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IOT based Vehicle Health Monitoring System

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***Abstract*—In this paper, vehicle monitoring and tracking systems are implemented using IOT platform acting as a medium for data transfer and communication. The system is developed to monitor various user vehicle parameters like engine temperature, fuel indication and fuel leakage. The developed system takes care of vehicles and its safety. The owner is notified about the excessive heating of the engine or the blockage in fuel pipe. A temperature sensor is employed in the engine that warns the owner about overheating of engine and a flow sensor is used that senses the proper flow of fuel in the pipe. The monostable multivibrator is placed between the fuel tank and the fuel leakage sensor is placed near the fuel tank and if any fault is observed it sends an alerting message to the app and also rings the buzzer. Here LCD screen has been provided so that it displays the error message and store the required data like the car documents, RC book and driver DL, if the state of the vehicle is abnormal then a notification is sent to app. The developed system takes care of vehicles and its safety.**

I. INTRODUCTION

The Internet of Things (IoT) is the network of physical objects—devices, instruments, vehicles, buildings and other items embedded with electronics, circuits, software, sensors, and network connectivity that enables these objects to collect and exchange data. Design of IoT architecture involves many factors such as networking, communication, business models and processes, and security. Due to the fact that things may move physically and need to interact with each other in real-time mode, IoT architecture should be adaptive to make devices interact with other things dynamically and support unambiguous communication of events.

A. Problem Definition

Vehicles needs repair after a certain interval of time and if are not repaired at fixed intervals then vehicle can get damaged or even can break down while driving which may lead to loss of life of the person driving the vehicle and travelling on it. So, due to this a kit has been developed which would alert the driver/owner about the upcoming risk and in addition we can store our RC book, pollution certificate and insurance paper so that we need not carry our papers manually.

The objective of the paper is to notify the owner about the excessive heating of the engine or the blockage in fuel pipe. A temperature sensor is employed in the engine that warns the owner about overheating of engine and a flow sensor is used that senses the proper flow of fuel in the pipe. This helps in proper monitoring of vehicle.

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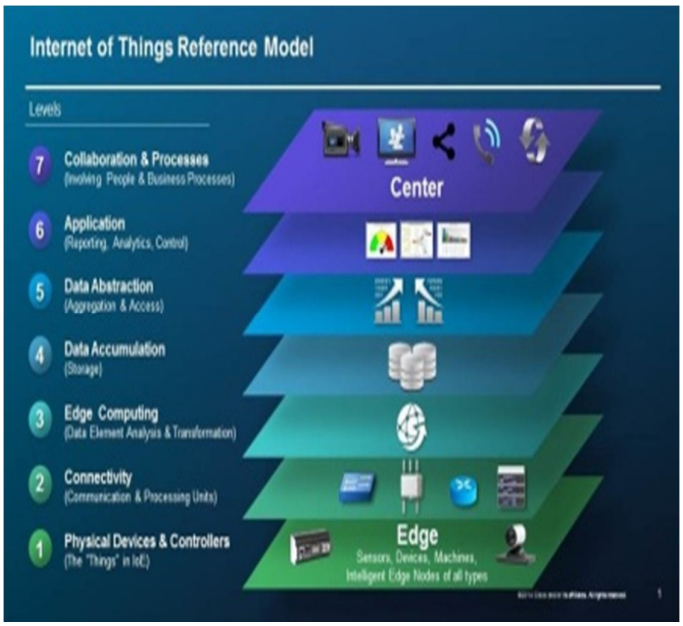

Figure 1 . IoT Architecture

B. Objectives

The objective of this paper is to develop an app-based IoT system which can be used to monitor the health of vehicle. The data gathered by the sensors will be uploaded to the designated cloud for the owner's reference. When the temperature raises or the fuel level is low or the leakage sensor get activated, the buzzer is triggered which makes an alerting sound and also the data obtained is sent through a Wi-Fi module to the cloud as there is no sufficient memory space for storing the data in Arduino . The system is also meant to let the user (owner of the car) monitor the car's condition and every detail of the vehicle, with the help of a user interface through cloud-app login.

II. Literature Review

Sensor technology, network technology and computer technology are advancing together while the demand grows for connecting information systems with the real world. Internet of Things, as a technology that is in trend, allows sensors to become intelligent by connecting them to the Internet. This allows sensors to communicate with each other. All technologies produce a lot of data, which requires massive data storage. Cloud, as a form of technology, that gains momentum as IoT, could allow storage of large amounts of data on the Web. In the current vehicle monitoring technology the user gets the information about the vehicle. This helps in maintaining a health vehicle and increases durability, human error in very rare in this field. Literature is rich with researches on vehicle heath monitoring systems for various applications; using wireless networks, IoT based systems for vehicle health monitoring, vehicle temperature monitoring, fuel level monitoring, etc. The Internet of Things is a system in which various physical objects are interconnected through web [1].A health monitoring system for a vehicle system includes an operational support system. Each manager corresponds to a different sub-system of the vehicle system, and comprises a plurality of reasoners and a fusion block. Each reasoned is configured to obtain data and provide preliminary output regarding a different component of the sub-system based on the data [2]. The fusion block is coupled to the plurality of reasoners, and is configured to receive the preliminary output and generating manager output based on the preliminary output.

III. Architecture Diagram

An architecture diagram is a graphical representation of a set of concepts, that are part of an architecture, including their principles, elements and components. Figure 2 shows the architecture of the system.
The use case diagram of this work consists of two actors namely admin and users. The main functionalities are System analyzing, login, cloud database, maintenance, check vehicle status and alerting.

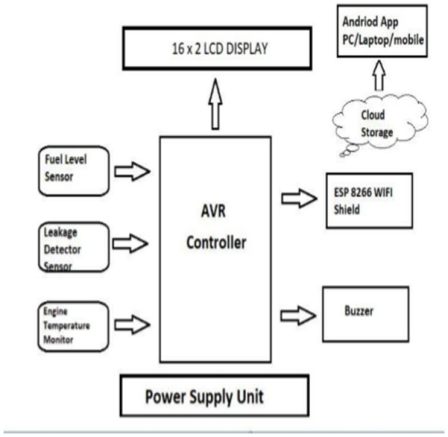

Figure 2. Architecture Diagram

Figure 3. Use Case Diagram

A. Sequence Diagram

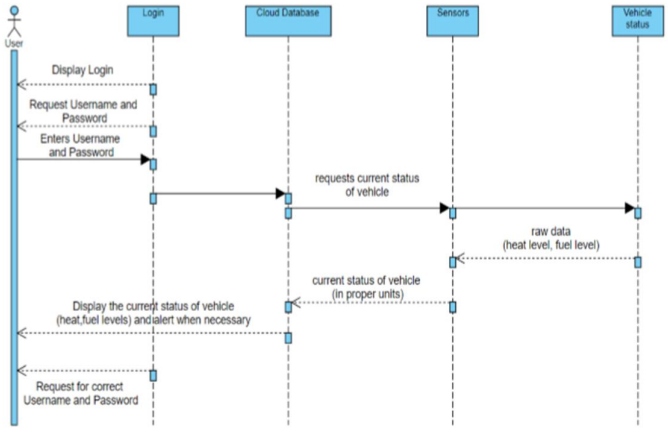

Figure 4. Sequence Diagram between User and Cloud (Thingspeak)

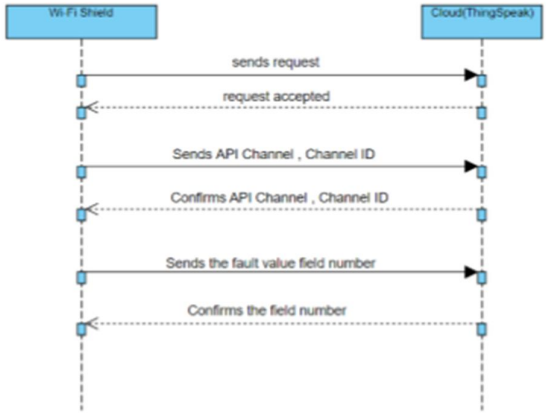

Figure 5. Sequence Diagram between Wi-Fi, shield

IV. Implementation Details

A. PCB Design

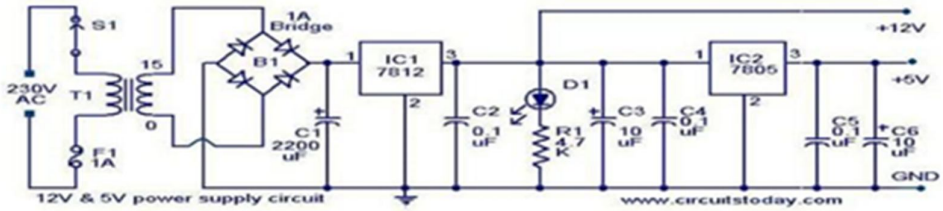

Figure 6. Power Supply Circuit

Draw the component layout on graph paper systematically, positive and negative power supply is also drawn which should be kept apart otherwise these two creates capacitance, also the width of the negative line should be thicker depending on the current flow through it. After completion of drawing, the same drawing should be copied on the copper plate by attaching the stickers or marker. Afterwards the copper plate is dipped into the ferric chloride solution, till the un – required copper portion is removed from the copper plate. Now the ferric chloride becomes greenish from bluish color. Now remove the remove the stickers with the help of sprit of petrol or nail polish removal if marker is used only solder points are cleaned by sand paper. With this we get desired layout of circuit on P.C.B Next, drilling should be done on the P.C.B to provide insertion of components with the help of drill machine. With the completion of this procedure the result will be P.C.B ready for connecting the circuit. This is a simple approach to obtain a 12V and 5V DC power supply using a single circuit. The circuit uses two ICs 7812(IC1) and 7805 (IC2) for obtaining the required voltages. The AC mains voltage will be stepped down by the transformer T1, rectified by bridge B1 and filtered by capacitor C1 to obtain a steady DC level. The IC1 regulates this voltage to obtain a steady 12V DC. The output of the IC1 will be regulated by the IC2 to obtain a steady 5V DC at its output. In this way both 12V and 5V DC are obtained. Such a circuit is very useful in cases when we need two DC voltages for the operation of a circuit. By varying the type number of the IC1 and IC2, various combinations of output voltages can be obtained. If 7806 is used for IC2, we will get 6V instead of 5V. Same way if 7809 is used for IC1 we get 9V instead of 12V.

A. Data Collection

The data to be used for the project is collected from 3 Sensors namely

Temperature SENSOR: LM35 is an analog, linear temperature sensor whose output voltage varies linearly with change in temperature

Fuel Level Sensor (Monostable Multivibrator): Automobile vehicles use fuel as a basic source of energy. This device measures the amount of fuel still in the vehicle.

Leakage Detector Sensor (MQ3): A petrol leakage detector is disclosed here in sensitive to the presence of moisture, having an elongated sensor strip comprising a pair of conductors separated by insulation.

B. Data Analysis

a) Data analysis is a process of inspecting, cleansing, transforming and modeling data with the goal of discovering useful information, informing conclusion and supporting decision making.
b) The analysis also included researching about the Vehicle Conditions like Fuel level, heat level of Vehicle.
c) Thing-Speak is an open-source Internet of Things (IoT) application and API to store and retrieve data from things using the HTTP and MQTT protocol over the Internet where we can view the status of the vehicle, temperature, fuel level and also view the data in terms of graphs or plots.

C. Tools Used

1. ThingSpeak: It is an open-source Internet of Things (IoT) application and API to store and retrieve data from things.
2. Arduino IDE: The Arduino Integrated Development Environment (IDE) is a cross platform application. It is used to write and upload programs to Arduino compatible boards.
3. Proteus: The Proteus Design Suite is a proprietary software tool suite used primarily for electronic design automation.
4. Express PCB: Express PCB is a CAD (computer aided design) free program designed to help you create layouts for printed circuit boards on your Windows PC.

V. RESULTS

Figure 7. Analysis of ThingsSpeak

VI. TEST CASES

Table 1 indicates the various test cases occurred during the execution. The results show the output obtained is very efficient and is as expected.

TABLE I. TEST CASES ANALYSIS

Sl no	Input	Expected output	Actual output	Remarks
1	Temperature from sensor	If temperature greater than threshold temperature send data to cloud and Buzzer is turned ON	If temperature greater than threshold temperature send data to cloud and Buzzer is turned ON	pass
2	Fuel Level from sensor	If Fuel Level is below the threshold level send data to cloud and Buzzer is turned ON	If Fuel Level is below the threshold level send data to cloud and Buzzer is turned ON	pass
3	Fuel Leakage Information from sensor	If Fuel Leakage occurs the sensor sends the message to cloud and Buzzer is turned ON	If Fuel Leakage occurs the sensor sends the message to cloud and Buzzer is turned ON	pass
4	Temperature from sensor	If temperature is below threshold temperature the data isnot send to cloud and Buzzer is turned OFF	If temperature is below threshold temperature the data is not send to cloud and Buzzer is turned OFF	Pass
5	Fuel Level from sensor	If Fuel Level is above threshold level the data is not send to cloud and Buzzer is turned OFF	If Fuel Level is above threshold level the data is not send to cloud and Buzzer is turned OFF	Pass
6	Fuel Leakage Information from sensor	If Fuel Leakage doesn't occur the data is not sent to cloud and Buzzer is turned OFF	If Fuel Leakage doesn't occur the data is not sent to cloud and Buzzer is turned OFF	Pass

VII. CONCLUSION

By implementing this system in the vehicles, the vehicles will be easier to operate and users will maintain the vehicles smoothly. The alerts given by the system at right time will save the vehicles and also the money. This system will help user to regularly monitor the health of the vehicle.

The main motive of designing this system was to provide extra features in a vehicle at cost effective rates, so that middle class of the society who use economic class vehicles get benefited.

This system will add few more costs to the vehicle cost but it would increase the life span and enhance performance of the vehicle. The designed system collects data from our various sensors and sends the status of the vehicle to the cloud, when detects any fault in it and also triggers the buzzer so that the person riding the vehicle is alerted.

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