SMART FUEL THEFT DETECTION SYSTEM USING RASPBERRY PI

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ABSTRACT

Today, a lot of efforts are being taken all over the world to maximize the utilization of fuel use in engines of vehicles. Rising fuel prices and depletion of non-renewable resources are the main reasons behind such concerns. Technology plays a very important role in our lives. In our project, we have worked in the direction to save fuel from being stolen directly from fuel tanks at commercial and individual levels by implementing a system which detects any

change in the fuel level in the fuel tanks and reports to the owner through a call and a message immediately. Vehicle fuel theft has always been one of the major concerns for both bike and car owners and especially for goods and transport agencies. The main intention of this project is to avoid theft of fuel and minimize the financial loss

Keywords: *Raspberry Pi, GSM, Fuel theft, Tracking vehicles, Continuous sensing, Fuel level sensor, ADC.*

I. INTRODUCTION

Vehicle buyers these days are more fascinated by the technological benefits provided to them during the purchase of the vehicle. So coming up with one such beneficial systems which keep a check on the users' fuel tanks will be a revolutionary step in the automobile industry. In recent years, continuously increasing oil demand and its cost is the main concern to many businesses and those with large vehicle fleets.

To counter the above-discussed problems, continuous monitoring of the fuel level in the fuel tank is necessary. Whenever the unwanted decline in the fuel level occurs, the vehicle owner should be alerted. This system is implemented using the Raspberry Pi computer and Global System for Mobile Communication (GSM) module which alerts vehicle owner through call or by sending SMS or both.

Raspberry Pi is a mini-computer which has a processor of 1GB RAM, operates on 300MHz frequency, 40 GPIO pins and many other external ports for connection of external devices It operates on +5V DC power supply and can be connected to an external display device. It is widely used to perform advanced and complex operations. GSM Module which provides a digital cellular network which is used for transmitting mobile voice and massage services. GSM also supports International roaming and is compatible with all available digital networks. The GSM system digitizes the information and sends it over the medium to the client intended. GPS is a system widely used these days because of its versatility in applications over varied firms and sectors which includes military and weather broadcasts. One of the noteworthy features of GPS is that it makes satellite navigational information available to the

user without any additional charges. In our project, we are availing the benefits of GPS so as to track the exact current location of the vehicle precisely as and when required by the owner.

Sensing of the fuel level is done using a fuel level sensor. Fuel level sensor is the variable resistor which has the resistance range of 17 ohms to 110 ohms. These resistance values indicate each level of fuel in a tank. 17 ohms represents an empty tank and 110 ohms represents full tank. These resistance values are converted into equivalent voltages and are given to Raspberry Pi through Analog to Digital Converter

(ADC) 0808. ADC 0804 gives 8-bit digital output with a resolution of 19.6 mV.

The existing system suffers from following drawbacks

Continuous sensing: Most of the system does not implement continuous fuel sensing. If this is not implemented then the system works only once and it has to be restarted for future use.

Fuel level sensor: Some systems use fuel level sensors which are less accurate and complex. False scanning of fuel level can lead to the false application of the system.

Calling mechanism: Whenever false decline in fuel level occurs, existing systems send only SMS to the user or vehicle owner which sometimes may be ignored by the owner.

II. LITERATURE SURVEY

The system addresses the issue of theft detection by keeping the fuel level of the vehicle under constant check. It sends a message to the owner when it detects the change in the fuel level in the fuel tank of the vehicle while it is not in running condition. It involves the use of Microcontroller LPC2138 and a GSM modem which detects the present location of the vehicle. The ARM 7 requires more cycles for execution of a program thus increasing the total execution time and causing a delay in the overall functioning. [1]

This facilitates vehicle fuel level monitoring and if there's a theft, an SMS is sent to the owner. It uses GSM 900 which is costlier than GSM 800 and also, does not provide Internet benefits as GSM 800 modem. ATmega 16 is being used as the Microcontroller which is interfaced with GSM, sensors and LCD display. One of the major drawbacks of this system is that it restricts the programmer to use C language as its coding input whereas the use of a microprocessor or Raspberry Pi is compatible higher languages such as Java and Python. [2]

This system especially focuses on the theft done at fuel stations. This system converts the weight of the fuel present in that fuel tank in quantity of liters, thus detecting the amount of fuel loaded in the tank. For the above-mentioned purpose, the system uses a Microcontroller for processing, interfacing, calculations, and conversion. Also, the Microcontroller detects whether the vehicle is at a halt or running presently thus checking the present state of the vehicle. Microcontroller specifies the problem but also it limits the extent to which the system can be enhanced and developed for further use. Thus the further scope of any extension and addition of new facilities to the system is restricted due to the use of Microcontroller. Also, the use of microcontroller as the chief component in this project makes it bulkier and complex as far as the implementation view is concerned. [3]

The problem of air pollution is tried to be addressed here. A Microcontroller interfaced with various components is being used to check the number of air pollutants from vehicles. A smoke detector is required to check the pollutant level being released in the surroundings. The GPS installed in the system interfaced with the Microcontroller ARM7TDMI-S checks the exact location of the vehicle. The use of Microcontroller here restricts the scope of the project to the detection of CO gas only. Further gas sensors need to be enabled in the system to make it more dynamic. [4]

The project presented here aims to design an auto theft detection system and also a tracking system in the vehicles. It uses an ARM Cortex M3 which works as the ultimate processing and interfacing system. Cortex M3 struggles with efficiency issues as it requires a lot of power for the ARM system to function. Also, it is difficult to have simple OS systems with ARM controllers. [5]

This system has an ultrasonic system incorporated to check the level of fuel present in the fuel tank. The fuel is under the constant check of the owner with the help of the numeric lock installed for the safeguard of the fuel. This system ensures complete security of the protection of the fuel from theft. There are instances seen in the ultrasonic system that the waves are sometimes absorbed by the liquid medium and are not hit back to the system. This leads to false readings in the system which questions the authenticity of the final report sent to the owner.

The performance of ultrasonic sensors is many times hampered by the turbulent fuels which are quite common in liquid fuels. [6]

This system works on the principle of Hall Effect to sense the amount of fuel level present in the tank. It uses Microcontroller MSP430F149 for processing and interfacing components. The microcontroller does not allow multiple executions simultaneously which reduces the overall speed of the system. The microcontroller cannot fully operate with internet facilities with high efficiency, thus not being able to locate the exact position of the vehicle using the GPS system. The use of Reed Switch in the system makes it different from all such projects of this kind. Reed Switch is used so as to read the current fuel sense and then it is interfaced with the Microcontroller. But the usage of the switch in the system also comes with the delicacy factor of the switch because it can have breakage issues during time of installation or during vibration applications. Also, the switch comes with limited life which leads to often replacement of the system. [7]

III. SYSTEM DESIGN

The proposed system uses Raspberry Pi 3 model B+, GSM/GPRS module incorporated with SIM 808, fuel level sensor, ADC 0804, buzzer, ignition lock.

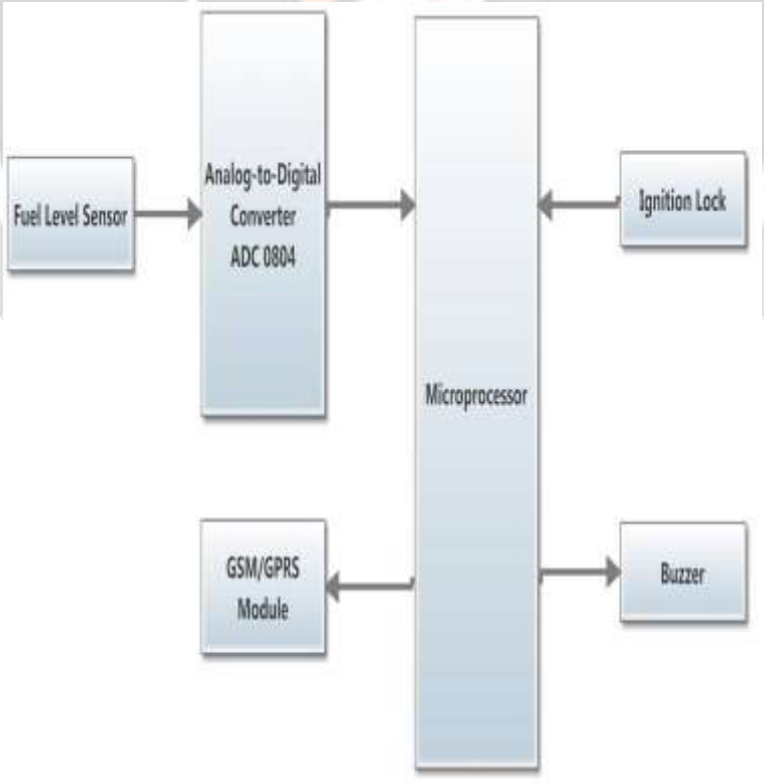

Fig1: Block Diagram of the proposed system

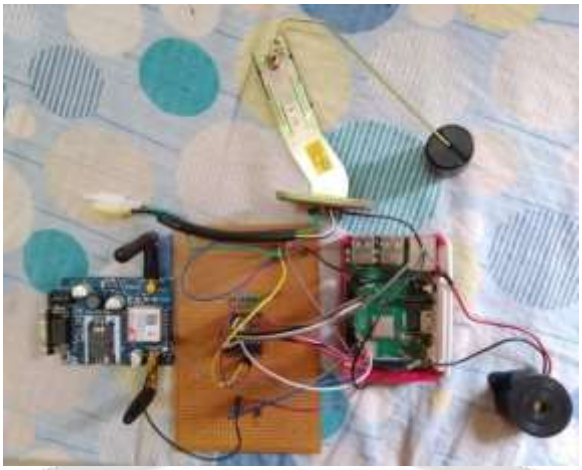

Fig2: Proposed system

The Raspberry Pi is used for comparison of current and preceding fuel level in the tank. Raspberry Pi is connected to the GSM/GPRS module through Tx and Rx pins available on 40 GPIO header pins. The voltage obtained from the fuel level sensor is given as input to single channel ADC 0804. ADC 0804 converts an equivalent analog input voltage to the corresponding 8-bit digital output. The 8 output pins of ADC are connected to 8 Raspberry Pi GPIO pins. The buzzer is directly connected to Raspberry Pi to indicate a false decline in fuel level.

When the system is switched ON Raspberry Pi since the fuel level in tank continuously and stores the first value of fuel level as the reference value. Whenever a false decline in fuel level occurs, the resistance of the fuel level sensor changes (decreases) which changes the corresponding analog voltage obtained from the sensor. Change in analog voltage changes the 8-bit output of ADC 0804. Raspberry Pi converts this 8-bit binary output into an equivalent decimal format and compares it with the reference value. If the difference exceeds the threshold value the buzzer is switched on for a specific duration and Raspberry Pi transmit AT commands to GSM/ GPRS module. GSM/GPRS module then executes call request and send SMS to the specified mobile number. After the execution of call and SMS request current value of fuel level becomes the reference value of Raspberry Pi and again monitoring starts. GPS is also incorporated to accurately track the vehicle's current position.

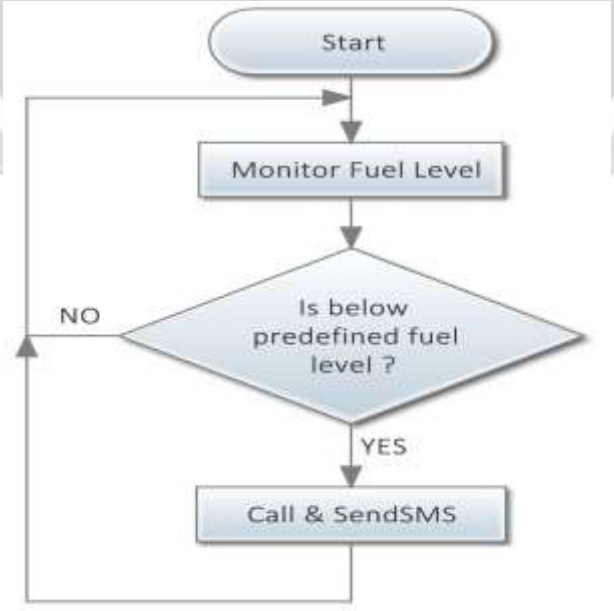

Fig3: Flowchart of the proposed system

IV. CONCLUSION

The idea of implementing a 'Smart Fuel Theft Detection System' opens new avenues for safeguarding fuel from thefts and has a wide range of applications as mentioned earlier. Our scheme provides proper and accurate details regarding the fuel level and also the current location of the vehicle. Thus this project assures the owner of complete protection of the fuel and the automobile considering the future aspects

V. REFERENCES

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