Vehicle Health Monitoring and Tracking System Using Smartphone and GPS

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Abstract— The system proposed a real low cost design of vehicle diagnostic and tracking unit using Smartphone and GPS. System monitors a vehicle’s performance and traces the location by communicating the obtained data to a mobile device using Bluetooth. Then the results can be viewed by the user to check fuel consumption and other essential vehicle electromechanical parameters. Data can also be sent to the vehicle’s maintenance department which is useful to detect and guess faults in the vehicle. This is done by collecting live readings from the engine control unit (ECU) uses the ADC to convert into digital format. An electronic hardware unit is built to perform the interface between the Atmega32 and a Bluetooth module, which in part communicates with Smartphone. The Smartphone is able to transmit data to a server using cellular internet connection. The system uses GPS to trace the current location of navigating the driver or passenger wear seatbelt. Seatbelt sensor: Seatbelt sensor is used to check whether the driver or passenger wear seatbelt.

Key words: ULM2803 microcontroller, Android mobile, GPS, Engine control unit, Atmega32, Bluetooth.

I. INTRODUCTION
From the start of the 21 century, technology has major impact on human being. that created lots of opportunities for research and development in the different technologies. Apart from that the major trend nowadays developments in automobile industry with the help of Information Technology. Different improvements in the vehicle manufacturing and communication technology fields given importance to following things:

(1) The main focus of most automobile companies is Eco friendliness.

(2) Safety, over comfort.

(3) Collection of different diagnostic values from engine control unit and analysis of that values

(4) Then results of that analyze values use for identifying and preventing the faults in the vehicle

So for that purpose information technology need to performed important role while manufacturing vehicle.

A new system model that helps users to performed vehicle maintenance wirelessly. The we captured values from different sensors embedded in the engine control unit of vehicle through Atmega32 important information related to vehicle are displayed to the owner of the vehicle. After seen the captured values from engine control unit driver can use this information for better maintenance of the vehicle.

System aims to implementing GPS tracking of the vehicle. So, if vehicle needed urgent maintenance user can search for service centers near to the GPS location of vehicle. Location of the vehicle is also important for anti-theft solutions and finding vehicle.

The Android Application will provide Graphical Interface to the user. The Application is Start when user will enter correct Username and Password. HC-05 Bluetooth is used for communication between Atmega32 IC and Android Application. Diagnostic trouble codes and commands are use in Atmega32 Connector for getting different engine values. We have given priority to android Smartphone application because of its growing popularity in the world.

A. Diagnostic System
Intention of proposed system is to provide inexpensive, easy, flexible vehicle diagnostic system that is well-suited with all vehicles. The graphical user-interface is provided by using android phones and utilizes the standard Bluetooth to make possible taking out and relaying of readings, diagnostic trouble codes (DTC), and commands. System uses Smartphone as computing device cause of popularity and growth in demand, in addition to reducing the overall cost system uses some inbuilt functionality of vehicle. Also, when install properly, such devices can be a inexpensive alternative to integrated navigation systems. in addition, our choice of Android as our operating system platform is reliable with current market trends and user acceptance.

B. Global Positioning System (GPS)
The Global Positioning System (GPS) is a space-based global navigation satellite system (GNSS) that gives time information in all climatic conditions and also offers consistent location tracking. It is maintained by the United States government and is freely accessible by anyone with a GPS receiver. To overcome the limitations of preceding navigation systems in 1973 GPS project was started, integrating ideas from several predecessors, including a number of classified engineering design studies from the 1960s. GPS was developed and realized by the U.S. Department of Defense (USDOD) and was originally run with 24 satellites. It became fully operational in 1994. System uses GPS to trace the current location of navigating vehicle. Which help to give the service at site when some faults occur in the vehicle.

C. Sensors
Sensor is the device used to detect events and detect changes in quantities give alert in the form of electrical or optical signal. The sensors are used in various places to monitor and control many activities. Some sensors are describe as follow-

(1) Light sensor: Light sensor used to detect the sparking where the complicated connections are present which help to prevent the vehicle from damage of electrical equipments.

(2) Temperature sensor: The temperature sensor is used to calculate the coolant temperature of internal combustion engine.

(3) Fuel sensor: Fuel sensor is used to provide remote real time control and monitoring of fuel level.

(4) Seatbelt sensor: Seatbelt sensor is used to check whether the driver or passenger wear seatbelt.
II. LITERATURE SURVEY

The efficient method for project development is using black box that collects all the data in a specific period and can be monitored after that. The other way consists of devices by which the data can be sent to a various places having a database by using GSM and GPS systems. This provides accurate and realtime data to avoid delays and data duplication which is important from security point of view. An electronic hardware unit is built to provide the interface between the vehicle’s diagnostic system and a Bluetooth module. The mobile device is able to transmitting data to a server using internet connection.

Ashraf Tahat[1] proposed the concept of Android-Based Universal Vehicle Diagnostic and Tracking System on 2012 system test and diagnose vehicle parameters manually I t uses diagnostics trouble codes to detect and analyze the faults.

Pankaj Verma[2] proposed “DESIGN AND DEVELOPMENT OF GPS-GSM BASED Tracking System”. This system used GPS and GSM which informs us the route travel by the vehicle it also used user hence information is accessed from any remote location, the advantages of this system is that it gives exact location of vehicle in any weather condition.

Abid khan[3] proposed “GPS – GSM Based Tracking System”, the proposed system used GPS and GSM. GPS is used to detect the Location and by the GSM model the information reach towards the server. It helpful for tele-monitoring system in inter-cities transportation such as taxies and buses.

Mohammad A. Al-Khedher proposed “Hybrid GPS-GSM Localization of Automobile Tracking System”. proposed system is used Google earth application to track the vehicle.GPS is mount on the vehicle which gives current location and it is transport by GSM along with various parameters in the form of SMS to the receiver, the advantage of the system is that it help to the police automobile distribution and theft caution[4].

Ashish Shrivastava[5] proposed “GSM Enhanced GPS Based Vehicle Tracking System” this system implement tracking unit by using GPS also uses GSM for mobile communication. The feature of this system is communication take place rapidly and reports are generated instantly, Real-time tracking using SMS.

Block Diagram gives detail description of the project as to how we are going to design the further modules. The intention of our Android-based user interface vehicle diagnostic system implemented in this effort is the execution of diagnoses on a remote server.

Here we are using four types of sensor temperature sensor, fuel level sensor, light sensor and seat belt sensor. Whatever readings coming from sensor are analog in nature so they are send to ADC which is inbuilt in AVR microcontroller that digital signals are given to AVR microcontroller the buzzer is connected to the AVR microcontroller through Ulm2803 device driver block. Microcontroller is connected to Bluetooth module which is corresponding with android mobile phone.

On android mobile phone, we develop an application which shows the different electromechanical parameters readings which we are going to accept these reading are send to the remote server via internet can be viewed in graphical manner on the server to determine the malfunctioning of the vehicle. [Fig.1] represents combination of a low cost hardware unit and user friendly and efficient android based mobile application software used to create on vehicle diagnostic system. The server is held at the maintenance department where it receives the information about vehicle in the form of HTTP/TCP packets. The server should have a static public IP address which helps to destined application packets.

A. On-Board Diagnostic System (OBD)

From 1996 all vehicles manufactured contain on board diagnostic system for our system we are using different sensors. most of the vehicles do not have built in screen. So OBD systems are not been utilized all the readings. so sensors are used to secure and easy data and transmitted to the server via android phone and Bluetooth.

B. AVR Atmega32

The Atmel is 8bit AVR microcontroller.AVR is RISC based microcontroller having 32 kb isp flash memory and 1kb of EEPROM. A brief introduction is necessary because we will be programming mainly in C during the course of the book. This is the basic hardware configuration of Atmega32. AVR having mainly four porta PORT A is configured with eight momentary switches which are utilized to connect sensors [Fig.2]. The AVR core combines a rich instruction set having 32 general purpose working registers. All the 32 registers have directly connection with Arithmetic Logic Unit (ALU), allowing two independent registers to be accessed in one single instruction executed in one clock cycle. This architecture is more efficient and gives throughputs ten time faster than CISC microcontroller.

This AVR microcontroller has serial programmable UART and in built A/D convertor having 6 channel which process 10-bit data.AVR microcontroller operates between 1.8 to 5.5 volts.
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(IJSRD/Vol. 3/Issue 03/2015/281)

C. ULN2803
The ULN2803 having main feature is provide continuous load current ratings to 500 mA for each of the drivers, the Series ULN2803 high voltage, high-current Darlington arrays are preferably used for interfacing between low-level logic circuitry and multiple peripheral power loads. Usually loads include relays, solenoids, stepping motors, magnetic print hammers, multiplexed LED and incandescent displays, and heaters. All devices characteristic open-collector outputs with integral clamp diodes.

D. Bluetooth Transceiver
The HC05 Bluetooth module mainly act as serial port protocol(SPP) and mainly design for transparent wireless communication. The microcontroller is programmed to send the readings on its UART towards the Bluetooth module. Bluetooth is used to connect devices such as mobile phones over a secure, globally unlicensed short-range radio frequency (2.45 GHz) and able to exchange of information between them. We used the HC05 Bluetooth transceiver module that has an approximate range up to 100 meters. The receive/send data from/to the Atmega32 microcontroller is sends to/from the HC05 Bluetooth module on the serial port at a speed of 9600 bps. The Bluetooth module and mobile phone are configured as master—slave. The Bluetooth is act as slave and the mobile phone is to be functioning as a master. The microcontroller sends/receives data to/from the Bluetooth module, which transmits/receives data continuously as raw binary bytes. Bluetooth utilize a radio technology called frequency hopping spread spectrum, where data transmitted is in the form of chunks, which are transmitted approximately 79 bands, each band have a bandwidth of 1 MHz centered from 2402MHz to 2480MHz.

E. Mobile Application Software
Android application development is also open source and need little efforts to develop the application compare to other programming languages. Android is the most popular mobile operating system which is based on JAVA language and run on Linux kernel. The android platform mainly acts as operating system, middleware or the application software. The features of android operating system which make it popular are-

1. It is open source. That means developer can do easily update the existing application. That is developer can easily modify software according to market needs.

Fig. 3: ULN2803

Fig. 4: HC-05 Bluetooth Device

Fig. 5: PCB block diagram
(2) The android is based on JAVA hence java features (like Security, portability, inheritance, etc.) are inherited.

(3) Development of android application is easy and all the development resources are available free of cost.

Mobile application is responsible for following activities-

(1) Make the connection with server.
(2) Establish the connection with Bluetooth device.
(3) Request to OBD system for certain electromechanical parameters of vehicle.
(4) Receive response from OBD.
(5) Sends the notification message to the user in case of emergency.
(6) Display values by using efficient GUI.
(7) If necessary send values to remote server and give indication at some values like as temperature level or fuel level.
(8) Gives the current geographical location of the vehicle at the sever side

Fig. 6: Activity chart for operation of mobile application

F. Development of the Android Application Software

We have developed our Android mobile application software on a Windows® 7 platform for minimum Android 2.2 driven API level. We set up the development environment which mainly included java development kit (JDK), Eclipse for developing android application GUI, Android software development kit (SDK), Android virtual devices (AVD) such as Blue stack. Android development tools (ADT) is the plug-in through which Eclipse is adapted for Android applications development. It provides a dominant integrated environment and extends the activities of Eclipse that allows users to create applications quickly and add components on the API. AVD is a collection of virtual devices (such as emulator or Blue stack) where each AVD utilize a virtual device to run the Android platform and test the application software before they are run on users mobile.

Fig. 7: Client side GUI

G. Remote Server Set-Up

The server is placed at the maintenance department where it accepts the readings in the form of HTTP/TCP packets. The server should have IP address to which the application packets are reached. The mobile application sends data through cellular internet from the inbuilt OBD system. The server analyzed received parameters and used that data to determine any malfunctions present in the vehicle [1], or predict faults that may occur in the future. The server is a java programmed server that backend contains My SQL database. The database contains a NULL table. Table contain field for each PID where the readings are recorded. To make sure about faults the server needs to receive real time data, hence, the application at the mobile device needs to have a high data rate broadband connection such as 3G.
Fig. 8: Server Side GUI

IV. APPLICATIONS

(1) Early Faults Detection and Prevention.
System provides the efficient and users friendly GUI by which driver or owner easily understand fault arise in the vehicle and remedy for such faults.

(2) Monitor vehicle performance and health.
The vehicle is under review regularly via mobile application hence vehicle performance is better.

(3) Location tracking using GPS.
System uses the GPS by this current location of navigating vehicle is easily trace.

(4) Protection from theft.
The vehicle uses the GPS hence current vehicle location is traced which help to search vehicle in case of robbery.

(5) Eco-Friendly environment.
The vehicle health is maintained properly which prevent environment from various pollutions such as air pollution etc.

V. CONCLUSION

The proposed system aims to develop vehicle diagnostic and tracking system combining hardware and software modules which will help us to provide low cost maintenance and tracking of the vehicle using android Smartphone.

Also used embedded GPS used to trace the current geographical location of vehicle. Mobile application provide user friendly GUI through which user can easily understand and monitor the information about various vehicle parameter.

VI. REFERENCES


