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Antitheft system for fuel detection using IoT

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***Abstract*-** IoT has been a great area of research for providing excellence in area of designing smart cities and intelligent systems. Fuel theft from standing vehicles is a major problem which can be very easily resolved using this technique. In this paper we have proposed a system for detection of fuel theft from vehicle using the concept of IoT as well as wireless sensor networks. The method has shown very good results as compared to other state of the art methods.

***Keywords*-**IoT, Wireless sensor network, smart homes, Internet protocol.

I. INTRODUCTION

Internet of Things (IoT) attracts much attention recently and paints a beautiful picture of future life for us. It is a technology that deals with bringing control of physical devices over the internet. In the upcoming years, IoT-based technology will offer advanced levels of services and practically change the way people lead their daily lives. Advancements in medicine, power, gene therapies, agriculture, smart cities, and smart homes are just a very few of the categorical examples where IoT is strongly established.

Here we propose an efficient anti-theft system that allows users to efficiently monitor the condition of the vehicle over the internet. This technology is the wireless sensor network technology, which mainly uses interconnected intelligent sensors to sense and monitoring. Our system uses a microcontroller Node MCU for processing all user commands. We have used Node MCU because it has an inbuilt Wi-Fi module that is used to connect to the internet and receive user commands. The device will monitor the environment using the different sensors and with the help of the internet, information is sent to the server using Wi-Fi. The Server will accept the information from only one particular IP(internet protocol) address and then represent the data in the form of the JSON (JavaScript Object Notation). JSON (JavaScript Object Notation) data will further used to represent the monitored data in the form of the Google graph. Each sensor is having its unique graph which represents the latest entries that are sent by the device.

The details of the method are provided in detail in the third section.

II. BACKGROUND STUDY & LITERATURE REVIEW

The work in this area has not been done very much. It is a very recent research area. In one of the articles GSM modem has been used, which send message to the owner of the vehicle when there is fuel theft going on [1]. This system assures the security of vehicle fuel whenever the vehicle is at rest and also monitors the fuel level in the fuel tank. If the fuel level decreases when the bike is at rest the system detects that fuel theft is going on. And it will raise the alarm and send the message to the owner of the vehicle that “Fuel Theft Detected”. To send this message GSM module is used. This GSM module has a unique IMEI number which is used to track the vehicle’s position. The major drawback of this method is that it takes a long time to deliver the message, the position of the vehicle is not accurate most of the times and it is complicated to use.

In another system developed by Mr. P. Senthil Raja and Dr. B.G.Geetha [2] Vehicle Area Network (VAN) and embedded design have been used. In the proposed system, the owner of the vehicle immediately receives 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. The process involves measuring the fuel level followed by eliciting the information and sends it to the server for further detection. The major drawback observed in this project is that the numeric lock opens after several trials, which is very time consuming, also the proposed system is extremely expensive. There is a scope of improvement for sensors.

Another work is done by Mr. M. Saravanan, Mr. T. Krishnapriya, Mr. S.R. Lavanya, and Mr. P. Karthikeyan [3] contributed their efforts in making this system. There are various methods to monitor the quantity of fuel namely Dipsticks, level sensors, float switch, load cell, analog, and digital meters, Dipsticks are widely used and it is a manual job. To overcome this issue, this system is proposed to know the number of liters present inside the tank with the help of the Ultrasonic sen-

sor and GSM to indicate the level in case of full/empty and theft. The disadvantages observed here are it requires continuous electric energy for the production and display of signal. It also requires an amplification circuit for the generation of display because the signals produced by the gauge itself are of very much low voltage almost in millivolts. It cannot be used highly reactive or corrosive materials because they can damage the gauge. It cannot be used for the measurement of very high pressure if the diaphragm use is made of plastic.

Mr. Heda Venkata Sai Ajith1 and Mr. Pinjala Sai Kiran[4] have developed an Antitheft security system that utilizes an embedded system designed with GSM to monitor and safeguard a car. In an attempt of theft, the system sends a text message to the car owner and at the same time starts up an alarm from the buzzer installed within the system. The sensors are not effective in most cases, also, it is complicated to do the setup within the fuel tank.

Ms. Nandini Hiremath, Ms. Mrunali Kumbhar1, and Ms. Aakriti Singh Pathania developed one more system [5]. The system includes a GPS module, Microcontroller, GSM module, LCD, and a keypad. The GPS module transmits coordinates to the microcontroller that converts the data which is sent to the user in text format. This text message contains longitude and latitude of the location. This smart system gives 24x7access to fuel consumption, alerts when fuel drains, and storage tank leaks immediately identified. The only drawback observed here is the size of the model. It is not ideal to fit in small tanks.

Our system uses a microcontroller Node MCU for processing all user commands. Node MCU is used since it has inbuilt Wi-Fi module which is used to connect to the internet and receive user commands. Device will monitor the environment using different sensors and with the help of the internet, information is sent to the server using Wi-Fi. Our system is cost effective and easy to deploy. Also the sensors used work with great efficiency with almost zero percent chances of error.

III. METHODOLOGY

Anti-theft system will comprise of a microcontroller and some sensors which will send alerts whenever the value changes drastically. This system will use IoT for connecting to the internet and sending alerts.
Techniques proposed for this method is shown in Fig 1.

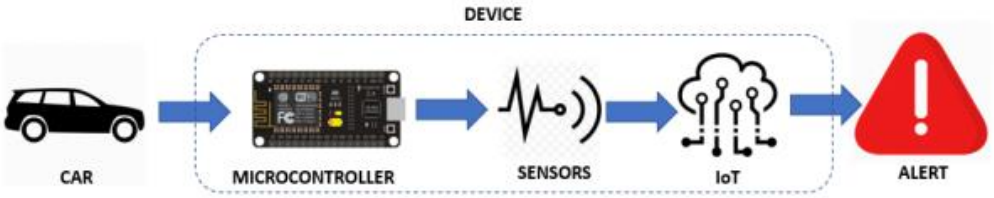

Fig 1. Basic Methodology

3.1 HARDWARE USED

1. Node MCU :- Node MCU is an open-source LUA based firmware developed for ESP8266 Wi-Fi chip. By exploring functionality with ESP8266 chip, Node MCU firmware comes with ESP8266 Development board/kit i.e. Node MCU Development board. Since Node MCU is an open-source platform, their hardware design is open for edit/modify/build. Node MCU Dev Kit/board consists of ESP8266 Wi-Fi-enabled chip. The ESP8266 is a low-cost Wi-Fi chip developed by Espressif Systems with TCP/IP protocol.
Node MCU proposed for this method is shown in Fig 2.

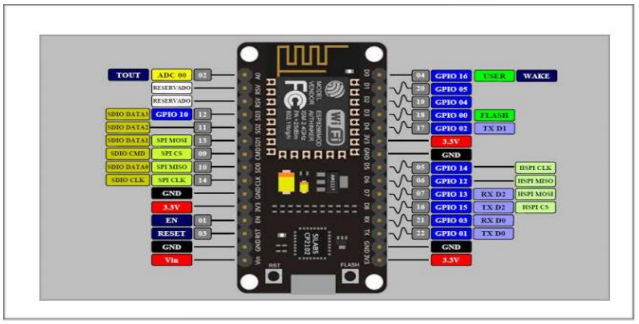

Fig 2. Pin diagram for Node MCU

2. Ultrasonic Sensor :-HC-SR04 is an ultrasonic distance sensor. This economical sensor provides 2cm to 400cm of non-contact measurement functionality with a ranging accuracy that can reach up to 3mm. Each HC-SR04 module includes an ultrasonic transmitter, a receiver, and a control circuit. There are only four pins that you need to worry about on the HC-SR04: VCC (Power), Trig (Trigger), Echo (Receive), and GND (Ground). You will find this sensor very easy to set up and

use for your next range-finding project. This sensor has additional control circuitry that can prevent inconsistent "bouncy" data depending on the application.
Ultrasonic Sensor proposed for this method is shown in Fig 3.

Fig 3. Ultrasonic Sensor

3. Temperature Sensor (DHT11) :- DHT11 is a Humidity and Temperature Sensor, which generates calibrated digital output. DHT11 can be interface with any microcontroller like Arduino, Raspberry Pi, etc. and get instantaneous results. DHT11 is a low-cost humidity and temperature sensor which provides high reliability and long-term stability. HVAC, dehumidifier, testing and inspection equipment, consumer goods, automotive, automatic control, data loggers, weather stations, home appliances, humidity regulator, medical and other humidity measurement and control.
Temperature Sensor proposed for this method is shown in Fig 4.

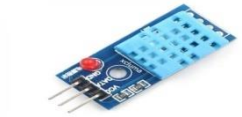

Fig 4. Temperature sensor

4. Bread Board :- A breadboard is a rectangular plastic board with a bunch of tiny holes in it. These holes let you easily insert electronic components to prototype (meaning to build and test an early version of) an electronic circuit, like this one with a battery, switch, resistor, and an LED (light-emitting diode). The connections are not permanent, so it is easy to remove a component if you make a mistake, or just start over and do a new project. This makes breadboards great for beginners who are new to electronics. You can use breadboards to make all sorts of fun electronics projects, from different types of robots.

Breadboard proposed for this method is shown in Fig 5.

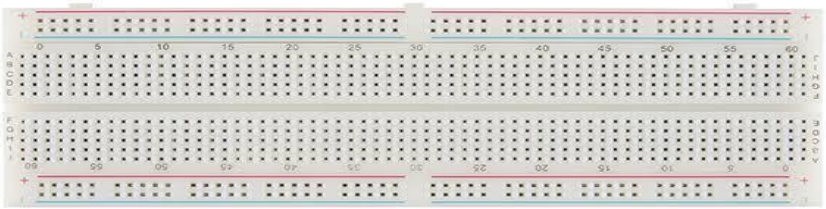

Fig 5. Breadboard

5. Vibration Sensor :- The vibration sensor is also called a piezoelectric sensor. These sensors are flexible devices which are used for measuring various processes. This sensor uses the piezoelectric effects while measuring the changes within acceleration, pressure, temperature, force otherwise strain by changing to an electrical charge. This sensor is also used for deciding fragrances within the air by immediately measuring capacitance.
Vibration Sensor proposed for this method is shown in Fig 6.

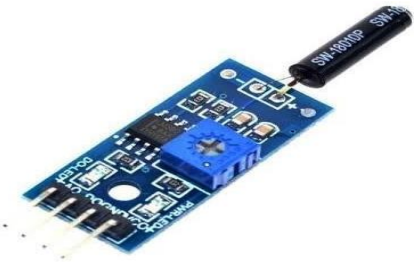

Fig 6. Vibration Sensor

6. Light Emitting Diodes (LED) :- The LED is a light source which uses semiconductors and electroluminescence to create light. There are two major kinds of light emitting diodes: LED and OLED. The LED is different than EL lamp in that it uses a small semiconductor crystal with reflectors and other parts to make the light brighter and focused into a single

point. The OLED is very similar to the EL lamp in design, using a flat sandwich of materials. It is different than the LED and EL lamp in that it uses organic (carbon) molecules in the layer that emits light.
LED proposed for this method is shown in Fig 7.

Fig 7. LED

7. Buzzer :- A buzzer or beeper is an audio signaling device, which may be mechanical, electromechanical, or piezoelectric (piezo for short). Typical uses of buzzers and beepers include alarm devices, timers, and confirmation of user input such as a mouse click or keystroke.

Buzzer proposed for this method is shown in Fig 8.

Fig 8. Buzzer

3.2 SOFTWARE USED

Arduino-IDE:- It is an integrated-development-environment which is a multi-platform application in which the programmable code will be written in Java. It is used to create and burn the programs to Arduino boards. Also, with the help of cores of third party, other manufactured development boards like Node MCU.

Multi-Platform Application− Arduino IDE works on the three most popular operating systems: Windows, Mac OS, and Linux. Aside from that, the application is also accessible from the cloud. These options provide programmers with the choice of creating and saving their sketches on the cloud or building their programs locally and upload it directly to the board. Board Management− Arduino IDE comes with a board management module, where users can select the board they want to work with at the moment. If they wish to change it, they can do so easily from the dropdown menu. Modifying their selection also automatically updates the PORT information with the data they need in relation to the new board.

3.3 Circuit Diagram

Circuit Diagram proposed for this method is shown in Fig 9.

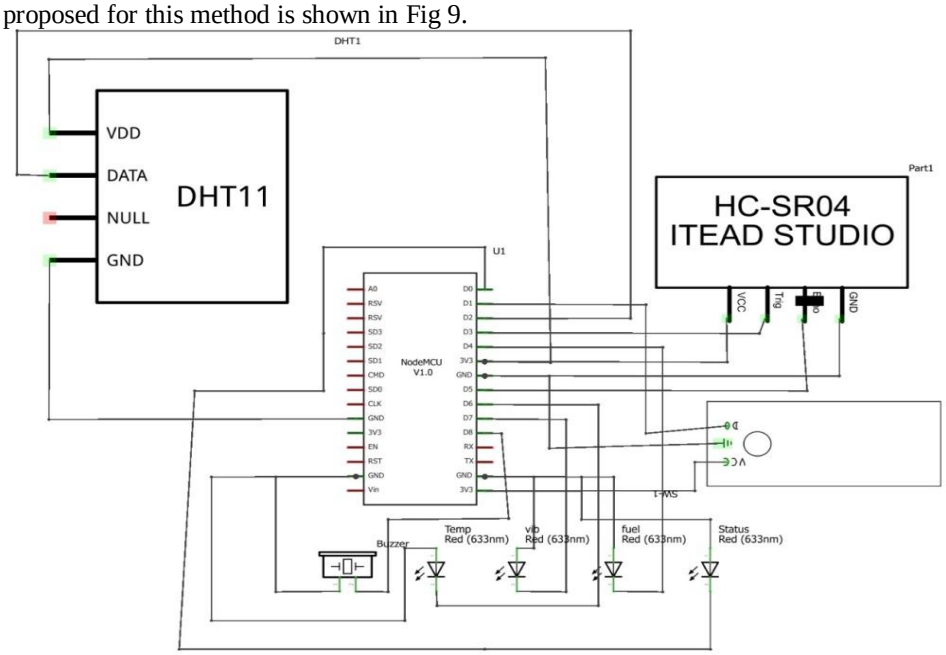

Fig 9. Circuit Diagram

3.4 Flow Chart

Flow Chart proposed for this method is shown in Fig 10.

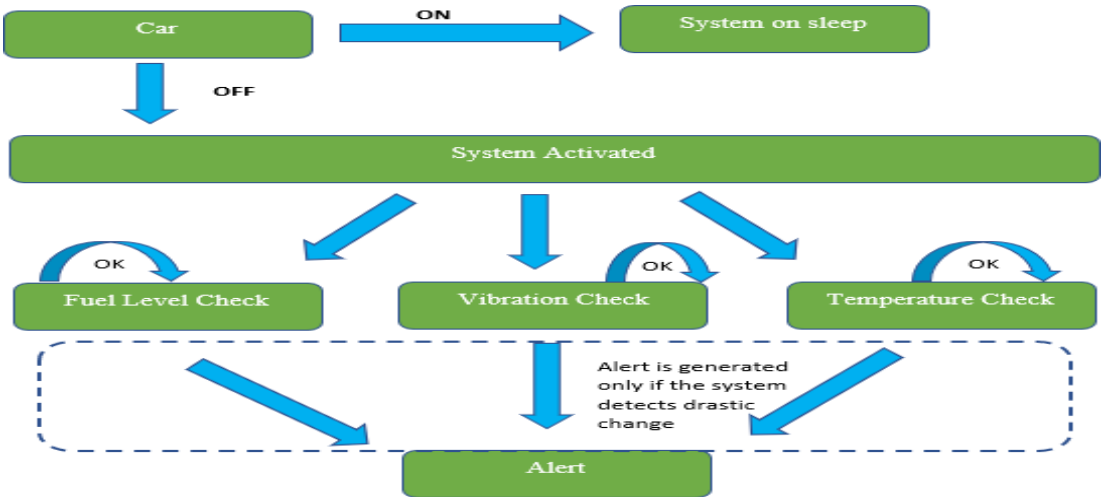

Fig 10. Flow Chart

The Proposed System will only work when the car is off. System has three features :-

- Fuel level check:- It will check the level of fuel whether it is increasing or decreasing.
- Vibration check:-It will check if any vibration is held in the car.
- Temperature check:- It will check if the temperature is increasing or decreasing.

If there is any change in the value, alert will be sent to the website. This particular system will execute in the loop until the car is off. When the car will start it will stop executing.

IV. RESULTS AND DISCUSSION

When we start the system at first there is no change in value of any of the sensors and the device is sending the value to the website. Then we decrease the amount of the petrol from the petrol tank as soon as the value in change in the amount of petrol crosses the threshold value the change is shown in the graph on the website and the buzzer starts and LEDs started blinking and by observing the change in graph on the website we were able to detect the reason for the alarm. Same things we do with the other sensors.

As shown in Figure 11, a database is created in which:

- Id is auto incremented and is a primary key.
- Email can be decoded using Base64 algorithm to get the original value and is a unique key.

Base64 is a group of binary-to-text encoding schemes that represent binary data in an ASCII string format by translating it into a radix-64 representation. The term Base64 originates from a specific MIME content transfer encoding.

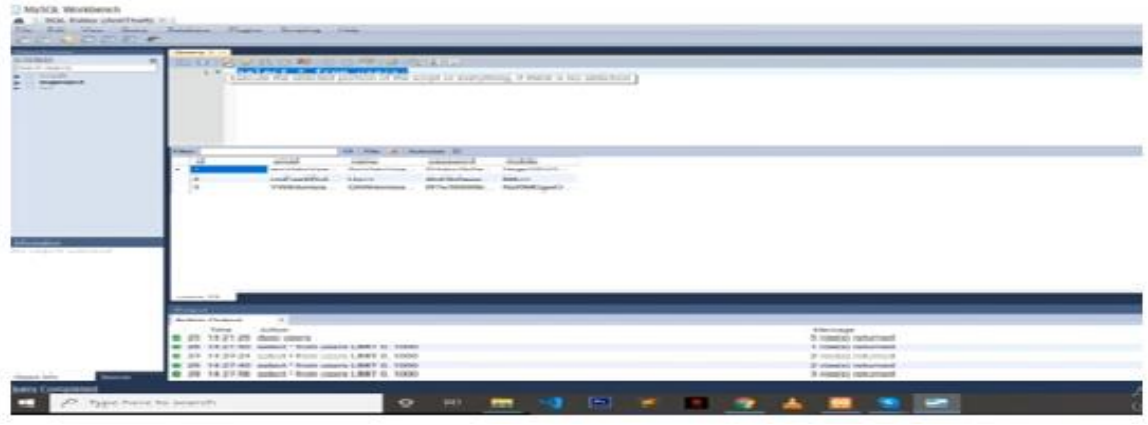

Figure 11: Database

Each Base64 digit represents exactly 6 bits of data. Three 8-bit bytes (i.e., a total of 24 bits) can therefore be represented by four 6-bit Base64 digits.

- Password cannot be decoded due to the use of MD5 Hash algorithm.
- Name and mobile can also be decoded.

The **MD5** message-digest algorithm is a widely used hash function producing a 128- bit hash value. Although MD5 was initially designed to be used as a cryptographic hash function, it has been found to suffer from extensive vulnerabilities. It can still be used as a checksum to verify data integrity, but only against unintentional corruption. It remains suitable for other non-cryptographic purposes, for example for determining the partition for a particular key in a partitioned database.

As shown in Figure 12, When we will sign in the device, this data will be seen.

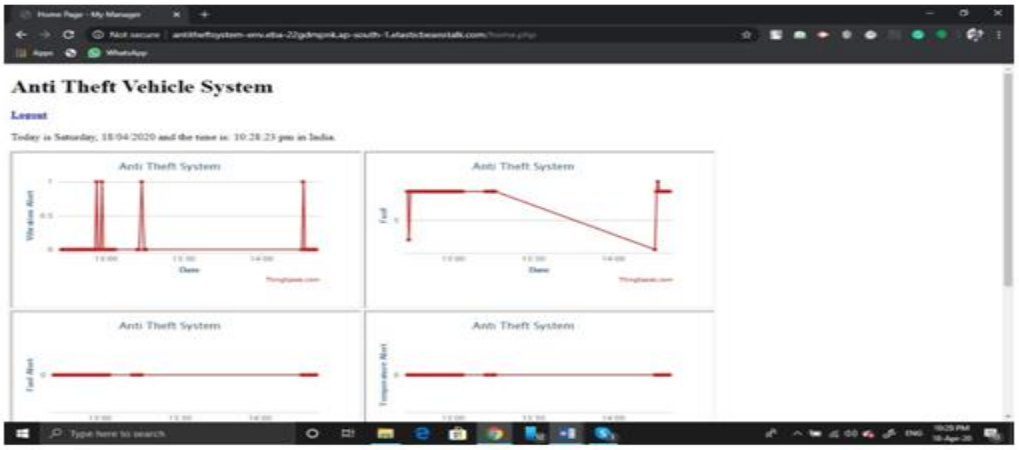

Fig 12. Resultant graph (a)

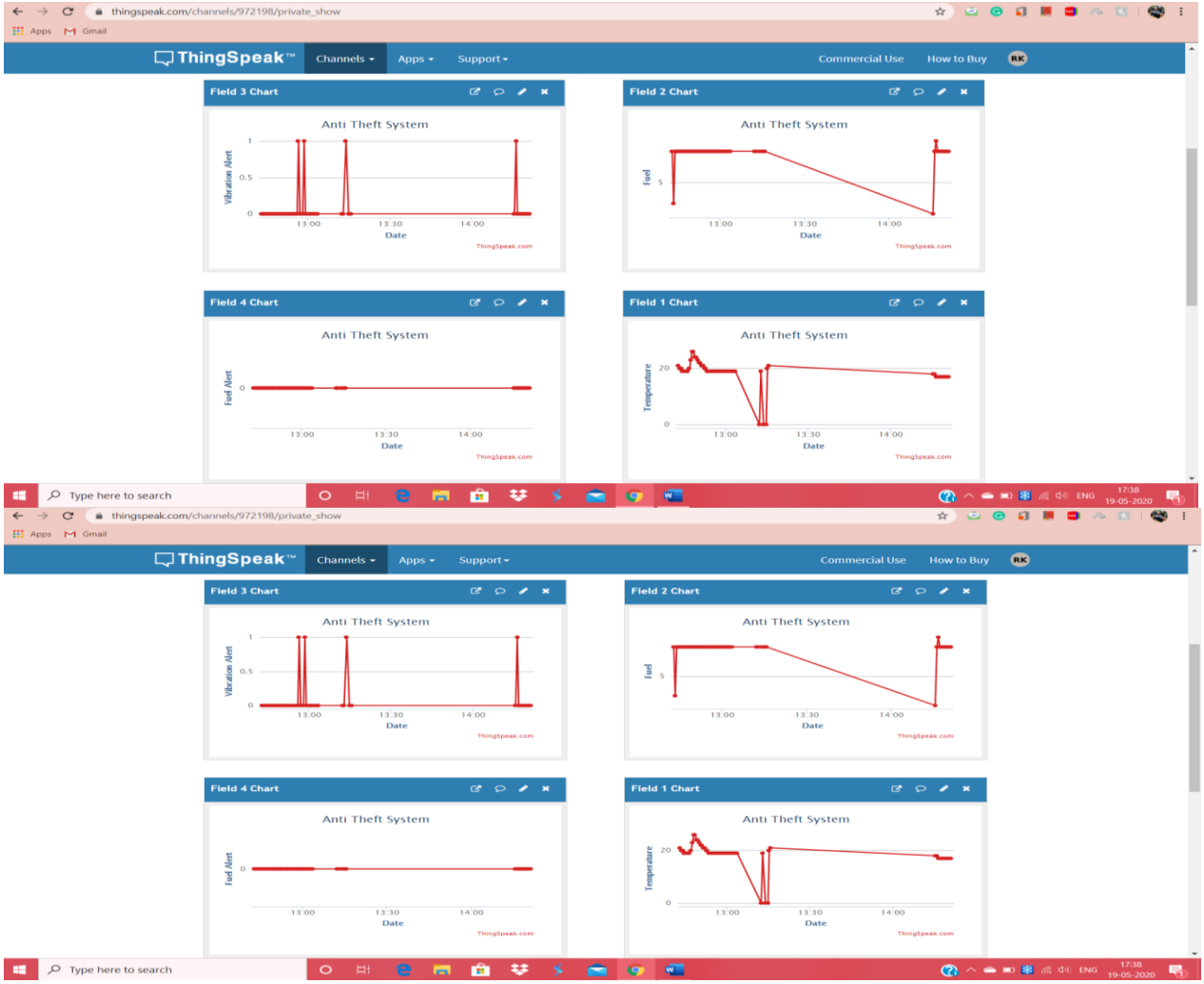

Fig 13. Resultant graph (b)

V. CONCLUSION

In this paper a method for detecting the fuel theft of vehicle has been proposed. The method has been developed using recent IoT and wireless technologies provided by new java bases libraries. It is observed that the method has shown very good results as compare to other state of the art methods.

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