

# Diagnostics of Various Parameters For Vehicles Using OBD System

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## Abstract:-

On-board diagnostic systems play an important role in the current generation of cars and will play an increasingly important role in the next future. This paper proposes the development of ON-BOARD DIAGNOSTIC SYSTEM for vehicles using microcontroller. This OBD system consists of PIC 16F877A microcontroller that acts as a processing unit, sensors, LCD and keypad as user interface. The vehicle parameters such as fuel level, temperature, voltage are sensed and those results are viewed from LCD display. Initially, the sensors are installed at different parts of the vehicle to sense various vehicle parameters. For data transmission, MAX 232 is used.

## Keywords:-

PIC 16F877A,MAX 232,OBD

## I.Introduction

Automation is the most wanted mechanism nowadays in each and every field with latest available resources in an inexpensive way.

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On-board diagnostic systems play a very important role in the performance of vehicles. Usually it takes more time to diagnose a problem in vehicle than to rectify it. So these systems not only

diagnose the faults but also save us a lot of time. Parameters observed and diagnosed by OBD system are used by the Electronic Control Unit (ECU) of vehicle which in turn controls the engine's main operation (like spark timing control, air fuel mixture, fuel injectors spraying period etc.).Combination of these two systems ensures safety and efficient vehicle operation.

## II. Existing System

The existing method of measuring the amount of fuel in the fuel tank is based on analog system. The amount of fuel in the tank is read through a gauge in the form of a meter. However this meter cannot specify the exact level of fuel in the tank, which may lead to miscalculation in times of crisis.

The pointer in the meter if often found to be stuck, thus gives doubts about fuel availability in the tank.In modern vehicles, the replacement of a single fuel gauge is cumbersome and may lead to change of an entire unit, which may cost heavy.This miscalculation or poor reading of the pointer in the meter may lead to few technical and non-technical problems.

The continuous usage of the starter key with an empty fuel tank shall lead to starter motor problems, its complicating costs, the battery loosing its charge and slowly its life.Similarly, the alternate voltage of the engine, engine temperature, exhaust temperature, percentage of the hydrocarbons air etc can also be displayed through the LCD display. This system would be useful to any users to identify

the availability of all the parameters specified above.

The speed of the vehicle can also be obtained by using the IR sensor. During abnormal conditions set points have been set to awake the user for the specified parameters discussed above. Alternatively every action-taking place is indicated through the voice output. So every action will be indicated in the form of recorded voice.

### III. Proposed System

OBD system has a microcontroller based processing system and consists of sensors installed at different parts of vehicle to observe various parameters, processing unit that will take input from the sensors and signal conditioners, calculate the real-time values of vehicle parameters and give output and user interface.

System will be able to diagnose faults in parameters, abnormal abrupt changes, notify user of any abnormal condition, and in some cases indicate the cause of fault.

This system is designed basically to be implemented on vehicles that do not have factory installed OBD systems, and can be easily fitted without major modifications to the vehicle.

It is user friendly system with LCD and keypad interface though which user can view parameter values, warning notifications and define OBD system has a microcontroller based processing system and consists of sensors installed at different parts of vehicle to observe various parameters, processing unit that will take input from the sensors and signal conditioners, calculate the real-time values of vehicle parameters and give output and user interface.

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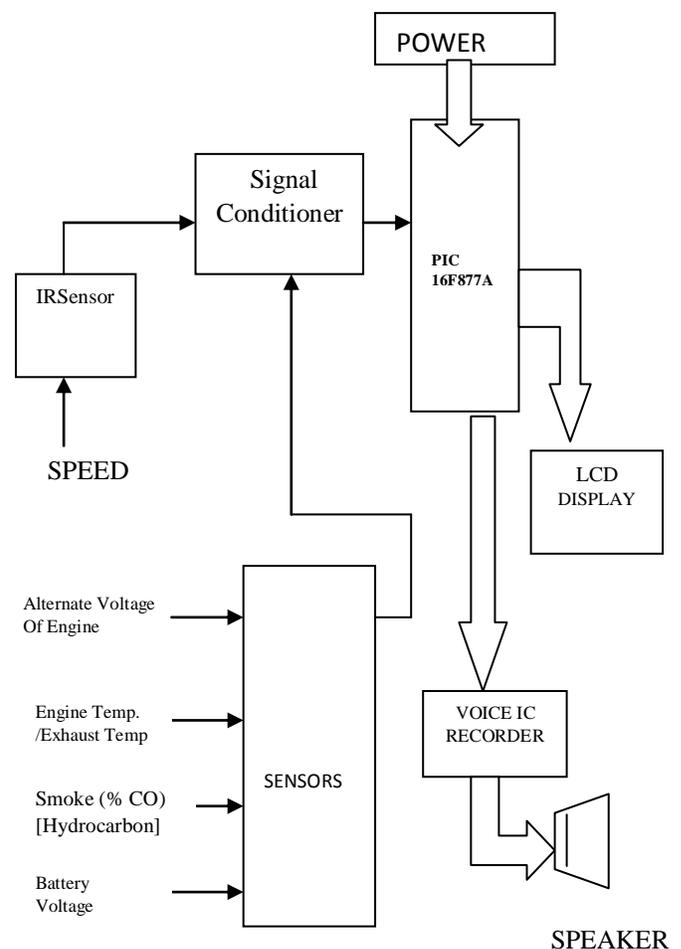


Fig 1: Block Diagram

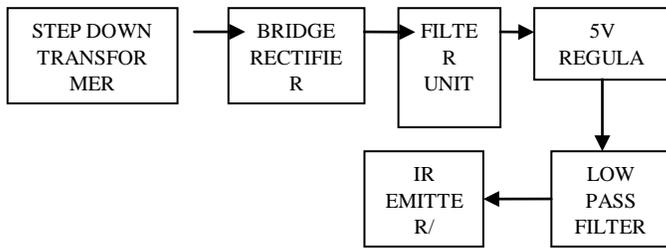


Fig 2: **Sensor Circuit**

1) *Step Down Transformer:* To maintain constant voltage and to achieve constant current for sensor IR Emitter and IR Detector we need a separate power source of 5 volt. We have used a 230V primary and 12 V secondary with an output current of 500mA capacity. Turns ratio of the transformer is approximately 20:1. This transformer is simple and commercially available at low cost isolated step down transformer.

2) *Bridge Rectifier:* Four Diodes full wave bridge rectifier is used with to convert 1V AC to DC. The output of the bridge rectifier will be 1.4V less than the applied AC voltage. 1N4007 diodes are employed for rectification purpose. 1N implies single junction, 4001 here 4 stands for 1 Amp. 4007 last digit multiplied by 100V. Bridge rectifier output frequency will be twice of the input frequency. The applied one is 50 HZ and receives 100 HZ.

3) *Filter:* Capacitive filter is used to remove 100 HZ pulse and make output as 0 HZ (pure DC). When a capacitor is employed, output voltage will be under root two times greater than the applied voltage. Capacitor value decides for load current.

4) *Voltage Regulator:* To maintain constant voltage irrespective of the line voltage change, we need a regulator to keep the voltage as constant. Once if the voltage is maintain, then output current can be controlled. We have used 7805 integrated chip regulator to get 5V. 78 stand for +ve polarity, 05 stand for 05 volt. IC7805 has a built in thermal shut down. This

can withstand up to 1000mA current with enough heat dissipation devices.

5) *Filter LPF and In Circuit Stability:* In any electronic equipment, unwanted high frequency spikes, Transients, Distortion may come from various sources. Due to the above problem computing system often hangs. To avoid above problem, we have used low pass filter. Low pass filter passes high frequency signal through it. Low frequency signal will be retained. The circuit stability capacitor is used to maintain the output voltage always changed and does not effect by its own loads.

#### IV. PIC Microcontroller

High-performance RISC(Reduced Instruction Set Controller) CPU Only 35 single word instructions to learn All single cycle instructions except for program branches which are two cycle Operating speed: DC - 20 MHz clock input and DC-200 ns instruction cycle 4K x 14 words of Program Memory (EPROM) 256 x 8 bytes of Data Memory (RAM) Interrupt capability (up to 14 internal/external interrupt sources) Eight level deep hardware stack Direct, indirect, and relative addressing modes 12-bit multi-channel Analog-to-Digital converter On-chip absolute band gap voltage reference generator Universal Synchronous Asynchronous Receiver Transmitter, supports high/low speeds and 9-bit address mode (USART/SCI).

Built in ADC of multi channel with 10 bit accuracy- used to acquire voltage, current, temperature, power. Built in reference facility and external reference provision- to fix a bandwidth of reference voltage. Built - in ports-to drive the relays and getting feedback from the relays.

*RS - 232 Converter:* RS-232 converter is used for PC application. The serial port converts the output of PC, which is in parallel form into serial data for

transmission. The external converter Quadruples the incoming 5V (from PIC) and gives 20 V output. i.e -10V to +10V. Similarly the incoming 20 V from (from PC ) is reduced as 5V by the converter.

## Conclusion

The discussed design is mainly proposed for non-OBD vehicles. Very few modifications in such a vehicle can make it suitable for the system. In this design great emphasis has been given to make the system user friendly and vehicle friendly. As compared to the OBD systems in the market this design has its own advantages. However the design can be improved by increasing the number of parameter to be observed. This can be easily done as the used local controllers have capability to handle more parameters. Also more local controllers can be added easily as all local controllers transmit their data in same format to a single main controller. The system can also be integrated with an electronic fuel injection (EFI) system of vehicle as EFI takes feedback of different parameters like coolant temperature, RPM, oxygen sensor, throttle position sensor etc. for controlling the timing of fuel injectors.

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