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Cell Phone Based Fuel Consumption Tracking System

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Abstract: -- In today's world, actual record of fuel consumption in vehicles is not maintained. To avoid this in this digitized world a system is created which will display the exact amount of fuel present in the fuel tank of a vehicle on to a cellphone. By keeping a track on the fuel consumption of the vehicle, the user will get an idea of the efficiency of the vehicle by incorporating embedded system into the existing system and creating a cellphone based application to display the data that has been transmitted wirelessly on to a cellphone.

Index Terms—Android, Bluetooth Application, Fuel Level sensor

I. INTRODUCTION

The area of focus in proposed system is getting the fuel readings of vehicles that is transmitted wirelessly on a mobile phone in digital form. The proposed system mainly concentrates on the indication of fuel level of vehicles on to a cellphone. The traditional system used is inaccurate; however some embedded systems can be incorporated into the traditional systems in order to obtain better accuracy and get the readings of fuel in digital form which can be transmitted wirelessly on a mobile phone when the vehicle is stationery and when the vehicle is at a distant location.

The existing system has fuel gauge which indicate the level of fuel contained in a tank .It has two main units, i.e. the sending unit and the gauge. The gauge unit is used to display the level of fuel in the tank and the sending unit to measure the level of fuel. By incorporating embedded system into the existing system we can get the accurate amount of fuel information present in the fuel tank of a vehicle in digitized form.

II. LITERATURE REVIEW

In the research paper [1] entitled "Digital Fuel Level indicator in two wheeler along with distance to zero indicator" focuses on knowing the exact amount of fuel available in the fuel tank in digital form, in terms of litres. The system comprises of Fuel tank, Analog fuel gauge, Battery, microcontroller, A/D Converter with LCD display. The fuel readings are displayed in terms of exact fuel level. In the research paper [2] entitled "Fuel Gauge Sensing Technologies for Automotive Applications" describes the existing fuel gauge techniques being used in automobiles i.e. the traditional fuel gauge system and the smart fuel gauge system and also discusses their operating principle and a comparison is done between the two existing techniques based on performance, complexity and cost of development. Some issues with respect to the existing techniques are identified and so a better alternate sensing technology (capacitive level sensing). In a capacitive fuel level sensing system, the capacitive sensors have two conducting terminals electrodes and the gap between the two rods is fixed and the fuel level can be found by measuring the capacitance between the two conductors immersed into the fuel has been suggested [2]. Android developers often need to use Bluetooth in their project. Unfortunately, Bluetooth can be confusing to use for those unfamiliar with the process. In the research paper [4] entitled "Sending and Receiving Data via Bluetooth with an Android Device" describes a method to utilize Bluetooth in order to communicate with a microcontroller.

III. IMPLEMENTATION OF THE SYSTEM

The main blocks are fuel level sensor, microcontroller unit, wireless device, and a mobile phone. The fuel level sensor is placed at certain place to find out the fuel level and the signal is sent to the microcontroller unit for further operations. Here sensor is placed at fuel tank to sense the fuel level and the signal from that sensor is sent to the microcontroller unit to decide the exact level

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information. The fuel level information is wirelessly been transmitted on to a mobile phone.

A) Hardware Requirements

The following are the hardware components which are used to implement the proposed system.

1. Fuel Guage

A fuel level detector (fuel gauge or gas gauge) is a device used to indicate the level of fuel contained in a tank. The analog fuel gauge has two main units, namely the sending unit that measures the amount of fuel actually left and a gauge or indicator that relays this information outside the fuel container. A sensing unit is the part of a fuel gauge found within or connected to the actual fuel storage container on a vehicle which usually uses a oat type sensor which is connected to a metal rod that runs to a small circuit. The end of the metal rod is mounted on a variable resister or potentiometer. The variable resistor consists of a strip of resistive material over it which moves across the variable resistor changing the resistance and flow of current depending on the movement of the float with respect to the level of fuel present in the fuel tank. Fuel level is inversely proportional to the resistivity of the variable resistor.. The gauge consists of a bimetallic strip i.e. a strip made of different kinds of metal and whose thermal coefficient of expansion differs from each other. When resistance decreases, current increases and thus the strip is heated during which one metal expands less than the other, so the strip curves and this bending action is what moves the needle move on the fuel gauge. As resistance increases, less current passes through the heating coil, so the bimetallic strip cools. As the strip cools, it straightens out, pulling the gauge from full to empty.

The smart fuel gauge system techniques has been implemented in some newer cars in which, instead of sending the current directly to the gauge, an intermediate microprocessor is used to read the output of the resistor and then communicate with the dashboard for displaying the fuel level in the digital form. The rear side of the analog fuel gauge has three terminals, namely B-battery, Float and G-ground. From these terminals, voltage values are taken from the terminals-FG and resistance value is taken from the terminal-F from zero to x liters (depending upon the capacity of the fuel tank). So, for a particular volt value, the corresponding liters value will be shown in digital [2].

Fig 1: Fuel Level Sensor

2. Arduino Uno

The Arduino Uno is a microcontroller board based on the ATmega328 (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega8U2 programmed as a USB-to-serial converter. The Arduino Uno can be powered via the USB connection or with an external power supply.

3. HC 05 Bluetooth Wireless Serial Port Module

HC05 module is an easy to use Bluetooth SPP (Serial Port Protocol) module, designed for transparent wireless serial connection setup. Serial port Bluetooth module is fully qualified Bluetooth V2.0+EDR (Enhanced Data Rate) 3Mbps Modulation with complete 2.4GHz radio transceiver and baseband. It uses CSR Blue core 04External single chip Bluetooth system with CMOS technology and with AFH (Adaptive Frequency Hopping Feature). It has the footprint as small as 12.7mmx27mm.

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4. GSM module

A GSM modem is a specialized type of modem which accepts a SIM card, and operates over a subscription to a mobile operator, just like a mobile phone. From the mobile operator perspective, a GSM modem looks just like a mobile phone. GSM (Global System for Mobile) TTL-Modem is SIM900 Quad-band GSM / GPRS device, works on frequencies 850 MHZ, 900 MHZ, 1800 MHZ and 1900 MHZ. It is very compact in size and easy to use as plug in GSM Modem. The Modem is designed with 3V3 and 5VDC TTL interfacing circuitry, which allows User to directly interface with 5V Microcontrollers (PIC, AVR, Arduino, 8051, etc.) as well as 3V3 Microcontrollers (ARM, ARM Cortex XX, etc.). The baud rate can be configurable from 9600- 115200 bps through AT (Attention) commands. This GSM TTL Modem has internal TCP/IP stack to enable User to connect with internet through GPRS feature. It is suitable for SMS as well as DATA transfer application in mobile phone to mobile phone interface. The modem can be interfaced with a Microcontroller using USART (Universal Synchronous Asynchronous Receiver and Transmitter) feature (serial communication).

5. Smartphone

A smartphone also called as mobile phone is a telephone with an advanced mobile operating system which combines the feature of personal computer operating system with other features useful for mobile or handheld use. It can make and receive calls over a radio frequency carrier while the user is moving within a telephone service area. Smartphones support a variety of services such as text messaging, MMS, email, Internet access, short range wireless communication, (infrared, Bluetooth), gaming, business applications. The important task of the smartphone in the following system is for displaying the amount of fuel on an android application that is been wirelessly transmitted using a Bluetooth device.

B) Software Requirements

The following are the softwares that are to implement the proposed system.

1. Arduino IDE

The open source Arduino Software (IDE) is used to write code and upload it on the Arduino microcontroller board. It runs on Windows, Mac OS X, and Linux. This Software can be used with any Arduino board.

2) Eclipse IDE

In computer programming, Eclipse is an integrated development environment (IDE). It contains a base workspace and an extensible plug-in system for customizing the environment. Eclipse is written in Java and its primary use is for developing Java applications.

3) App Inventor for Android software

App Inventor for Android is an open-source web application originally provided by Google, and now maintained by the Massachusetts Institute of Technology (MIT). It allows newcomers to computer programming to create software applications for the Android operating system (OS). It uses a graphical interface, very similar to Scratch and the Star Logo TNG user interface, which allows users to drag-and-drop visual objects to create an application that can run on Android devices.

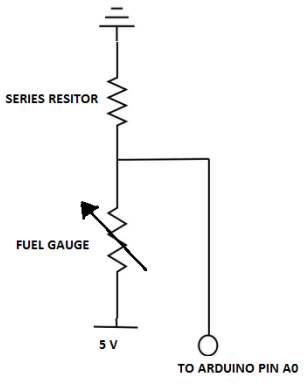

Fig 2: Circuit used for testing

RG = RS(5- VS)=VS
Where
RG-resistance of gauge

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RS-series resistance
VS-voltage across series resistance

The circuit has a series resistor which is connected to the fuel gauge. The gauge resistance varies according to the amount of fuel tank. As a result the voltage across gauge varies. The arduino analog pin A0 is connected across the fuel gauge as shown in the above figure

Using arduino microcontroller, we calculate the voltage across the gauge, which in turn gives the measure of fuel that is present in the fuel tank.

Fig 3: Battery connection for vehicle 1

Fig 4: Battery connection for vehicle 2

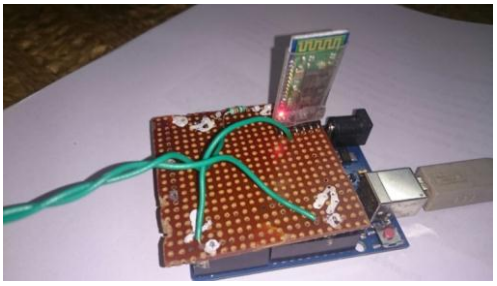

Fig 5: Interfacing Arduino Uno and Bluetooth module

Fig 6: Placement of Arduino and Bluetooth module in vehicle1(Honda Splendor)

Fig 7: Placement of Arduino and Bluetooth module in vehicle 2(Hero Honda Pleasure)

Creating a Bluetooth Application using Android

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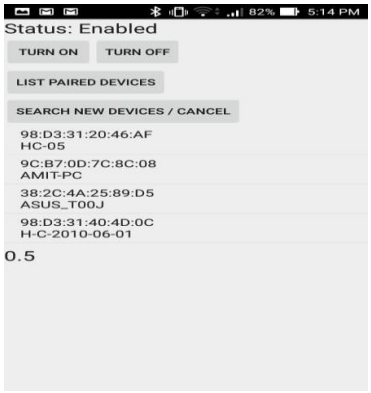

Fig 8: Layout to display fuel readings

Interfacing Arduino Uno and GSM Module

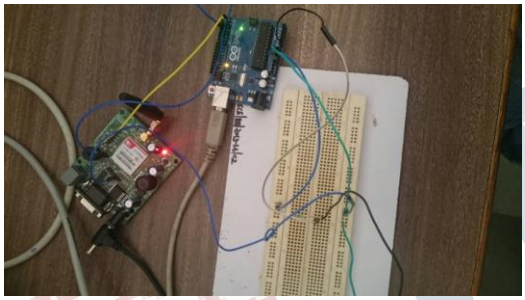

Fig 9: Interfacing Arduino Uno and GSM module

The above figure shows the interfacing of GSM Module to Arduino Uno microcontroller. This is implemented when the vehicle and the phone are at a distance greater than 10 meters.

Fig 10: Placement of Arduino and GSM module in the vehicle (Honda Dio)

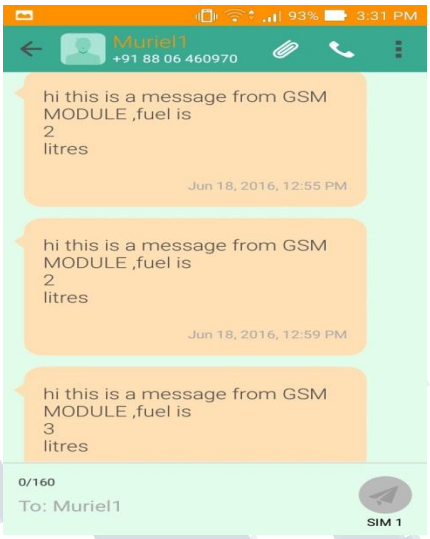

Fig 11: Layout indicating fuel readings transmitted from GSM Module

Creating a Bluetooth Application using App Inventor for Android (MIT App)

Fig 12: Fuel readings of vehicle 1

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Fig 13: Fuel readings of vehicle 2

IV. CONCLUSION AND FUTURE SCOPE

The proposed system was implemented on 3 vehicles i.e. Two wheeler vehicles (Hero Pleasure, Honda Splendor, Dio). On two vehicles we connected Arduino and a Bluetooth module which could transmit the amount of fuel present in the fuel tank on to a Smartphone which has a Bluetooth application wirelessly and on the third vehicle we connected arduino and GSM module which send message of fuel in digital form that is present in the fuel tank on to our phones when the bike is at distant location. The fuel readings in digitized form are transmitted wirelessly. The microcontroller based technique is more accurate compared to the traditional technique. Thus it is useful for fleet vehicle owners who can track fuel consumption, so also can easily predict fuel theft, and find which vehicles are fuels efficient in turn help in saving cash.

However the microcontroller based technique is more accurate compared to the traditional technique but still lacks accuracy due to fuel sloshing in the tank unless float sensor is calibrated with respect to the size and curves of the tank. A more efficient and reliable technology can be incorporated that makes use of inclinometer, tilt sensors that provide highly accurate measurement of the level of fuel in the tank when the vehicle is at a sloppy region. The embedded control system can achieve many tasks of the effective fleet management, such as fuel monitoring, vehicle tracking. Using GPS vehicle tracking technology and viewing interactive maps will enable us to see where it was losing money, time and wasting fuel. The proposed system can also be implemented on all the other vehicles such as a four wheeler vehicle in similar manner. Currently we have not concentrated on the safety issues of the system like protection from rain, damage of circuit, when vehicle travels on uneven roads.

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