Design of an Intelligent Vehicle Monitoring System using IoT

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***Abstract*—This paper proposes An Intelligent Vehicle Monitoring System Using IoT. The Intelligent Vehicle Monitoring is achieved through sensors, microcontroller, GSM and Internet. The Monitoring is achieved through Internet by Front End Coding. Long Distance Communication is achieved through Wireless Communication. The Intelligent Vehicle Monitoring System provides better vehicle maintenance and efficient post-accidental measures. The proposed system is designed to operate in highly noisy environment and in dangerous situations.**

Keywords—IoT,GSM,Wireless Communication,Front End Coding

I. INTRODUCTION

The IoT (Internet of Things) is a recently developed concept gaining popularity in all fields of Engineering. IoT will be popular in wireless communication as far as they offer the benefits of easy accessibility, high sensitivity and more reliable means of information. It has the disadvantage of needing high security mechanism coupled with high-cost, high-speed microcontrollers. The design to increase secured access with low-cost, low-speed microcontroller is proposed.

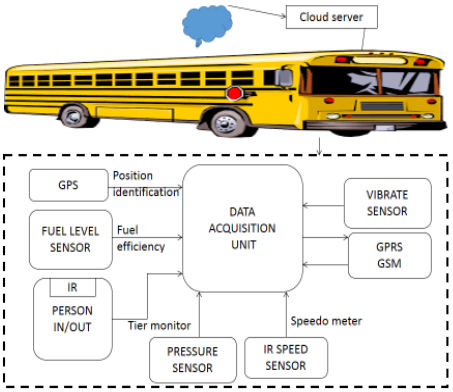
IoT is gaining importance in communication field due to the need of smart systems in telemetry, machine surveillance and operation maintenance. Eg: Intelligent Transport System, Boiler maintenance etc., .The sensors and other systems which guide in data access this system are low- cost, high-efficient systems [1].

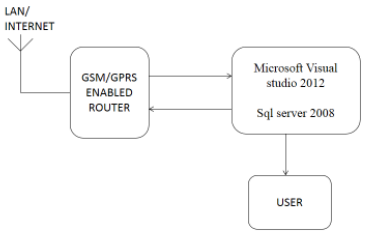
The five sensors: Pressure Sensor, Speed Sensor, People Count Sensor, Vibrate Sensor and Fuel Level Sensor [2] along with GPS [3] and Microcontroller [4] with GSM enabled with GPRS [5] form the hardware components of the system whereas the Front End Coding [6] of Server and Client Systems form the software part.

In the proposed design, two systems combine to form the entire proposed system: The hardware components system and Front End Coding System.

The paper is organized as follows. In section II Block Diagram and Components are introduced. In section III Working and Results. Section IV concludes the paper.

II. BLOCK DIAGRAM WITH DESCRIPTION





[1] Sensors and Components Used

In a vehicle, most important parameters of concern are fuel level, person count, tire pressure, speed and vibration in the external body of the vehicle along with the position of the vehicle.

- Fuel Level Sensor
- IR Person In/Out Sensor
- Pressure Sensor
- IR Speed Sensor
- Vibrate Sensor

In addition to the sensors, GPS and GSM Enabled GPRS systems are used

[2] Sensors with Description

Fuel level Sensor

The fuel level sensor senses the fuel level in the fuel tank. The fuel level sensing is done based on voltage variation which varies with the resistance value. According to the fuel level consumed, the voltage level swings based on the resistance value of the variable resistor. Based on the obtained voltage, the fuel level in the fuel tank is measured.

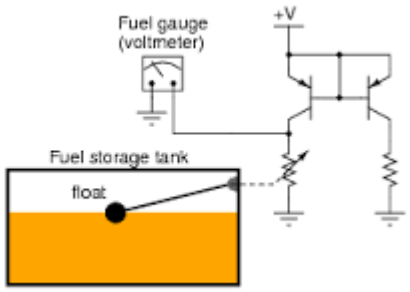


Fig: Structure of Fuel Level Sensor

IR Person In/Out Sensor

The IR Person In/Out Sensor senses the number of persons inside the vehicle based on simple obstacle detection principle. To find the total number of persons inside any vehicle, we need to know the number of persons entering and leaving the vehicle, so we place two of these sensors on the entrance and exit. Whenever a person crosses the entrance, the continuous IR radiation between the IR transmitter and receiver gets obstructed and the counter count increases by one. Similar obstacle detection is performed whenever someone crosses the exit and the counter count decreases by one. Thus at any time the number of persons inside the vehicle is known by the counter count.

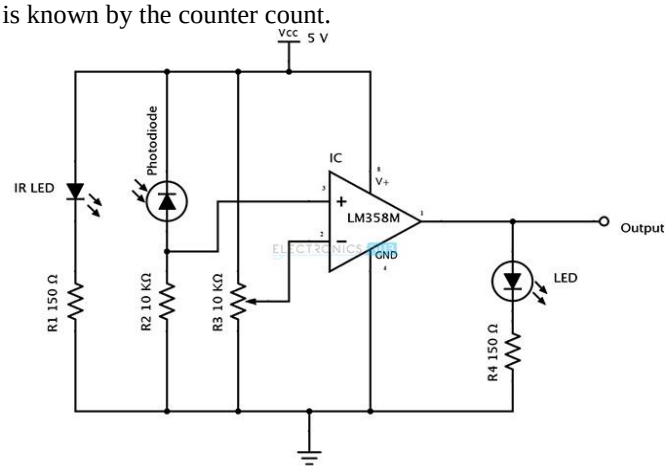


Fig: Structure of IR LED based Obstacle detection System

Pressure Sensor

The Pressure Sensor senses the tire pressure of the vehicle. It works based on comparison with external pressure. The Pressure Sensor converts the pressure to voltage and transmits it to the microcontroller. It can measure up to 700pascals.

Features:

- Pressure range: 0-5 .8 psi (40kpa);
- Work power supply 5 VDC,
- Input impedance of 4 - 6 KΩ
- The output impedance of 4 - 6 KΩ
- Operating temperature -40 ° F - +185 ° F
- Accessible media, clean, dry, non-corrosive gases
- Bias voltage ± 25 mV
- Full-scale output voltage 50 - 100 mV
- Bridge Resistance to 4 - 6 K
- Temp. coefficient of sensitivity -0.21 % FS/ °c

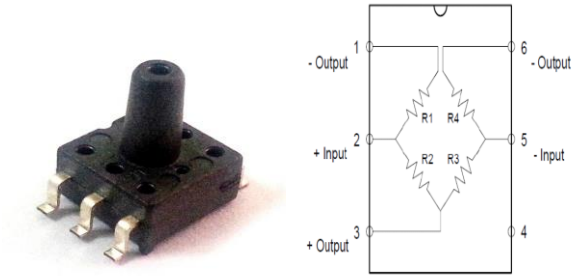


Fig: Pressure Sensor with circuit diagram

IR Speed Sensor

The IR Speed Sensor also works on the basis of obstacle detection principle. The Blades of the motor fixed in the wheels of the vehicle obstructs the continuous IR radiation between the IR transmitter and receiver thereby setting the counter to count the number of revolutions per minute (rpm) based on which the speed is calculated.

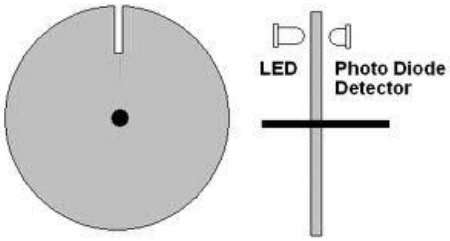


Fig: Figure showing how speed detection using IR takes place

Vibrate Sensor

The Vibrate Sensor works on the basis of piezoelectric effect. The piezoelectric plates converts the mechanical pressure/ vibration into voltage which is amplified and measured.

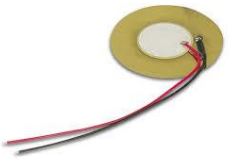


Fig: Piezoelectric Plate

[3]GPS

The GPS System senses the position of the vehicle to be monitored and sends it to microcontroller which acts as a data acquisition unit.

Features:

- Ultra high sensitivity: -165dBm
- Extremely fast TTFF at low signal level
- Built-in 12 multi-tone active interference canceller
- Low power consumption: Typical 22mA@3.3V

- ±11ns high accuracy time pulse (1PPS)
- NMEA Output: GGA, GSA, GSV, RMC
- Advanced Features: Always Locate; AIC
- QZSS, SBAS (WAAS,EGNOS,MSAS,GAGAN)
- UART interface: 4800/9600/38400/115200 bps
- Small form factor: 15x13x2.2mm
- RoHS compliant (Lead-free)

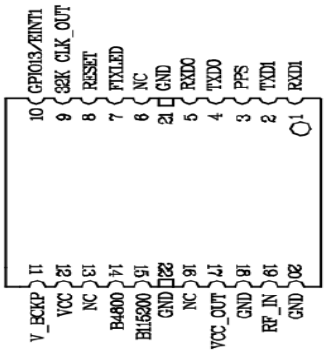


Fig: SKG13BL Pin Package

[4] Microcontroller

The microcontroller acts as a data acquisition unit. It collects the amplified sensor data and transmits it to the GSM Module. The data collected from sensors is displayed on LCD in user readable format. The 8-bit microcontroller PIC 18F4520 is used here.

***Features*:**

- 40-pin Low Power Microcontroller
- Flash Program Memory: 32 kbytes
- EEPROM Data Memory: 256 bytes
- SRAM Data Memory: 1536 bytes
- I/O Pins: 36
- Timers: One 8-bit / Three 16-Bit
- A/D Converter: 10-bit Thirteen Channels
- PWM: 10-bit Two Modules
- Enhanced USART: Addressable with RS-485, RS-232 and LIN Support
- MSSP: SPI and I²C Master and Slave Support
- External Oscillator: up to 40MHz
- Internal Oscillator: 8MHz

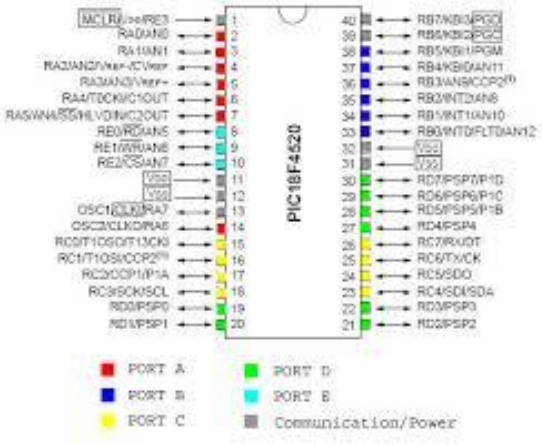


Fig: PIC 18F4520

[5]GSM enabled with GPRS

The GSM Module enabled with GPRS accepts information from microcontroller and converts it into packets and sends it the remote server. The GSM 900 SIM module is used to perform 2G data transfer.

Features:

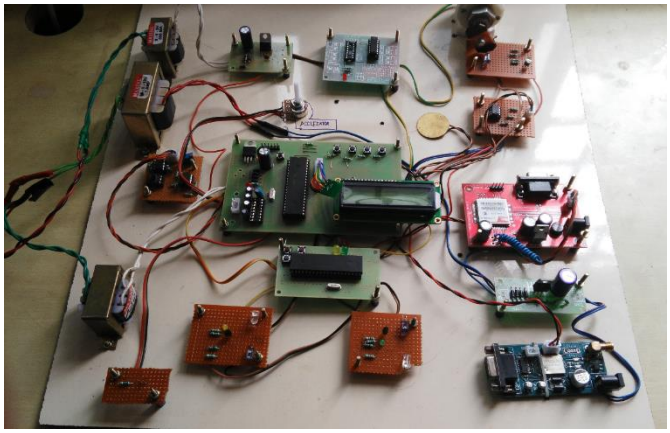
- Quad-Band GSM/GPRS 850/ 900/ 1800/ 1900 MHz
- Built in RS232 Level Converter (MAX3232)
- 9600 baud rate
- SMA connector with GSM L Type Antenna.
- Built in SIM Card holder.
- Built in Network Status LED
- Inbuilt Powerful TCP/IP protocol stack for internet data transfer over GPRS.
- Audio interface Connector
- Normal operation temperature: -20 °C to +55 °C
- Input Voltage: 5V-12V DC
- GPRS multi-slot class 10/8
- GPRS mobile station class B
- Compliant to GSM phase 2/2+
- Class 4 (2 W @850/ 900 MHz)

[6]Front End Coding

The Front End System consists of server where the data logs are stored in a database. The database consists of data in a table format. These data can be accessed by the user using port number. The webpage coding is done using ASP. NET and the server data is accessed through relational database coding- SQL. The data is always accessed by the user through an internet connection through which remote access is possible

III. WORKING WITH RESULTS

The server consists of a data base management logic that handles the requests from the interface and takes care of the extraction of data. The hardware system contains a variety of sensors like IR speed sensor, pressure sensor, Fuel level sensor etc., These sensors are used to measure the bus resource parameters with person count and transfers these data to microcontroller which acts as data acquisition unit. The GPS senses the location of the bus and sends this data to microcontroller. The microcontroller transmits the data acquired to the cloud server using the GSM enabled with GPRS. User takes the information from data base server by using Ethernet IP address that connects LAN server and SQL data base.



Thus the vehicle parameters can be obtained on the LCD Screen of microcontroller or on the PC Screen of the user.

IV. CONCLUSION

Limitations

In case of large number of users, the 256 byte flash memory will not be suffice. Also the microcontroller speed must be very high to tackle large number of users. With hacking growing stronger day-by- day security threats are possible, so high security systems are needed.

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