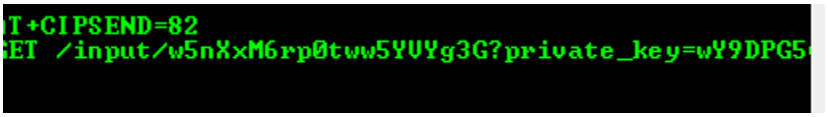
AT+CIICR :- bring up with the wireless network. Checking SIM card has data pack or balance

AT+CIFSR :- get IP (sometimes without this command GSM do not work so use this command)

AT+CIPSTART = ”TCP”,”SERVER IP”,”PORT” :- is used for creating TCP connection with the server that we provide in place of SERVER IP

AT+CIPSEND :- this command is used for sending data to the server. After input, this command server asks for data.

After inputting the data we send 26 to the server. If everything will be fine then data will be posted successfully to the server and local server responds with a pass or fail string.



2. Sketch of the GPS and GSM module

By using software serial library and liquid crystal library, the sketch is written Arduino C language Serial data transfer rate is specified as 96000baud. Without using GPS library and GSM library, GPS format and AT commands are used, respectively. Then, a connection of LCD is defined and second counter is also prepared for time elapsed for GPS satellite searching time. According to NMEA data string, the raw data from satellites
contains position, local time, and speed of object. Among them, position data and local time and date are collected by GPS shield and send it to Arduino to do the process of data expression on LCD. The prescriber’s android phone number is already mentioned in the sketch including with secret code. When the code message is sent to the GSM module, it is checked and confirmed whether code and phone number is matched or not. If these are identical, the GPS location data are sent to the predetermined phone which is sent the message code. The conditions and configurations of GPS and GSM are displayed on the LCD time to time. Data can be refreshed at the desired time interval. The program chart of the tracking system as shown in figure 3.

Circuit Explanation:

For Sending Data to local Server, we need to interface GSM module to Arduino. In this project we have used Arduino to taking input string from the GPS and sending commands to GSM/GPRS module. GSM/GPRS is used to communicate with the Internet for sending data to the local server. GSM Module's Rx and Tx pin is directly connected with Arduino's pin D3 and D2 respectively (Ground of Arduino and GSM must be connected with each other). A 16x2 LCD is used for displaying input strings and showing welcome message and data sending status as well. Pins of this 16x2 LCD namely Rs, en, d4, d5, d6, and d7 are connected with pin number 14, 15, 16, 17, 18 and 19 of Arduino respectively. Here we have also connected GSM Tx pin to Tx of Arduino to get response data over the serial monitor.

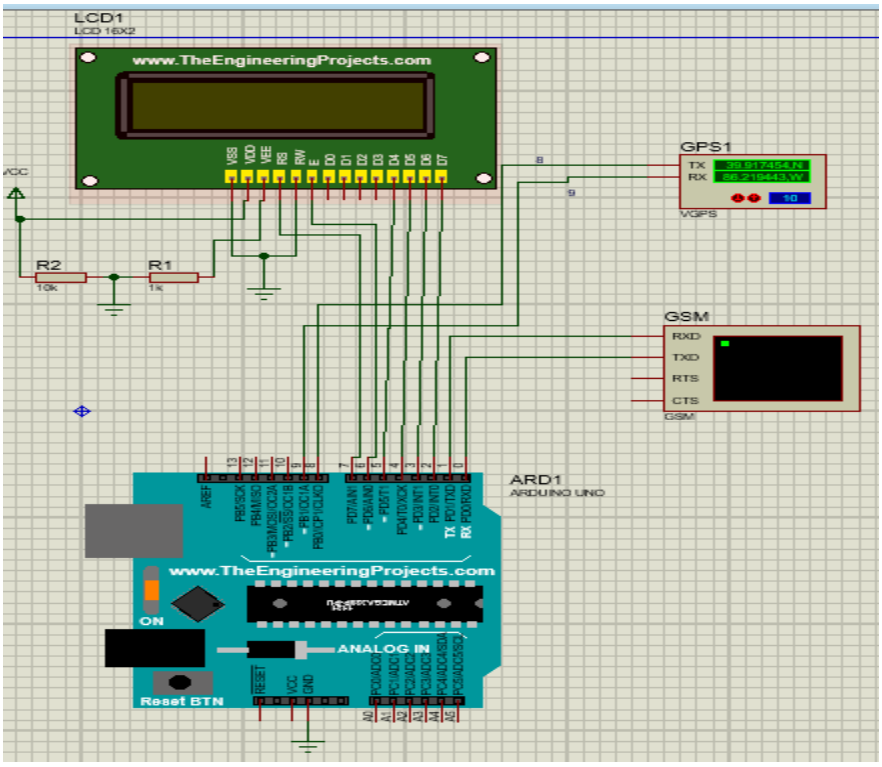
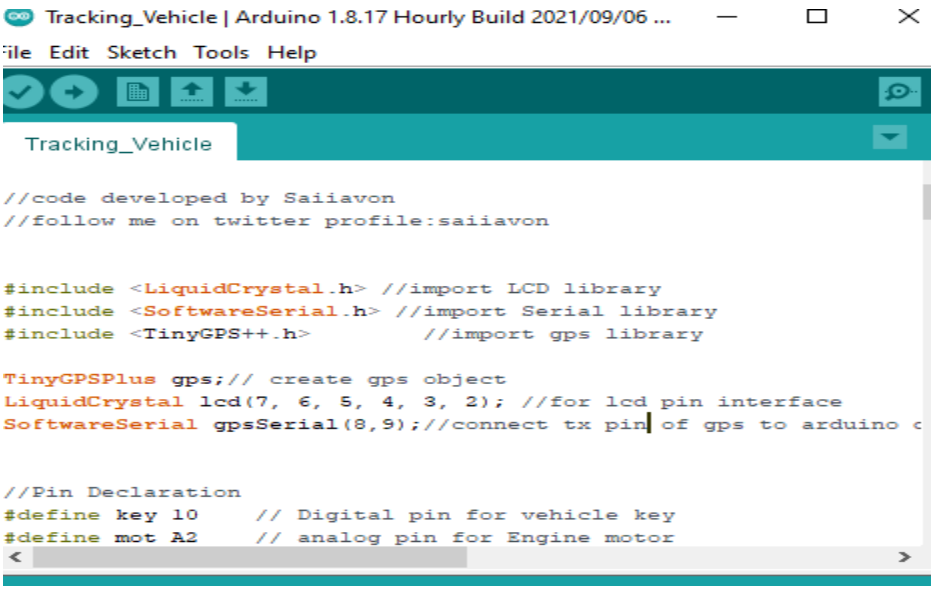


Fig. 2: GPS tracker circuit in Proteus

Implementation

Software used

Proteus 8 professional is used for simulation



Arduino IDE for write program

Xammp server for tacking the location form Arduino

Because of the connection is denied for hardware needed for this purpose we will use python script that listen in background port and take data and insert in to database

3. EXPERIMENTAL RESULT

In this paper, GSM module used to send receive message. The GPS based vehicle tracking system is designed to find out the exact location of any vehicle and intimate the position to the concerned authority about through an HTTP client Request. The system includes a GPS modem that it retrieves the location of a vehicle in terms of its longitude and latitude. The system uses geographic position and time information from the GPS. GPS location received from the Arduino based GPS tracking system is noted. The value of the latitude can be displayed on the as shown in figures. Because of the connection is denied for hardware needed for this purpose we will use python script that listen in background port and take data and insert in to database.

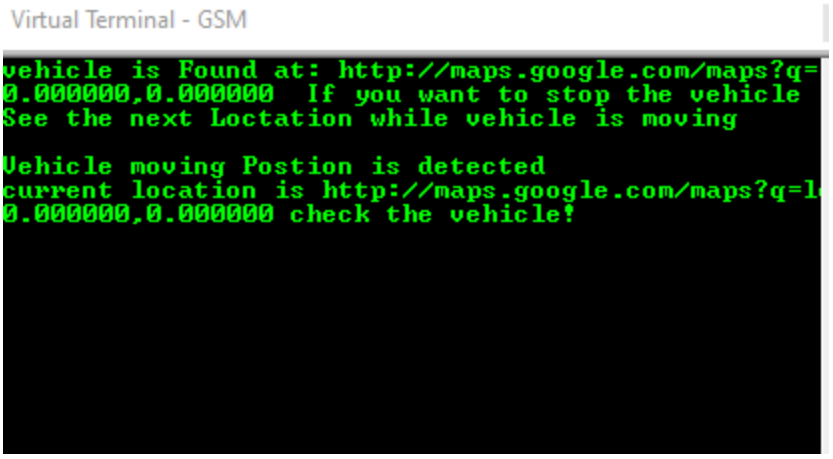


Fig. 3: GPS tracker virtual terminal in Proteus

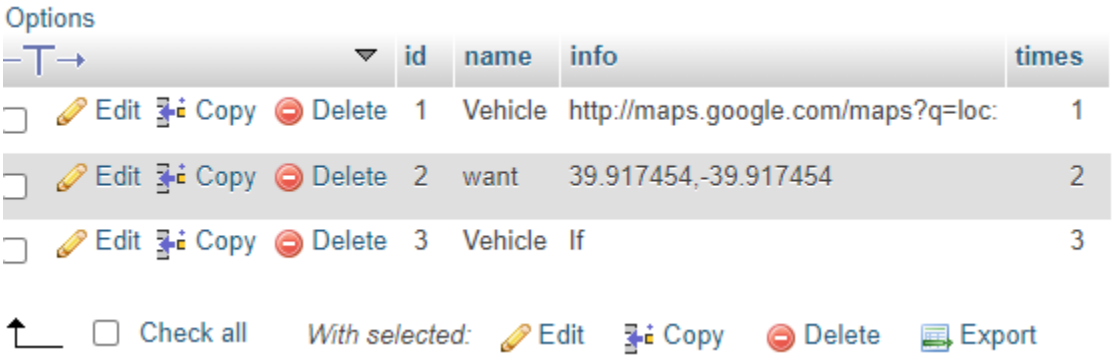


Fig. 4: GPS tracker data in MySQL server

4. References

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