International Journal of Innovations in Engineering and Technology (IJIET)
http://dx.doi.org/10.21172/ijiet.122.09

Antipilferage And Antiadulteration System For Fuel

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Abstract- Fuel is one of the most widely-used sources of energy in the world today. Most fuels are natural substances such as petro fuel, diesel, and natural gas, which are either extracted straight from the earth or produced by refining substances such as petroleum. Such important non-renewable fuels are pilfered by the people at different stages of fuel delivery process. In this paper, a Antipilferage and Antiadulteration System(AAS) has been developed to prevent the fuel from pilferage and adulteration. Increase in the incidence of fuel tankers pilfering and even adulterating liquid/fuel materials has prompted fuel companies to track and monitor the transport vehicles. The main intention of the AAS is to ensure the fuel safety. An experimental analysis is carried out using solenoid valve, flow sensor, electromagnet lock and GPS with the open source IoT platform. After these sensors get fitted in the fuel tanker, it monitors and controls the pilferage of fuel with the help of lids/valves during filling or emptying at the fuel stations. Electromagnetic lock helps in preventing adulteration. GPS will enroute the vehicles' path. All of this data is uploaded to the dashboard display using IoT technology. This solution will allow owners and managers of fuel companies to make informed business decisions, remote monitor tankers and prevent theft of fuel and goods.

Keywords – AAS, Pilferage, Adulteration, Electromagnetic lock, IoT, GPS, Solenoid valve, Fuel

I. INTRODUCTION

The energy produced by burning fuel has many applications, such as powering vehicles, ships, and airplanes as well as providing electricity for homes and buildings. The developments of automobiles have a significant role in modern civilization over the past few decades. Most of the vehicles like cars, motorcycles, buses, trucks etc. run by traditional transport fuels such as gasoline, octane, diesel etc. Furthermore, the fuel price over the past few years is increasing which may effect on the modern life. The vehicle may lose fuel in many ways such as leakage, cracking of fuel tank and fuel theft/pilferage. It may hamper both safety of life and economic loss. Fuel pilferage is a huge problem for many individuals as well as business owners with fleet of vehicle. So, the fuel loss or theft from the vehicle is an important issue in many countries in the world. Although there are many alarming issues, in this work, preference is given to the unanticipated issue of fuel theft from the transport vehicles. Most of the transport users are counting a loss of huge amount of currencies because of this unusual fuel loss. This unexpected fuel loss has a great impact on the economy of a country. It is very alarming and undesirable issue for developing countries. Petrol and diesel theft is an international problem [3].

Fuel theft has become a big problem for fleets around the world, and it is a real threat to the fleet's overall budget, as it can have a significant impact on the company's bottom line. Automation is mandatory to handle all type of systems. It is made possible by embedded design which is a combination of both computer and mechanical system, often with real-time computing constraints. In today's world, it is common to control most of the devices, by automation since it optimizes by reducing the size and cost of the product and increase the reliability and performance. Embedded systems are based on Microcontroller and their applications range from portable devices to large installations and it also extends to large complex systems. [2]

II. EXISTING SYSTEM

Rubayat Islam has described the automatic prevention of fuel theft using Ultrasonic sensor. It determines the fuel flow rate by measuring the distance of fuel level with respect to time. When the fuel flow rate or fuel consumption rate oversteps or falls behind the usual rate, then the sensor was activated which then sends a signal. After receiving the signal the GSM module sends a message to a specific number instantly by indicating that something is unusual so that one can immediately go into inspection.t1 is considered as the time taken for transmission of sound wave and t2 as the time taken for reflection of sound wave. So the average time taken as, $t = (t1 + t2)/2$. The velocity of sound in air is considered constant and that is taken approximately 332 m/s. The distance of the fuel surface from the ultrasonic sensor is calculated as, $S= v*t$. Ultrasonic sensor responses effectively within the range of 0.3~3m

effectively. As some ripple occurs in liquid, the value given by the sensor fluctuates a little. So, one of the limitations of this approach is that this cannot be used for fuel reservoir fully filled with fuel. At least there should be some gap or level difference so that ultrasonic sensor cannot touch the liquid as the sensor is non-contact type. Proper calibration was needed to get reliable value from ultrasonic sensor.[4]

Naomi Somer Lepcha focused on the enhancement of the vehicle alarm security system via SMS. The system will manipulate a mobile phone to send SMS. Even though the SMS can be sent using the features available in the mobile, the objective was to activate the SMS sending by the mobile phone using external program connected physically to the mobile phone. Antitheft security system utilizes an embedded system designed with GSM to monitor and safeguard a car. In attempt of theft, the system sends text message to the car owner and at the same time starts up an alarm from the buzzer installed within the system. The safety of vehicles fuel is extremely essential for public so this went to notice due to the alarming rate at which vehicles fuel are being stolen in our country and with this design the vehicle can also be monitored irrespective of where it is parked , provided there is a GSM network coverage. So this model (theft detector) uses very few electronic components and looks very small and compact and can be mounted on vehicles easily. An interfacing mobile is connected to the microcontroller. When a person attempts fuel theft then the microcontroller commands the GSM modem to send a text message as an alert to the vehicle owner and further an alarm is raised by the buzzer installed within the system. In this system the microcontroller AT89S52 is interfaced with SIM 900A modem to decode the message.[5]

P. Senthil Raja focused in the aspect to facilitate and enhance the vehicle's features such as speed, mileage and volumetric level of fuel by providing it with the detection of level and restrict illicit activities using sensor. It is implemented using Vehicle Area Network (VAN) and embedded design. The owner of the vehicle immediately receive a message when the fuel tank is opened by the operator or by a fuel traded and also the height of the fuel tank when opening and closing of the tank. The system uses Wireless based communication for monitoring the vehicle's position. A message is sent along with vehicle position and fuel level in the tank. This enables in identifying the level of fuel at different times whenever the tank is opened. Hence the larceners results rather than the fuel or to the vehicle theft by chance in the situation and provide the overall protection. The message are provided to the owner in relation to the fuel level in the vehicle in periodic manner and also avoids the other way to fuel theft of fuel tank fault detection system. The numeric lock system is to open authentication for the fuel in the vehicle fuel tank. The wireless technology will enable the vehicle owner, the vehicle with the mobile phone to monitor anywhere, anytime.[6]

Tatsuo Nakagawa et al (2013) describe a non-contact method for measuring liquid level by an opaque container is proposed. A millimeter-wave Doppler sensor is to detect by a target container developed, and measures the liquid level on the basis of the absorption of millimeter waves in the liquid. The feasibility of this method for clearly an air-liquid interface detecting hidden in an opaque container is confirmed experimentally. The non-linearity error of the measured liquid level within 0.5 mm. A capacitive sensor semi cylindrical mounted to a liquid container can measure liquid level, without coming into contact with the liquid, has, but its accuracy is not high, because the capacity of the distance between the container and the sensor is highly dependent. Optical sensors such as CCD cameras can measure fluid without the liquid with the image processing. However, to capture an image of the surface of the liquid, the container should be transparent, or the optical sensors should be introduced into the container. By the use of ultrasonic sensors, level can be calculated from the area between the sensor and the liquid surface. However, these sensors cannot be used for sealed containers. The principle of measurement is based on the absorption properties of a millimeter wave to a target liquid.

III. PROPOSED SYSTEM

The input block consists of electromagnet lock (i.e.) the inlet door indicator, Solenoid valve to control the flow of fuel, Flow sensor to measure the flow rate of the fuel. Also has an emergency switch that is used in case of erroneous situations. Arduino Mega 2560 is the controller which takes the inputs and produces the digitized outputs. GPS is to track the vehicles path from source to destination. Node Mcu is in contact with open source IoT platform.

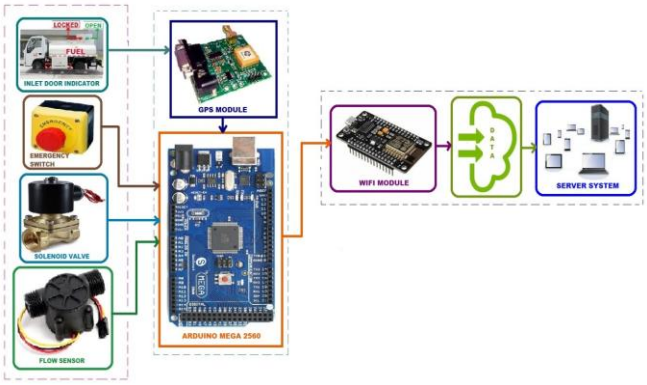

Figure 1: Block Diagram of Antipilferage and Antiadulteration System (AAS)

3.1 Working of AAS –

Initially the vehicle starts from its source i.e. fuel filling station .The vehicle moves towards the destination, once the tanker fuel is filled. Installation of physical parameters such as magnetic door lock, Emergency switch, Flow sensor, Solenoid value, GPS and controller with WIFI module should be fitted to the vehicle. Importantly, in case of emergency situations like fire accident or vehicle breakdown, intimation must be sent to the nearest service station. As the vehicles enroute path is monitored by GPS, this will intimate if the vehicle deviates from the desired path. As there is a magnetic door lock fitted to the tanker, this prevents from adulteration and pilferage. If there are any chances of occurring, then alert can be sent to the police station. Finally when the vehicle reaches the destination, the fuel gets deposited.

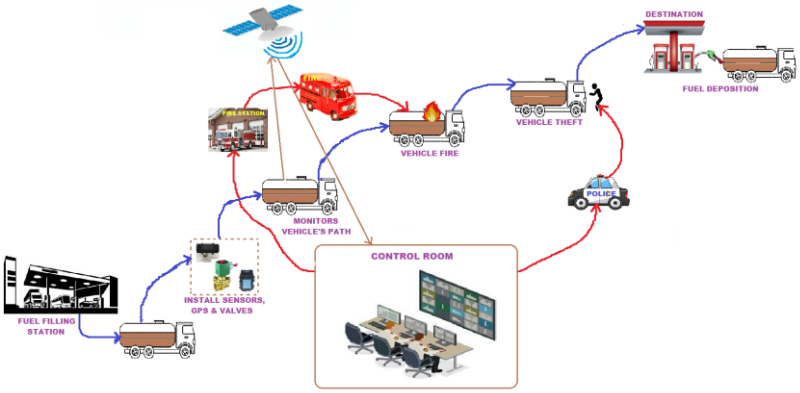

Figure 2: Working Principle of AAS

3.2. Use Case –

Initially, the tanker will fill the fuel from fuel filling station which is the source. The electromagnet lock is fitted at the inlet valve. Once the fuel is filled to the tanker, the valve gets locked. This lock can also be controlled via dashboard. As soon as the tanker reaches the destination, Solenoid valve is used to control the fuel flow. Followed by flow sensor which determines the flow rate of the fuel.

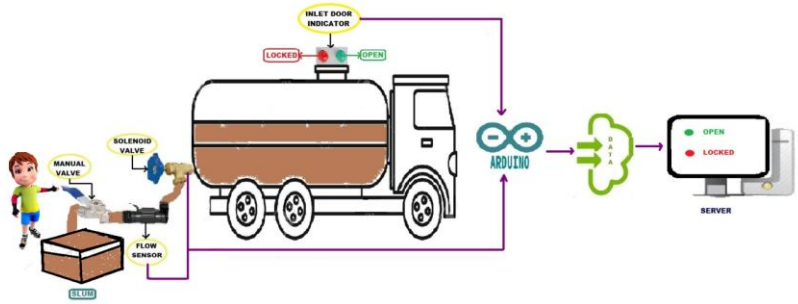

Figure 3: At fuel filling station

In this proposed system Phase I is designed to get the OTP entered into system which is to be verified and indicated their reserved seat with a LED indication. During this process the Controller get the OTP and its corresponding reserved seat number from the cloud-storage and is stored in the controller. When the booking is done the details are send to the cloud data base which stores it till the date of commence. After the due date the data is discarded. During boarding the data is verified by the system, when the passenger enter the data and the booking is confirmed.

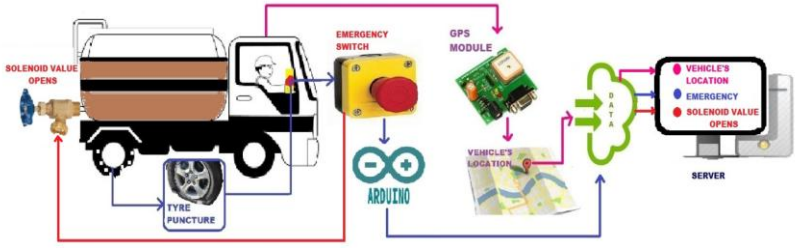

Figure 4: In case of emergency

IV. RESULTS

Figure 5 shows the working model of the AAS with the sensors, valves and GPS module.

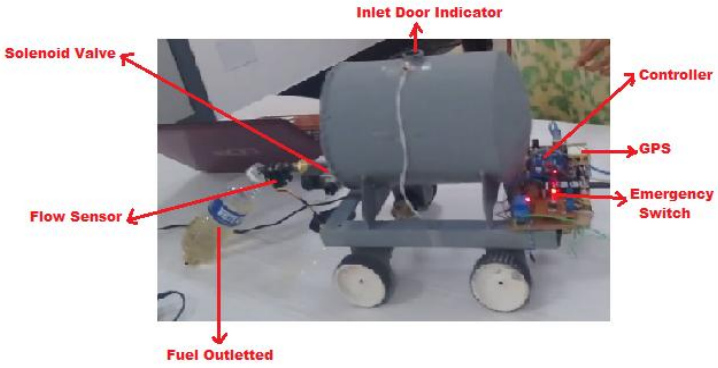

Figure 5: Working Model of AAS

The electromagnetic lock is fitted in the inlet valve, which can be controlled from the control room. Figure 6 shows the status of the inlet valve/ door on the display of the system in the control room.

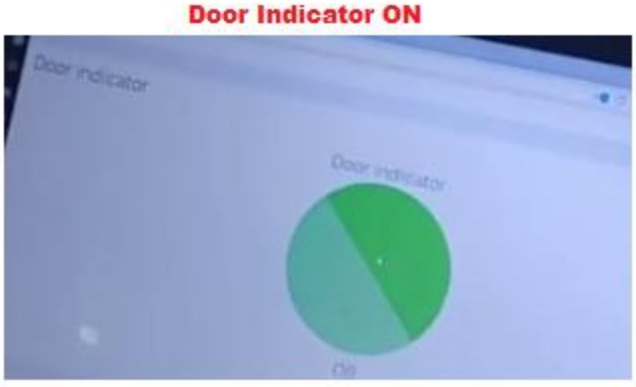

Figure 6: Door status displayed on the system

The solenoid valve connected at the outlet of the fuel tank is used to control the fuel flow rate, which operated manually/ from the control room. Figure 7 shows the solenoid valve control.

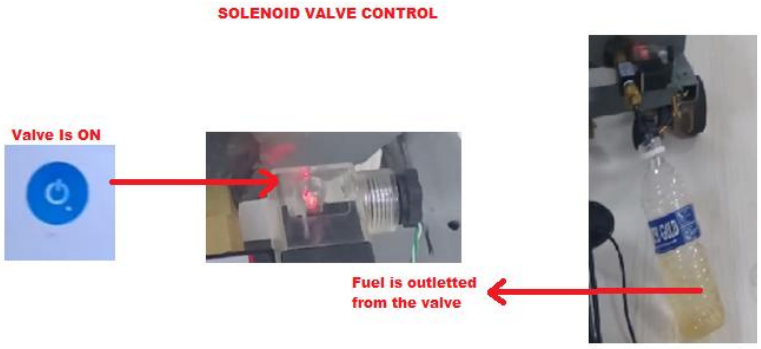

Figure 7: Solenoid valve control

When the solenoid valve is open, the fuel from the tank is flow out. The valve can be opened manually in the case of emergency or in the intention of theft. To know this, the flow rate of the fuel is displayed on the system in the control room. The person from the control room can continuously monitor the flow rate and know the status. Figure 8 shows the flow rate table displayed in the control room.

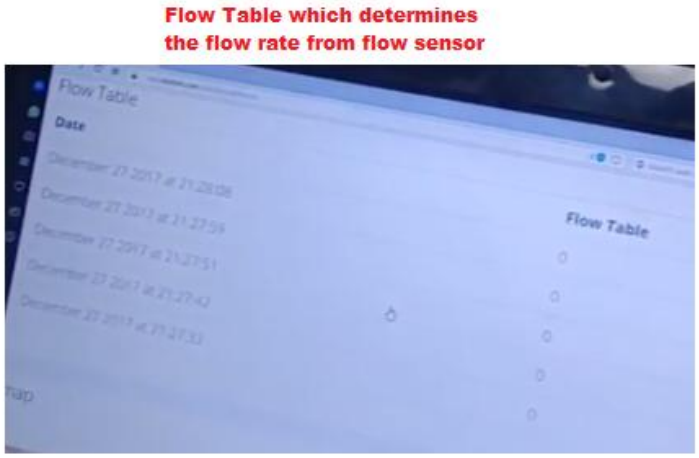

Figure 8: Flow rate displayed on the system

The GPS module fitted in the tanker vehicle makes the person in the control room to track the location of the vehicle at any time. Figure 9 shows the vehicle tracking at the control room.

Figure 9: Tanker Vehicle tracking by GPS

V.CONCLUSION

The embedded devices in the environment for monitoring, enables self-protection (i.e., smart environment) to the environment. By deploying sensor devices in the environment, the environment might be brought into real life i.e. it can interact with human through the network. The proposed AAS is one of such embedded devices designed with electromagnetic lock, solenoid valves, flow sensor and GPS module. The AAS prevents the fuel pilferage and fuel adulteration. The flow rate sensed by the flow sensor at the outlet valve controlled by the solenoid valve makes the person at the control room to know the theft of fuel if the outlet valve is opened manually. The inlet valve of the fuel tanker is electromagnetically lock which avoids the adulteration of fuel. The GPS module is used to track the tanker vehicle at any instance of time from the control room.

VI. REFERENCE

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