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GPS Based Automotive Monitoring and Control System Using Smartphone

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Abstract

The technological evolution which occurs in digital systems favors the appearance of new services to be applied in Automotives. Communications are playing an important role in the management, exploration, and maintenance of transports. Due to the vital importance of security and comfort of user , a cost effective GPS- GPRS based object tracking System is studied and implemented with significant changes through the integration in its operation of the global system for vehicle control. It acquires the current position of the vehicle using Global Position Systems which is sent to web server using TCP protocol from the GSM network through GPRS. The vehicle information is stored and instantly updated in the database for live tracking. The vehicle can be controlled from the feedback signal by sending it through SMS to the control unit, so that the controller will drive the actuators such as Starter motor, AC, engine Immobilizer according to the received signal. This system can be implemented for monitoring and controlling the vehicle with great user interface.

Index Terms— GPS, GPRS, GSM, NMEA, Latitude, Longitude, TCP, MySQL, Visual Basic, Visual Studio, HTTP.

I. INTRODUCTION

A good number of tracking systems had so far been developed with a wide range of tracking facilities. But the operation cost of most of these systems is higher as well as the user doesn't have control over the tracking vehicle which prevents from widespread use the system. On the other hand, the rate of car theft, asset theft, child kidnapping and train accident in many countries are increasing at a higher rate. The objective of this research is to enhance safety, security and comfort by giving remote access to vehicle. In addition to it also reduces the cost of the tracking system using the latest technologies and making it available to the common people with user interface.

Our research has been mainly focused on taking control over the tracking vehicle with user interface and to do Smartphone and actuators are used. NAVSTAR-GPS is a satellite based service developed and provided by United States Department of Defense. Global Positioning System (GPS) is a 24-hour worldwide service. It provides accurate, three-dimensional information of the location as well as precision velocities and timing services. It is accessible to an unlimited number of civilian and commercial users. The service is free of cost to everybody. Low cost GSM/GPRS is one of the best possible communication media for the present and the future.

Cost effective GPS-GPRS based object tracking system was discussed by Khondker Shajadul Hasan, that mainly focused on cost effective methods[1]. Intelligent Anti-Theft and Tracking System for Automobiles was discussed in details by Montaser N. Ramadan, Mohammad A. Al-Khedher [2]. Hybrid GPS-GSM Localization of Automobile Tracking System was reported by Mohammad A. Al-Khedher [3]. Yang Liu, Zhang Junmei discussed Intelligent Vehicle Control Terminal of Forestry Monorail Car Based on ARM that makes use of the existing GSM networks and its extension GPRS for data communication [4]. António José Duarte Santos developed Tracking Trains via Radio Frequency Systems [5]. T.Krishna Kishore did similar works Vehicle Tracking Using a Reliable Embedded Data Acquisition Sysytem With GPS and GSM [6].

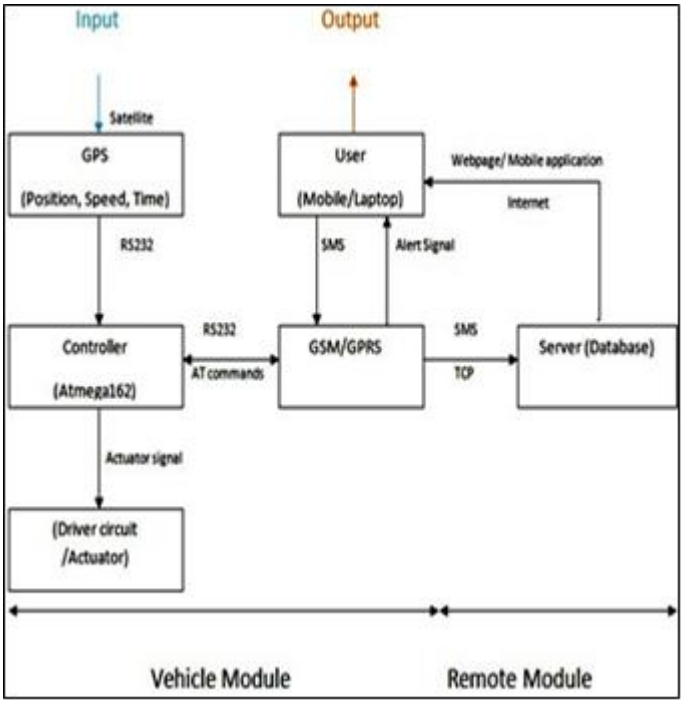

Fig 1 Vehicle Monitoring with Remote Access

II. SYSTEM OVERVIEW

The work described in this paper is mainly concerned with the vehicle control terminal based on Atmega162 of the vehicle. The control scheme, hardware and software design of the vehicle control terminal will be discussed in the following sections.

The system has two parts, the vehicle module and remote module. The vehicle module is attached with the moving object and gets the position, speed from GPS satellite in real-time. It then sends the information to the server. The data is checked for validity and the valid data is saved into the database. When a user wants to track the device, she/he logs into the service provider's website and can get the live information of the vehicle as well as can control the vehicle by giving command signal. A custom report is also generated which includes a detailed description of the vehicles status.

III. HARDWARE SPECIFICATION

We need a module which is compatible with 900MHz/1800MHz/1900MHz frequencies of cellular networks. GPS, GSM/GPRS is the module we have selected for this system .This device is capable of working in any GSM network around the world. It supports complete standard AT command set plus custom AT command set.GSM and GPS module needs to communicate with controller at same time, so that Atmega162 is used. Atmega162 controller is used because of RISC instruction set and less cost. After turning on the device, it automatically initializes the network. Then it gets the GPS data in NMEA 0183 format .It then tries to connect to GPRS. If it fails due to GPRS unavailability then it logs the data in the non-volatile memory and waits for a certain fixed time period. After that it tries to connect to the GPRS again. After establishing the GPRS connection it tries to connect to the service provider's server using the HTTP protocol or Short Message Service. After successful connection, the GPS data is sent to the server as a string. Then after a certain time period it checks the availability of GPRS and connects to the HTTP server. The current location of the device is sent. In this way the device communicates with the server and sends the location.

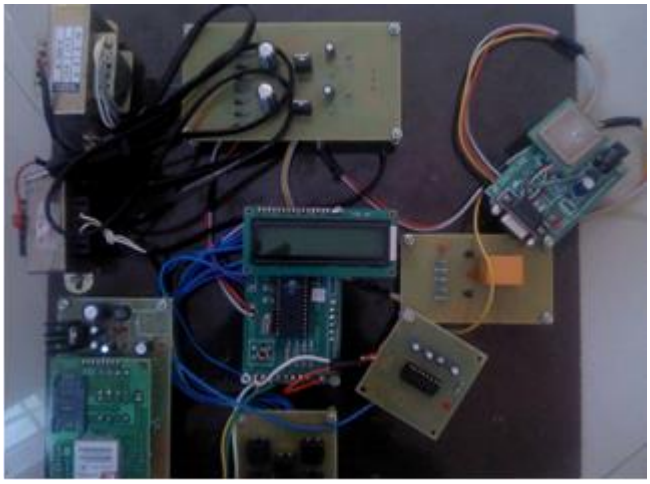
Fig 2 Vehicle Module

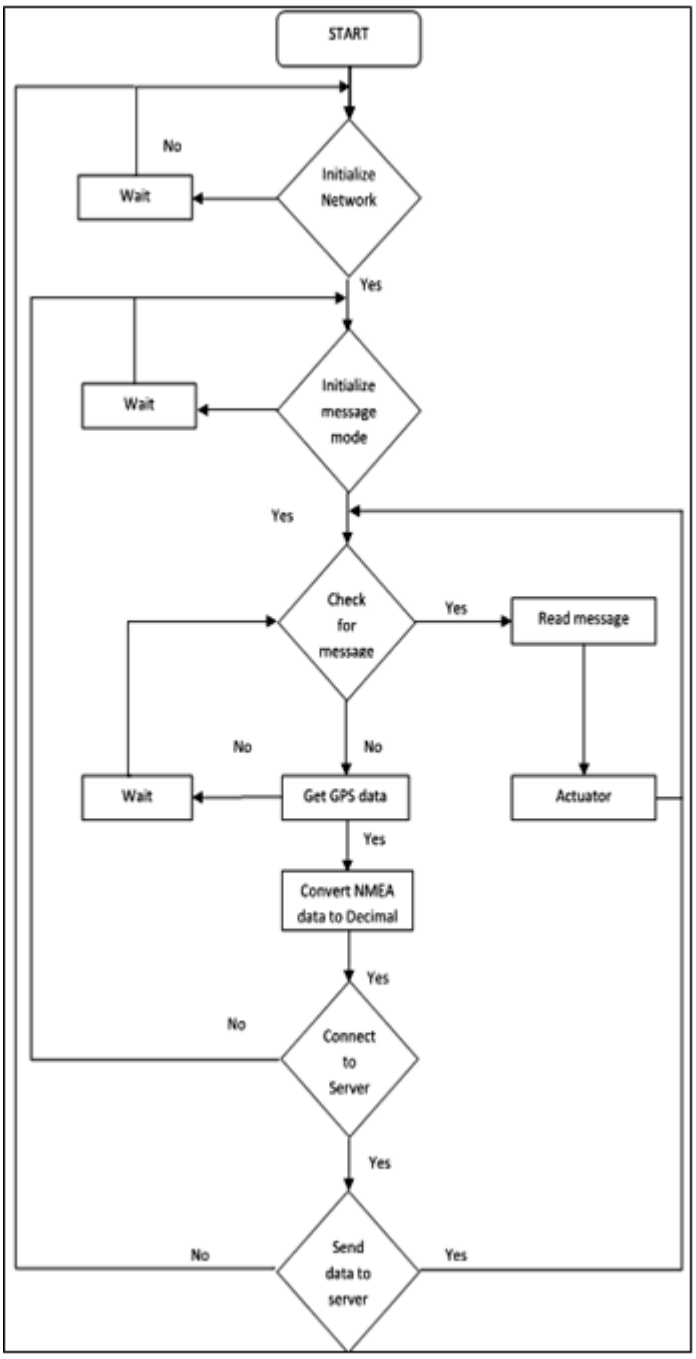

Fig 3. Hardware flow chart (overall)

IV. SOFTWARE SPECIFICATION

To view the current position of the device a web-based application has been developed. Using this Web application an end user will be able to view the live position of the device. To develop this software scripting language was used. SQL database server is used for storing data because of its high-performance query engine. MySQL database server is used for storing data because of its high-performance query engine, tremendously fast data insert capability, and strong support for specialized web functions like fast full text searches.

A. The flow of GPRS Communication

The SIM 300 GPRS module communicates with Atmega 162 UART0 port, the system sends AT instructions to GPRS module and gains GPRS module's input information through serial port. As the GPRS module's baud rate is 9600 bit/s, set the baud rate to 9600 bit/s in the program. Before sending a short message, the system sends AT commands to GPRS module. When it returns 'OK', it reveals the communication is normal, if it returns 'ERROR', there might be some basic communication problems.

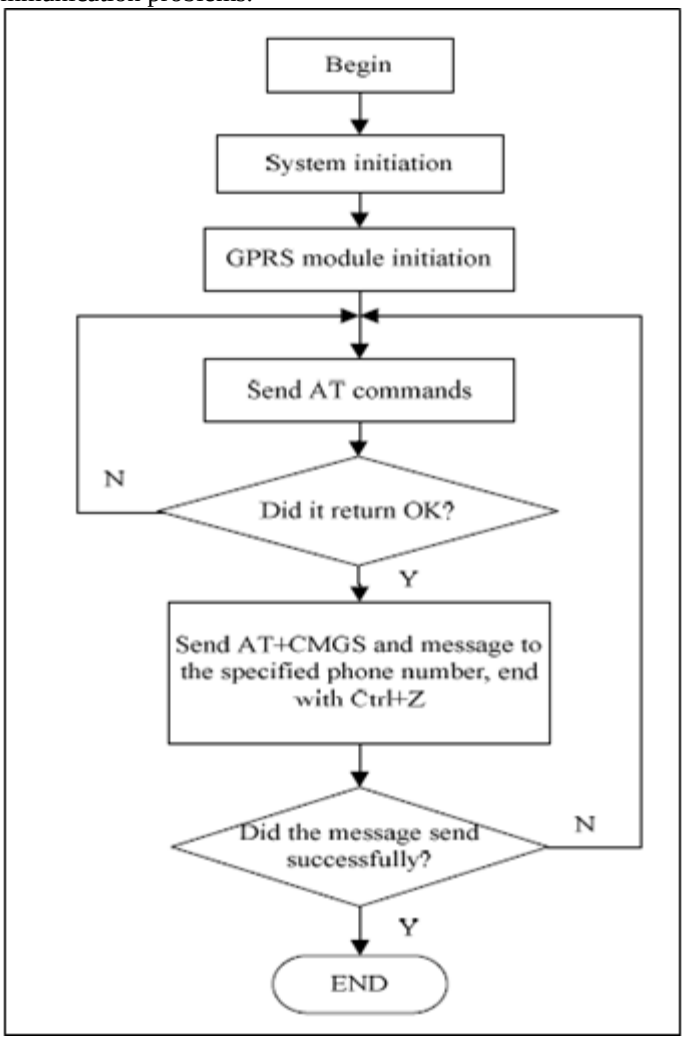

Fig 4 GPRS Communication

B. NMEA Conversion

This following NMEA protocol is received using GPS device.

$GPRMC, 161229.487, A, 3723.2475, N, 12158.3416, W, 0.13, 309.62,120598

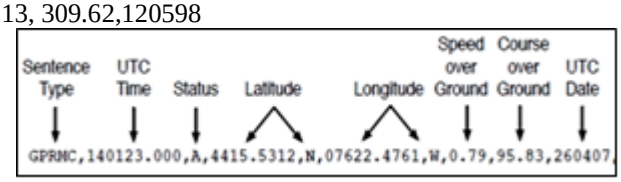

Fig 5 NMEA Data

Initially GPS data is taken as string by the controller. After accepting NMEA data from the device the controller will parse the NMEA data into required fields. MEA formatted data converted to the decimal format by the following formula.

- Latitude = DD + (MM.MMMM / 60)
- Longitude = DDD + (MM.MMMM / 60)

After converting NMEA formatted data to decimal Latitude and longitude, it changes as following.

- Latitude
  4415.5312, N is converted to 44.258853 degrees.
- Longitude
  07622.4761, W is converted to 76.374603 degrees.

V. REMOTE ACCESS & MONITORING

Vehicle control module is one of the significance parameter of this project interfaced with remote module which will enhance user comfort and vehicle security system. Remote access can be accomplished according to user command. The user command signal is sent through SMS to vehicle module and thereby it is analyzed by controller and actuates the signal to driver circuit according to the information code. The application of Remote Access (vehicle control) can be implemented to Vehicle remote start, Immobilizer, Air Condition ON and OFF.

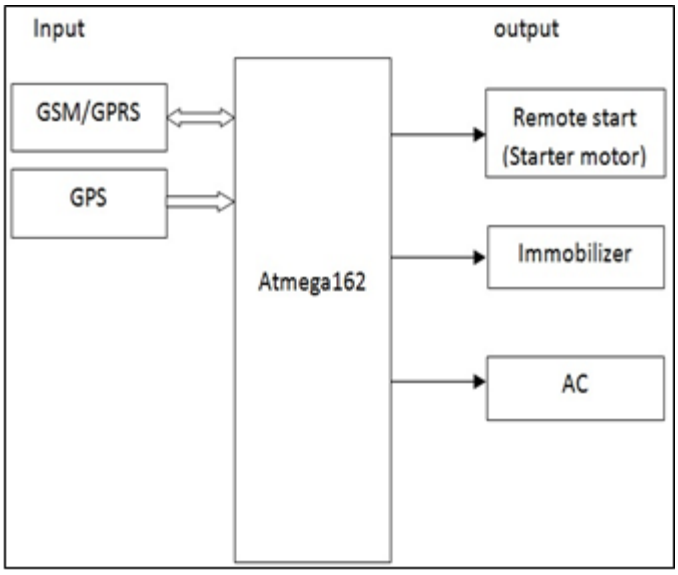

Fig 6 Remote access

A. Vehicle Monitor

Vehicle live monitoring is also applicable as part of this application which enables the user to view the position (latitude and longitudinal), speed of the vehicle in the Smartphone. After Logging in to a web page, the user is automatically redirected to Local host page in which all the required information's are obtained by concept of visual basic and visual studio functions from the server.

VI. CONCLUSION

The application of the project is remote access for vehicle with a low cost Monitoring system using GPS and GPRS of GSM network which is more suitable for wide range of applications all over the world. The GSM provides remote access to vehicle with this one can access from anywhere at any time. In addition to it provides continuous and real time monitoring to the users by the combination of the GPS and GPRS. The full implementation of the proposed system would ultimately replace the traditional tracking systems.

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