Internet of Things based vehicle monitoring system

Mayuresh Desai
Department of Electronics
K. J. Somaiya College of Engineering
Mumbai-77, India
mayuresh.desai@somaiya.edu

Arati Phadke
Department of Electronics
K. J. Somaiya College of Engineering
Mumbai-77, India
aratiphadke@somaiya.edu

***Abstract*— Advances in technologies and availability of economical open source hardware systems are setting a new trend in system designing. Use of technologies like Internet of Things (IoT) can ease the process of data collection and analysis.**

The main objective of the paper is to describe a system which can monitor or track the location and vehicle parameters of different test vehicles from a centralized place for research and development purposes and to store data of testing parameters of those vehicles on the server for further analysis and records. System design will be generalized for monitoring different parameters like Location, Vehicle speed, Engine compartment temperature, Fuel consumption and many more. Proposed system uses Open source controller and GPS/GSM/GPRS module for data transfer application.

Keywords*— *IoT; Vehicle Monitoring; Arduino; GPS/GSM/GPRS technology

I. INTRODUCTION

Vehicle tracking/monitoring system is getting higher importance in modern era. Advances in technologies like Internet of Things (IoT), Ubiquitous computing and availability of economical Open source hardware systems, is setting a new trend in system design. Monitoring of test vehicles is an essential activity for the Research and Development team of an automobile company which helps them to make required changes in vehicle components or design, depending on observations and results of the test vehicle. Maintaining records for test vehicles manually needs time and manpower. Sometimes keeping records manually for multiple vehicles can become complex and difficult for data analysis and comparison study.

Use of technologies like Internet of Things (IoT) can ease the process of data collection and analysis. The Internet of things is nothing but networking of physical devices, vehicles or any other connected devices with electronics, software, sensors, network connectivity which enables these devices to collect and exchange data. IoT allows objects to be sensed and/or controlled remotely across existing network infrastructure. “Things” in the IoT can refer to wide variety of devices. These devices collect useful data using various technologies and then communicate with other devices.

IoT can assist in integration of communications, control and information processing across various transportation systems. Application of IoT extends to all aspects of transportation systems i.e. the vehicle, infrastructure and driver or user. Dynamic interaction between these components of a transport system enables Inter and Intra vehicular communication, Vehicle monitoring, Vehicle tracking, Smart traffic control, Smart parking, Logistic and Fleet management, Vehicle control, Safety and Road assistance. Network used for communication between nodes plays the important role in IoT. Technologies that support IoT are WiFi direct, Bluetooth, ZigBee, GSM/LTE, GPS, RFID, NFC, Ethernet, optical technologies like Li-Fi. It shows that a wide variety of options are available to implement IoT in various systems. IoT still has a long way to go and it will definitely grow exponentially over the coming years. Use of open source Arduino controller with some modifications in its core directory and SIM808 GPS/GSM/GPRS module makes this system efficient and cost effective due to availability of economical modules.

II. OBJECTIVE

The system is designed for testing of vehicles which will help research and development team in automobile industries for design validation of the vehicles. Proto vehicles need to undergo different tests according to automotive standards including indoor and outdoor testing. These tests are important for constant improvements and design change of the vehicles. The proposed system will be used for outdoor testing of vehicles. Table I gives outdoor tests performed on vehicle and respective vehicle parameters to be observed.

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TABLE I. OUTDOOR TESTS PERFORMED ON VEHICLE

Outdoor tests performed on vehicle	**Observed vehicle parameters**
Speedometer and odometer calibration	Vehicle speed, Vehicle location coordinates
Average fuel consumption	Fuel level, Distance travelled
Temperature mapping	Engine compartment temperature
Endurance running	Vehicle location, Vehicle speed, Engine temperature, Fuel level

III. WORK DONE

Many researchers have contributed to the development of Intelligent Transportation System (ITS) for various applications like Vehicle position tracking systems, Vehicle anti-theft tracking systems, Bus Tracking system [2][5], Logistics management system [4] and Fleet management systems, SMS based vehicle tracking system to transfer the latitude and longitude from GPS and automobile data to end systems [3]. A lot of research has also been done on Web-based vehicle tracking system, where the latitude and longitude are transmitted to the server through HTTP protocols. Some researchers have also developed Open source platform for GPS tracking [1]. As technology advances, researchers are exploring Internet of Things (IoT) for vehicle tracking, where the system has a GPS to determine the current location of the vehicle. Study of these systems gave the basic structure of the system. Combining GPS, GPRS, data acquisition and IoT to have a database of testing vehicle for research and development purpose is the main objective of this paper.

IV. METHODOLOGY

Proposed system mainly consists of a microcontroller and GPS + GPRS module. Vehicle parameters and location coordinates from GPS module are fed to the controller. Controller transfers this data to server with the help of GSM/GPRS technology. Sim808 module is used for GPS and GSM/GPRS connectivity along with Arduino controller. Typical vehicle parameters monitored are vehicle location, vehicle speed, engine compartment temperature, fuel level etc. These parameters are stored in database on a web server and a webpage is created to display vehicle parameters data. Simultaneously vehicle location data is linked with Google maps to display vehicle location on map.

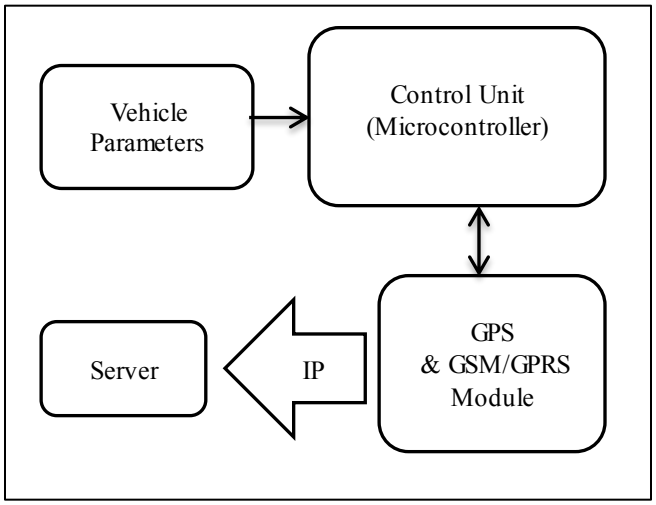


Fig. 1. Proposed system for vehicle tracking/monitoring

V. HARDWARE

A. Arduino

Arduino is an open source platform of microcontroller having different variants of boards depending on controller chip used. Mainly ATMEGA series 8 bit controller chips are used. Some variants have ARM based 32 bit controllers. Arduino MEGA 2560 controller board is used in this project which is having ATMEGA2560 (8 bit) controller chip.

B. SIM808

SIM808 is integrated with high performance GSM/GPRS engine, a GPS engine and BT engine. GSM/GPRS engine is quad band GSM/GPRS module that works on 850 MHz, 900 MHz, 1800 MHz, 1900 MHz frequencies and supports class 12/class 10 GPRS. A GPS solution offers best-in-class acquisition and tracking sensitivity. SIM808 is designed with power saving technique so that the current consumption is as low as 1mA in sleep mode. SIM808 integrates TCP/IP protocol and extended TCP/IP AT commands which are very useful for data transfer.

VI. RESULTS AND VALIDATION

SIM808 is configured and interfaced with Arduino to get GPS parameters along with vehicle speed. Arduino is programmed to process data of vehicle parameters and send it to a database on a webserver. SIM808 module works on AT commands which can be given via Arduino code. These commands and the responses of the SIM808 module can be monitored using Arduino's serial monitor.

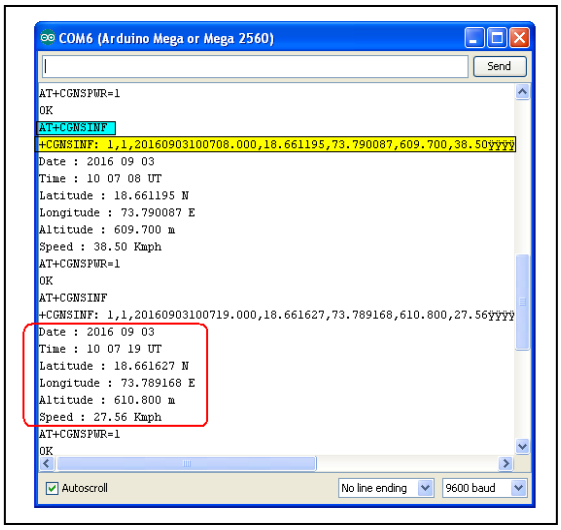
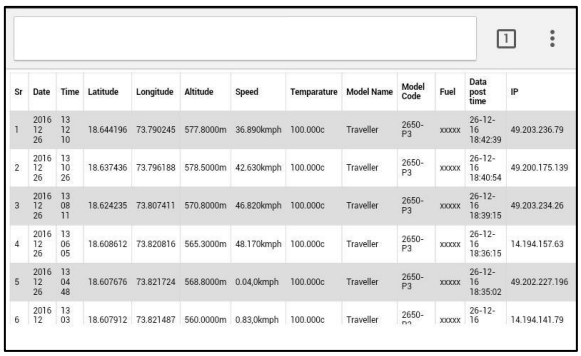


Fig. 2. Vehicle location and vehicle speed from test vehicle on Arduino

A webpage is created to display data of vehicle parameters sent by Arduino and SIM808 hardware system to the database. This data is also linked with the Google maps for real time location display of vehicle on map.



Sr	Date	Time	Latitude	Longitude	Altitude	Speed	Temparature	Model Name	Model Code	Fuel	Data post time	IP
1	2016 12 26	13 12 10	18.644196	73.790245	577.8000m	36.890kmph	100.000c	Traveller	2650-P3	xxxxx	26-12-16 18:42:39	49.203.236.79
2	2016 12 26	13 10 26	18.637436	73.796188	578.5000m	42.630kmph	100.000c	Traveller	2650-P3	xxxxx	26-12-16 18:40:54	49.200.175.139
3	2016 12 26	13 08 11	18.624235	73.807411	570.8000m	46.820kmph	100.000c	Traveller	2650-P3	xxxxx	26-12-16 18:39:15	49.203.234.26
4	2016 12 26	13 06 05	18.608612	73.820816	565.3000m	48.170kmph	100.000c	Traveller	2650-P3	xxxxx	26-12-16 18:36:15	14.194.157.63
5	2016 12 26	13 04 48	18.607676	73.821724	568.8000m	0.04,0kmph	100.000c	Traveller	2650-P3	xxxxx	26-12-16 18:35:02	49.202.227.196
6	2016 12	13 03	18.607912	73.821487	560.0000m	0.83,0kmph	100.000c	Traveller	2650-	xxxxx	26-12-16	14.194.141.79

Fig. 3. Data received from system hardware to the database on webserver

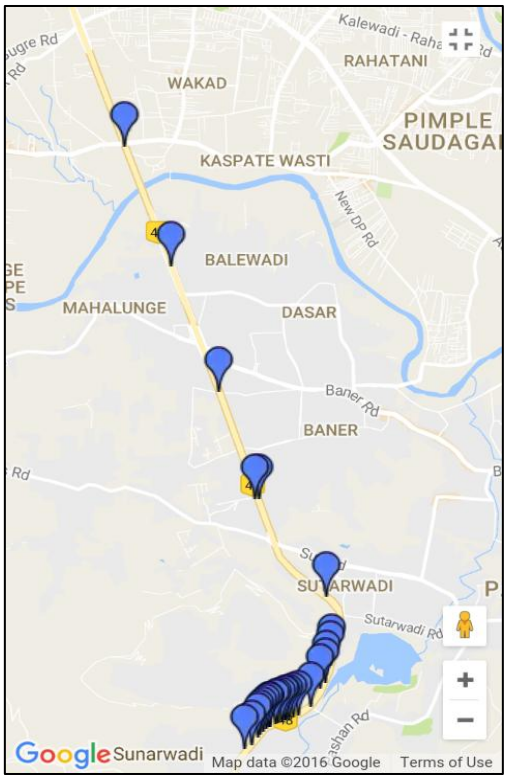


Fig. 4. Vehicle location display on Google map

VII. CONCLUSION

The system will be used to monitor or track the location and vehicle parameters of different test vehicles from centralized place for the research and development purpose and to store data of testing parameters of those vehicles on the server for further analysis and records. IoT and open source platform makes this project very dynamic, efficient and cost effective; thereby it can be used to generalize the monitoring of different vehicle parameters.

REFERENCES

[1] Thiyagarajan Manihatty Bojan, Umamaheswaran Raman Kumar and Viswanathan Manihatty Bojan, "Designing Vehicle Tracking System – An Open Source Approach", IEEE International Conference on Vehicular Electronics and Safety (ICVES) December 16-17, 2014.

[2] Jaun Zambada, Ricardo Quintero, Ramon Isijara, Ricardo Galeana, Luis Santillan, "An IoT based scholar bus monitoring system", IEEE 2015.

[3] SeokJu Lee, Girma Tewolde, Jaerock Kwon, "Design and Impementation of Vehicle Tracking System Using GPS/GSM/GPRS Technology and Smartphone Application", IEEE World Forum, 6-8 March 2014.

[4] Sun Jianli, "Design and Implementation of IoT based Logistics Management System", IEEE Symposium on Elecrtical and Electronics Engineering (EEESYM), 2012

[5] LV ZHIAN, HU HAN, "A Bus Management System Based on Zigbee and GSM/GPRS", International Conference on Computer Application and System Modeling (ICCASM), 2010.