

# Vehicle Diagnostic 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 vehicle's built in on-board diagnostics system (OBD). An electronic hardware unit is built to perform the interface between the vehicle's OBD system and a Bluetooth module, which in part communicates with Smartphone. The Smartphone is able to transmit data to a server using cellular internet connection.

**Key words:** ELM327 microcontroller, Android mobile, GPS, Engine control unit, OBD II

## 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 OBD II kit .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. Link-Matik 2.0 Bluetooth is used for communication between ELM 327 IC and Android Application. Diagnostic trouble codes and commands are use in OBD II Connector for getting different

engine values. We have given priority to android Smartphone application because of its growing popularity in the world. OBD II connector is built-in in the vehicles manufacture after the 1996.

### A. Diagnostic System:

Intention of proposed system is to provide inexpensive, easy, flexible vehicle diagnostic system that is well-suited with all vehicles manufactured after 1996 (OBDII obedient). 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) Alcohol sensor: Alcohol odor sensor used to detect the presence of alcohol in the air inside the vehicle cabin. It alert when alcohol is detected.
- (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

**Ashraf Tahat[1]** proposed the concept of Android-Based Universal Vehicle Diagnostic and Tracking System on 2012 system test and diagnose vehicle parameters manually. It 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 server 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 taxis 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 mounted on the vehicle which gives current location and it is transported by GSM along with various parameters in the form of SMS to the receiver. The advantage of the system is that it helps to the police automobile distribution and theft caution[4].

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

## III. PROPOSED SYSTEM

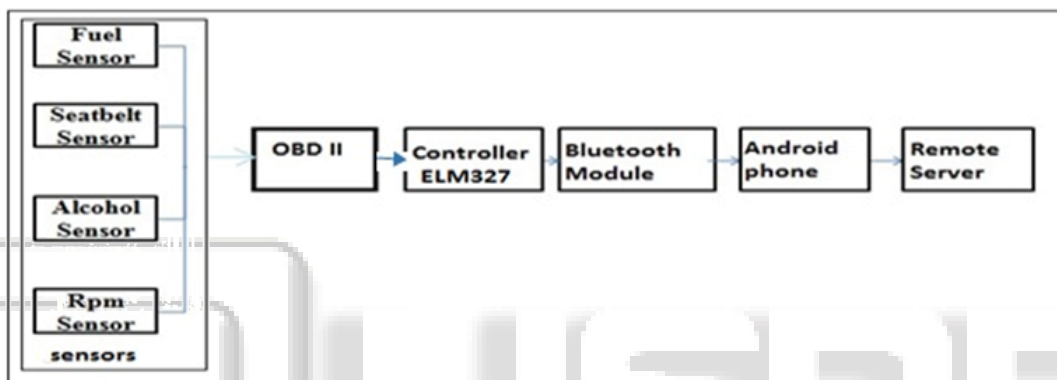


Fig. 1: System overall architecture

This system wants to provide the user interface by using android application and detect the faults in the vehicle on the basis of data trouble codes which are internationally agreed.

The fig. 1 describes the implementation of proposed system. The system provides interface to user or specialist through which they are easily understand information about vehicle. To achieve this OBD is used. The vehicles which are manufacture before 1996 have not OBD. Some vehicles not have screen to display electromagnetic parameters. The Engine control unit is used to store and analysis of data trouble codes. ECU does not store those values which are out of range. The data trouble codes which are within range are used to detect and predict the current faults in the vehicle.

The GPS is used to trace the current location of vehicle which is useful to give service at site where the fault is occur in the vehicle.

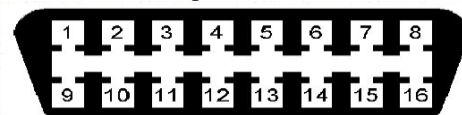
### A. OBD II:

After 1960 there was rapid increase in number of vehicles in US. Hence the problem of air pollution arises. To control the air pollution in 1963 congress government passed clean air act. That time several implementation take place to interface the vehicles ECU for control and monitor engine byproducts. The best example is General Motors they use Assembly Line Diagnostic Link (ALDL). This is previous version of OBD I.

The term OBD is mainly used in the automobile. The self diagnostic and reporting capability is the feature of

OBD. OBD is responsible to inform vehicle’s owner or technician about status of vehicle’s parameters. Nowadays the OBD II system used in the vehicle which uses digital communication port to provide real time data (Diagnostic trouble codes). These DTCs are used to identify faults generated in the vehicle. We use 16 pin OBD connector and it is fixed within two feet of steering. The OBD support following five protocols-

- (1) SAE-J1850 pulse width modulation.
- (2) SAE-J1850 Variable pulse width modulation.
- (3) ISO-14230 keyword protocol 2000.
- (4) ISO-15765 Controller Area Network (CAN).
- (5) ISO-9141-2 protocol.



Pin	Description	Pin	Description
1	Vendor Specification	9	Vendor Specification
2	J1850 Bus positive	10	J1850 Bus
3	Vendor Specification	11	Vendor Specification
4	Chassis Ground	12	Vendor Specification
5	Signal Ground	13	Vendor Specification
6	CAN (J-2234) High	14	CAN (J-2234) Low
7	ISO 9141-2 K-Line	15	ISO 9141-2 Low
8	Vendor Specification	16	Battery Power

Fig. 2: Pin Diagram for the OBD

### B. ELM327 Microcontroller:

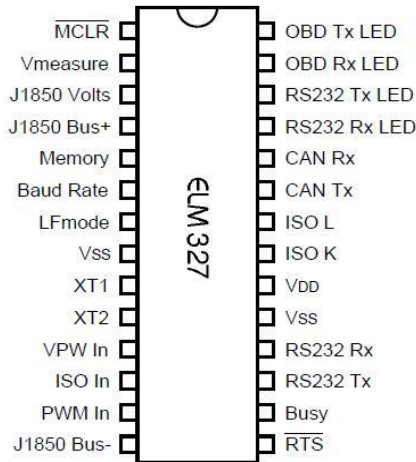


Fig. 3: Pin Diagram of ELM327 microcontroller

ELM electronics developed ELM327 for interfacing OBD. Which are found in most of the cars/ vehicles. ELM provides interface called as UART for connecting any computer program using RS-232 or Bluetooth. The ELM327 is applicable as-

- (1) To read the diagnostic trouble codes.
- (2) Scan tool in automobile.

The ELM acts as OBD to RS-327 interpreter. The RS-232 has baud rate up to 500kbps which is useful in faster communication. The ELM supports 12 protocols and selection of protocol is done automatically. It has low power of CMOS consumption. it is programmed by AT commands.

### C. Bluetooth Module:

The Bluetooth module access reading from microcontroller by using the UART port. The Bluetooth provide secure, fast and exchange of information between mobile and microcontroller. We are using Linkmatik 2.0 Bluetooth transceiver module. It has approximately 100m range.

The Linkmatik 2.0 works as auto save and auto master configuration which has no host control, if it is control by host then it uses command set. It leads to provide interface to Bluetooth devices such as mobile phones. It provides faster data rates and consume less power.

### D. 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 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.
- (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) Validate user by checking its user name and password.

- (2) Establish the connection with Bluetooth device.
- (3) Request to OBD system for certain electromechanical parameters of vehicle.
- (4) Receive response from OBD.
- (5) Display values by using efficient GUI.
- (6) If necessary send values to remote server.

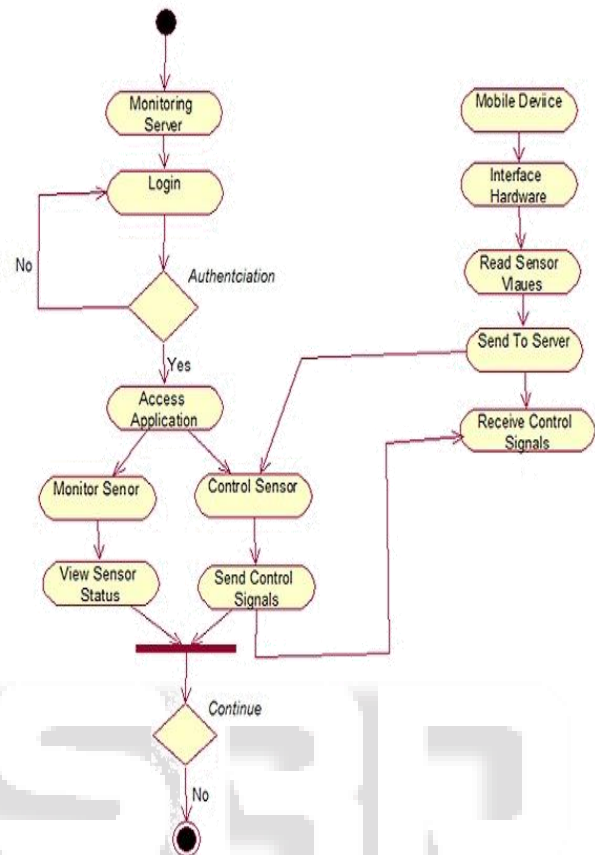


Fig. 4: Activity chart for operation of mobile application

## IV. APPLICATIONS

### A. Early Faults Detection and Prevention:

System provides the efficient and user friendly GUI by which driver or owner easily understand fault arise in the vehicle and remedy for such faults.

### B. Monitor vehicle performance and health:

The vehicle is under review regularly via mobile application hence vehicle performance is better.

### C. Location tracking using GPS:

System uses the GPS by this current location of navigating vehicle is easily trace.

## 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.

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