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GSM based Fuel Theft Detection

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Abstract: *Vehicle Petrol theft is one of the main concerns of many bike owners and car owners. Many times, we have heard or some of us have already faced that petrol from their bike or cars has been stolen. Main intention of this project is to avoid such situation.In GSM based petrol theft detection system, we have used a Level sensor to detect the petrol level in petrol tank. If the level goes below certain threshold level, then this sensor gives a particular signal to the microcontroller. The level sensor is activated only when the ignition key is removed so that no inconvenience is caused to the driver while driving. The microcontroller then turns on the buzzer and sends SMS to the car/bike owner. Microcontroller is the main heart or Central Processing Unit of the system. Apart from this, the project also has a gas sensor which will detect any fuel leaks in the system. GSM based Fuel Theft Detection System finds application in Car, Bikes and all other vehicles. This project has a GSM Transmitter which send SMS to owner of vehicle when there is fuel theft going on.This project focuses on the fuel theft problem and puts forward an effective solution for the same. I feel that the product serves something good to this world and we are better able to understand the various facets of doing an embedded system project which is emerging as one of the most 'in demand' technologies in this decade.*
Key Word*: Fuel theft detection, GSM, most in demand*

I.INTRODUCTION

Background / Context-
Theft of fuel is a major worry for many vehicle owners.
We've all heard stories about petrol/diesel being stolen from our bikes or automobiles, and some of us have even experienced it ourselves.
This project focuses on the problem of fuel theft and puts forward an effective solution for the same.
Relevance-
Fuel theft is illegally siphoning of fuel from fuel tanks of vehicles. Various techniques are used by thieves to achieve this goal, including puncturing the tanks.
While the thieves can benefit hugely from this illegal activity, individuals and businesses that own fleets of vehicles suffer massive losses. Fuel thefts in the United States of America account to losses of over $2.1 billion a year. In India, there is no figure estimated yet, but the linked newspapers articles show the gravity of the situation-
https://bit.ly/34eHdMv
https://bit.ly/3vFa9Zr
Apart from illegal sale of stolen fuel, it can be used for unethical and/or destructive purposes which can be hazardous for public.
Contemporary similar solutions do not cater to the sole purpose of fuel theft detection and enhanced safety. They have multiple features which might not be required for vehicle owners. Also, the contemporary solutions have to be maintained and renewed periodically unlike the one proposed here.
The solution suggested can capture the market at a lower price range, easy/no maintenance and one time cost.
These points impart huge relevancy to the problem and solution.
Literature Survey-
Research done using information from published papers on internationally as well as nationally recognized websites, resources, newspaper articles and contemporary vendors listed in references.
The novelties in the proposed solution are as follows-

1) exclusivity in solving the fuel theft problem
2) cost-effectiveness
3) one time cost incursion
4) easy/no maintenance
5) enhanced safety due to the smoke sensor
6) fuel security is maintained while the vehicle owner is anywhere across the globe.

Available products use complex development boards and integrate multiple features which are not always required by the user; thus, increasing the cost of production and need for maintenance and renewal.
Motivation-
Social motivation-

I feel that the product will serve something good to this world by easing an everyday problem of fuel theft faced by people around the world.
It will help individuals and organisations to optimise their spending on fuel.
It will not put the onus of fuel theft on driver of the vehicle.
Academic motivation-
I will be better placed to understand the various facets of doing an embedded system project which has emerged as one of the most 'in demand' technologies in this decade.
The domain of the project is 'Microcontrollers', which is an integral part of the Electronics and Telecommunication Engineering course as listed by the University.
Usage of sensors is a part of Mechatronics which is again closely related to the course.
Monetary motivation-
The potential of the solution to capture the market is huge because the problem faced is critical and vendors are abysmal.
Apart from catering directly to people, the product can be sold to car manufacturers, businesses and governments too.
Thus, the monetary gains will be significant.
With production at larger scales, the solution proposed can be manufactured at even lower costs- Principle of Economies of Scale; thus, increasing profits.

Aim of the Project-

- To develop a system that give alerts the user in events of fuel theft.
- The solution must be suitable for fleets of any size and type.
- The solution must contribute to enhancing fuel safety.

Scope and Objectives-

The project can be used in any fleet irrespective of the type and size of vehicle.
Whenever the vehicle is locked, the GSM based fuel theft detection system will activate. Any changes in the fuel level will immediately be detected by the system and a message will be sent to the owner. Smoke detection and intimation is another feature which will enhance safety of the user.
The objectives are to avoid fuel theft and enhance safety of the user and vehicle.

II. MATERIAL AND METHODS

When the fuel level falls below the existing level, the sensor sends a signal to the microcontroller through the ADC. The system's main heart, or Central Processing Unit, is the microcontroller.
The microcontroller then activates the buzzer and sends an SMS to the owner of the car or bike. The buzzer alerts people around the vehicle and the SMS sent alerts and informs the vehicle owner, deterring the thief from the theft.

Phase 1

a. Finalize components keeping an eye on the aims, objectives, intentions, need, practicality and specifications.
b. Begin schematic design of the system on Eagle PCB Design Software tool suite.
c. Troubleshoot and replace components (if required).
d. Complete the schematic design.
e. Generate PCB design (.brd file) on Eagle PCB Design Software tool suite.

Phase 2

a. Begin compiling and testing microcontroller and GSM codes and commands in Keil software.
b. Eyeball aims, objectives, intentions, need, practicality and specifications while compiling microcontroller and GSM codes and commands.
c. Generate Berger file (zip file) for printing the circuit board design.
d. Get the circuit board design printed.
e. Test and troubleshoot codes and commands on Keil software.
f. Accomplish code development.

Phase 3

a. Begin mounting and soldering of components on the PCB.
b. Begin hardware interfacing of sensors, actuators and ADC to the microcontroller.
c. Keep reference of the progress and resources of phase 1 and 2.
d. Accomplish soldering and building hardware.
e. Upload the developed code to the microcontroller.
f. Test for desired output eyeballing aims, objectives, intentions and need.
g. Troubleshoot (if required).

Theoretical Description of Project

Theoretical Background-

A simple, cost-effective solution is proposed here, by which fuel security of a vehicle is ensured while the vehicle owner is anywhere across the globe.
The developed system will alert the user in the events of fuel theft.

The solution will be suitable for fleets of any type and size.
It will also contribute to enhancing the safety of the vehicle.
Whenever the vehicle is locked, the GSM based fuel theft detection system will activate.
Any changes in the fuel level will immediately be detected by the system and a message will be sent to the owner.
Smoke detection and intimation is the feature which will enhance safety of the user and car.

Resources Required-

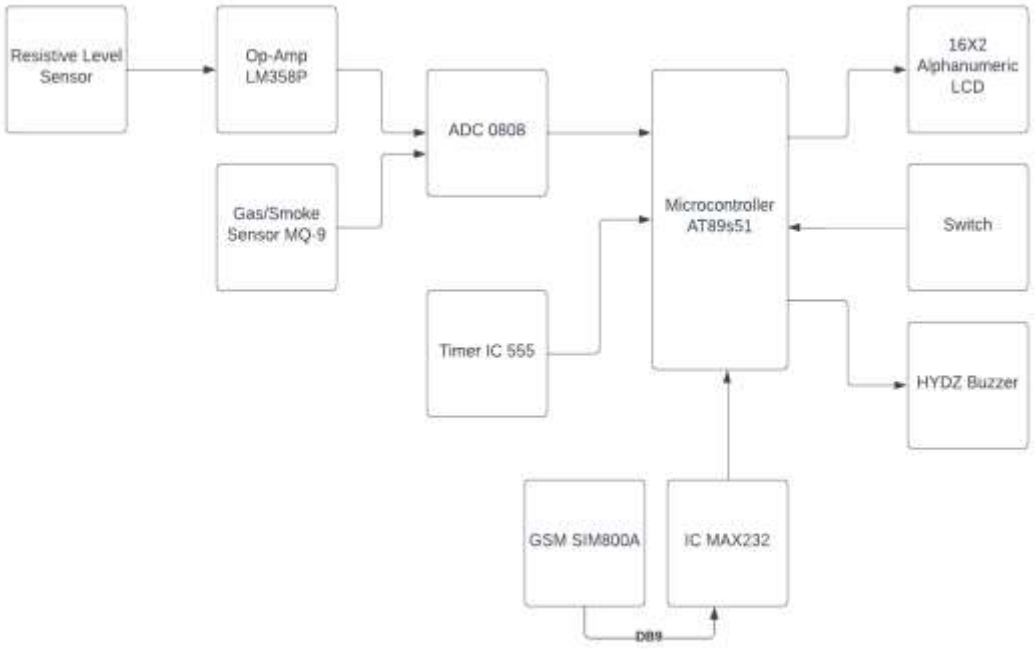
A) Hardware-

1. Microcontroller (AT89s51)
2. Resistive Level Sensor
3. Global System for Mobile Communication (GSM SIM800A)
4. IC MAX232
5. DB9 Connector
6. Gas/Smoke Sensor MQ-9
7. HYDZ Buzzer
8. Transformer (Centre tapped, step-down)
9. Bride Rectifier Diodes (1N4007)
10. Voltage Regulators (IC 7805, IC 7812)
11. Filter Capacitors
12. Liquid Crystal Display (16X2, Alphanumeric LCD)
13. Analog to Digital Converter (ADC 0808)
14. Timer (IC 555)
15. Op-Amp (LM358P)
16. Motor Drive (IC L293D)
17. Relay (RAS1210)
18. Transistor (BC547B)
19. Crystal Oscillator (KDS 11.0592)
20. Network Resistor (A472J)
21. Potentiometer
22. Light Emitting Diodes (Red)

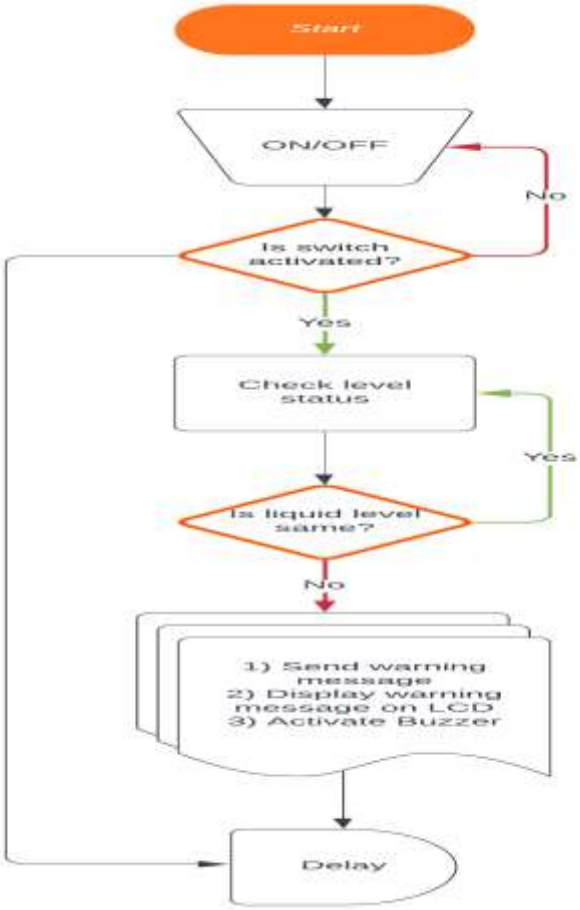
B) Software-

1. Eagle PCB Design
2. Keil MDK
3. Microcontroller Programmer
4. PuTTY

Block Diagram-



Algorithm/Flowchart-



III. RESULT

Fig. 1*- Once the switch is turned on, the system sends activation message.*

Fig. 2*- Message sent on the user's phone.*

Fig. 3*- Levels are constant here, no action needed.*

Fig. 4*- Level decreased, action needed.*

Fig. 5*- Decrease in level detected.*

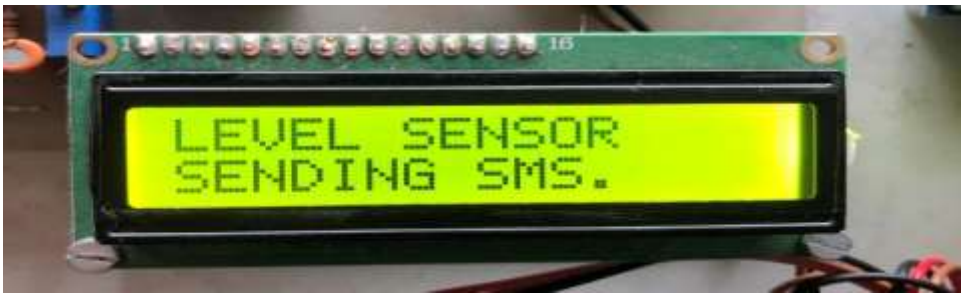


Fig. 6*- Message sent to the user.*

IV. CONCLUSION

With the use of 'Electronics', we are able to make our lives more comfortable.
This application of electronics- the target of a "GSM based Fuel Theft Detection system" will satisfy user needs and resolve a major worry of fuel theft by putting forth an effective solution for the same.
GSM based Fuel Theft Detection system is an automatic versatile system.
This product serves something good to this world and through this project, we are better able to understand the various facets of doing an embedded system project which is emerging as one of the most 'in demand' technologies right now.
It has varied applications-

1) This project can be used for all fleet of vehicles irrespective of the type, class and size.
2) The system is a fully automated system, so no human attention is needed.
3) It can be implemented in vehicles associated with commerce, industry, home, remote and hazardous applications.
4) This project can be used for the security of company buses and commercial vehicles.
5) GSM indication gives benefit of indication to the user.

Possible advancements-

1) A GPS modem to track the vehicle's whereabouts can be used.
2) The system can be connected to a variety of sensors, for example- weight sensor and speed sensor.
3) An application to track the speed and location of the vehicle especially for commercial vehicles' applications can be developed.
4) Another future development can be to detect the mental state of the driver based on the style of driving.

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