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A GPS-ENABLED FUEL SENSOR BASED VEHICLE TRACKING SYSTEM FOR FLEET MANAGEMENT USING THE INTERNET OF THINGS

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Abstract. The key objective of this paper is to monitor the Fuel consumption, route deviations, driving habits, breakdown details, vehicle maintenance conditions, and other vital performance details of a Heavy vehicle especially a college bus using a pre-fitted fuel sensor needed for an extensive fleet management system as operational costs and maintenance are escalating day by day. In particular, vehicle owners are confronting fuel break-ins, spare parts theft and illegal parking or route diversions in transport vehicles. In addition to this, vehicle proprietors don't ascertain operational details daily if they are illiterate. Various models are available which Standalone, Onboard diagnostics-based, GPS GPS-based fuel tracking Systems. This research project leverages IoT technology, GPS-based sensors, and a GSM tracking system to provide vehicle owners with real-time information on fuel consumption. This cloud-based and mobile application tracks the vehicle in real time. Most of the models are web-based and custom-built only. When the driver initiates fuel filling, the Fuel sensor in the tank automatically activates and senses the amount of fuel in the diesel tank by transmitting fuel input data to a connected cloud web server for storage and analysis along with other data. The gathered values are cross-verified with the database, and an alert message is promptly sent to the vehicle owner based on consumption patterns. This mobile app-based Vehicle Tracking System (VTS) application, using SMS and Vehicle tracking features offers numerous advantages to the vehicle owner, primarily focusing on preventing fuel theft.

Key words: Fuel Sensor, GPS Sensor, Ultra Sound Sensor, Arduino Uno, ESP 8266, Google Maps, Internet of Things

1. Introduction. The Internet of Things (IoT) network is composed of computing equipment, actuating mechanical and digital devices, and interconnected sensors. These devices, along with objects or individuals equipped with unique identifiers, can exchange real-time data over a network autonomously without requiring direct human intervention. Specifically, fuel management systems are designed to accurately measure and control fuel consumption in various sectors, including transportation and construction.

The Internet of Things (IoT) facilitates the regulation and communication with computer systems. In the era of IoT, Vehicle Tracking Systems (VTS) have gained significant importance. VTS applications are diverse, from route tracking and vehicle monitoring to component maintenance. VTS offers opportunities to integrate various new technologies for an enhanced On-Board Diagnostics (OBD) experience, particularly in virtual environments. OBD and GPS-enabled navigation systems have been actively researched in recent years. Within the realm of VTS systems, Sensor-based VTS stands out as the most organic, user-friendly, and intuitive means of facilitating communication between humans and machines, mirroring the patterns of human interaction. Its intuitive nature has resulted in widespread applications for navigating extensive and intricate data in fleet management. Fuel sensing and tracking have long been intriguing challenges in the Vehicle Tracking Systems community. This is primarily due to the significant fuel costs of transporting goods from one location to another. Ensuring minimal maintenance and vehicle downtime is crucial for fleet owners, presenting a real-time challenge. The main hurdle lies in the semantic gap between visually inspecting a vehicle and receiving real-time data from embedded sensors. While humans can often detect issues through experience or intuition, computers rely solely on live data.

Vehicle Tracking System (VTS) with automatic fuel Detection is meant to acknowledge various fuel consumption details and has become a valuable and mandatory component in Vehicles. Fuel sensors are essential components of automobile dashboards that provide straightforward and standard information. GPS-enabled Fuel Sensors have received much research attention in recent years. However, the sector still presents a variety

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of challenges for researchers. Fuel tracking facilitated by GPS processes additional data. The accumulation of data and interpretation of the route must be executed with precision and timeliness. The proposed is a low-cost VTS system with fuel tracing. Location detection and Google Maps API key-based tracking detection capture accurate locations from the background regions. A connected ultra-sound-based fuel sensing is also suggested to compare the fuel consumption in the vehicle. The primary objective of this system is to analyze fuel consumption by comparing the amount of gasoline used on a certain route with the data collected from a sensor. The system then converts this information into text alarm messages, which are sent to the owner of the vehicle. The Mobile Application provides an easy method of tracking fuel consumption.

The study aims to track the route and the consumption information of a fleet management system and detect fuel consumption utilizing a pre-fitted fuel sensor to the vehicle. People are dealing with gasoline theft in transport vehicles due to fuel price increases. Additionally, if a car owner is illiterate, they cannot determine how much fuel their vehicle needs daily. By employing this system, the owner of a car will be aware of the fuel use. For example, when the driver starts to fill up the tank with fuel, the ultrasonic and level sensors activate and record data for the portable application. A low-cost VTS system with Fuel tracking is proposed. Location detection and Google Maps API key-based tracking detection capture accurate locations from the background regions. A connected ultrasound-based fuel sensing is also suggested to compare the fuel consumption in the vehicle. The main aim of this system is to compare the fuel consumed based on the route travelled with the fuel consumed from a sensor and convert them into corresponding text alert messages to the vehicle's owner. The Mobile Application provides an easy method of tracking fuel consumption.

Vehicle Tracking Systems (VTS) can encompass a single function or a series of tasks within standard vehicle management, either static or dynamic. VTS systems must deliver accurate data promptly. Implementing a fuel detection system using GPS poses a significant challenge, as fuel sensors must be carefully deployed due to the high flammability of fuel. This complexity arises from various factors, including the diverse environmental conditions, vehicle status, flexible system designs, and the need for real-time execution. It is possible to save the information that is received by sensors in computerized systems , which enables the development of reports that include useful information to implement informed fuel management practices. This facilitates control over utilization, cost analysis, and accurate expense tracking related to fuel purchases. While contemporary vehicle tracking systems often utilize GPS technology for location tracking, other advancements in automatic vehicle location within the Internet of Things (IoT) can also be employed. The information collected from vehicles is crucial for identifying static and dynamic data changes and anticipating driver behaviors' and capabilities shifts.

There are various approaches to acquiring a Vehicle Information Securing Framework, including a compact system relying on standard hardware components such as a computer or CAN/USB interface for sensed data. The framework involves critical components like:

- KI: A database between the instrument panel and the vehicle Gateway.
- INFOTAINMENT: A data bus connecting entertainment devices (radio, amplifier, CD changer, etc.).
- ENGINE: A data bus connecting different engine parts (drive, ABS, transmission, wheel, etc.).
- COMFORT: A data bus linking comfort devices (air conditioner, door controller, central control unit, navigation panel, etc.).
- KLINE: A diagnostic bus.

Collectively, these components contribute to a comprehensive system for effectively acquiring and managing vehicle information.

2. Literature review. Chiwhane, S.A., et al. introduced in [1] a system to prevent fraud at petrol pumps. Their system involves a flow sensor that activates when fueling begins, providing pulses proportional to the flow rate, which are sent to a cloud server via ESP8266. The user's location is also tracked using GPS via a user application. Unlike earlier approaches that utilized a flow sensor, the proposed system utilizes an ultrasonic sensor to measure fuel levels in various dimensions of fuel tanks.

Padmaja, B.V. et al. developed in [2] a vehicle tracking system using Blynk for data transport and visualization . The system has Ultrasonic, Gas, IR, Temperature, and GPS sensors. The suggested system monitors via mobile app.

Dukare, S.S., Patil, D.A., and Rane, K.P. introduced in [3] a system for vehicle tracking, monitoring, and alerting. The alerting system transmits information via GSM or GPRS, while GPS provides the vehicle's specific position. In contrast, the suggested system goes beyond these functions by including gasoline monitoring, vehicle position tracking, identifying the closest fuel stations, and getting alarm alerts.

Gullipalli, Karri, and Kota introduced in [4] a system that incorporates an Arduino, GPS, GSM, a fuel sensor, and a speed sensor This system facilitates communication and data exchange between the devices on the bus, web applications, and desktop applications. The researchers utilized NodeMCU (ESP8266) as a key component of their proposed system. It also uses a web app to monitor the system, whereas the suggested solution uses a mobile app.

Ribeiro and Gonzaga presented in [5] several approaches for real-time background removal algorithms based on the Gaussian Mixture Method (GMM) employing video sequences for image segmentation.

Vanmore, S.V. et al. developed in [6] a GPS/GSM vehicle tracking and location system . GPS tracking reports allow this system to follow the vehicle's status. Android apps provide vehicle tracking for safety.

Alshamisi and K'epuska proposed in [7] a vehicle tracking system that utilizes GPS and GSM technologies. Their solution employs a GPS and a GSM modem, which are connected to a vehicle by an Arduino MEGA2560. On the other hand, the suggested solution chooses to use NodeMCU (ESP8266) which has an integrated Wi-Fi chip for transmitting data.

Rohitaksha, K., Madhu, C.G., Nalini, B.G., and Nirupama, C.V. created in [8] a parallel processor system. The user interface on another Android phone lets people follow a vehicle on Google Maps. The suggested system includes fuel monitoring and vehicle activity tracking, whereas the current system just tracks vehicle position.

Khin and Oo. recommended in [9] utilizing Arduino, GPS, GSM, and web-based technologies . The proposed method uses an online fireplace database, whereas the realized system uses an online MySQL database server. The evaluated study utilizes a web application for system monitoring, whereas the suggested method uses a mobile app.

Saini, J., Agarwal, M., Gupta, A., and Manjula, R. introduced in [10] a car tracking system that utilizes GPS and GSM technology via an Android app. The main objective of the system is to monitor the precise position of the vehicle. The suggested system utilizes NodeMCU to establish communication and transmit data to the user.

In the current research, most of the automatic fuel detection models using Mobile Application and Cloud-based data storage with Firebase technology are implemented in this paper that is custom-built or tailor-made to suit with useful and key functional features for a vehicle. The main gap is that the Software application can be designed, developed, and deployed in different technologies based on the requirements of the user. These software applications are web-based, Cloud-based, IoT enabled only. In this domain, advanced IoT and cloud-based models with more numbers are still in the nascent stage for moderate fleet management scenarios.

3. Proposed Methodology.

Data Authentication. The first module in the proposed system is the Registration module. A driver has to register with his Mobile number as UNIQUEID. Once registered it will authenticate and the tracking application presents a user interface to track basic vehicle data only.

Data Input and Pre-processing. Some basic input details like the purpose of travel. Source and destination along with the Vehicle Number, Date of Fitness Certificate, and some mandatory fields have to be entered the First time and once only.

Data Captured from the Sensors. Mainly a GPS-enabled Fuel Sensor is fitted in the vehicle and complete Fuel and Route information is tracked from that instance continuously. The data consumed for this purpose is also displayed.

System architecture. The system architecture, as illustrated in Figure 3.1, functions as a conceptual model that defines the system's structure, behavior, and perspectives. To fabricate this model, an ultrasonic sensor is utilized initially to measure the fuel level, after which the value is converted to volume. The NodeMCU (ESP8266) module is utilized to transmit this data to the server, whereas the GPS module provides the latitude and longitude of the vehicle. By aggregating all incoming data and displaying it through the mobile application interface, the server implements a system for location tracking and real-time monitoring.

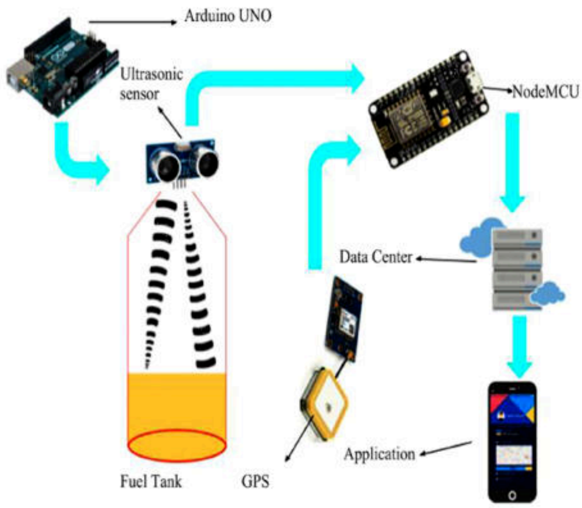


Fig. 3.1: Architecture of the Proposed System

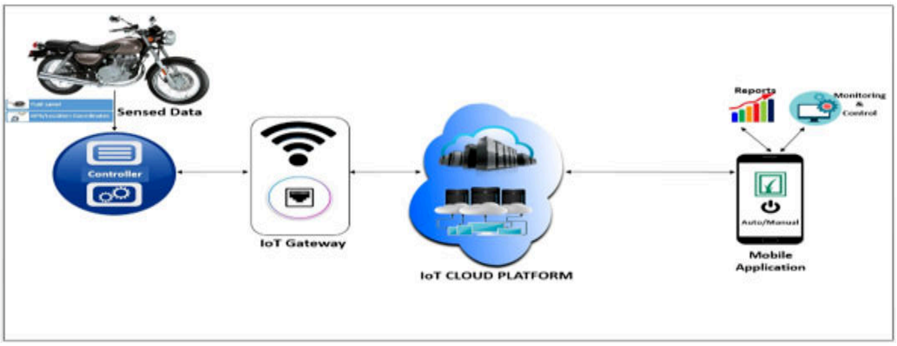


Fig. 4.1: Block diagram of the proposed method

4. Framework Design. A Framework design is a conceptual model that outlines a system's structure, behavior, and aspects, as depicted in Figure . To build this model, the first step is using an ultrasonic sensor to gauge the fuel level and then turning it into volume. Afterward, the data is sent to the server via the NodeMCU (ESP8266) module, while the GPS module transmits the latitude and longitude of the vehicle to the server. The server gathers and displays all of this data in the mobile application, enabling real-time monitoring via a global positioning system.

- Vehicles go outside the path of travel due to various reasons that are not intended or directed or related locations to driver behaviour and other personal reasons and arrive late to the destination. Do not report to a destination location within the set time indicated. That's why it was necessary to carry out a GPS Mapping.
- Different sensors were integrated with the vehicle that was to be tracked. Visually identical, they were only differentiated by being located in the wrong place. They needed to be identified.
- Fuel or vehicle conditions caused the reduction of the overutilization of the Fuel. Because of that, such cost was confused with the operational or maintenance of the vehicle, which was younger than the vehicle's life.
- It was necessary to include activities to the equivalent damage due to abnormal traffic and extreme

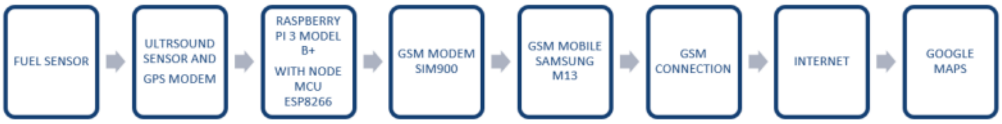


Fig. 4.2: Flow diagram of the proposed method

Fuel Management Section	Vehicle Management System Components
Raspberry Pi	Fuel Level Sensor (2)
NodeMCU (ESP8266)	Vehicle Speedometer Sensor
Ultrasound Sensor	GPS Module
PIR Sensor	Wi-Fi Module
Buzzer	Wide-angle camera

Table 4.1: List of Components

Fig. 6.1: Raspberry Pi 3 Model B+

road conditions corresponding to the route within the range of travel. The issue was addressed using Google Maps, incorporating authorized waybills provided by the client.

5. Fuel and GPS Sensors.

Fuel Sensor. The fuel tank pressure sensor, integral to the fuel pump assembly, is typically situated on top of or inside the fuel tank. This component is crucial to the evaporative emissions system ("EVAP"). Its primary function is to measure pressure within the fuel system, enabling the detection of evaporative leaks, such as those caused by a loose or malfunctioning gas cap. A concrete instance is the Lawrence Fuel Flow Sensor, which includes a 10-foot cable and a T-connector.

GPS Sensor. This global positioning system (GPS) is a satellite-based navigation system that utilizes a network of 24 satellites circling the Earth. GPS sensors, which are outfitted with antennas, function as receivers for this system. These sensors provide accurate information on position, velocity, and timing. A concrete example is the Globalstar 9600 Satellite Data Hotspot data.

6. Software and Hardware Specifications.

6.1. Hardware Requirements. The Raspberry Pi 3 Model B+, which is shown in Figure 6.1, is one of the physical components of the system. Other components include a Camera Board, a 5-inch 800x480 Resistive HD Touch Screen, an L298 H-bridge driver, a four-wheel-drive Rover chassis, rechargeable batteries for power delivery, and an ultrasonic sensor.

6.2. Software Platform. The Vehicle Tracking System is implemented using Python on the Intel Core TM i5 Processor. The Raspbian operating system is required. The required programs for the system may be summarized as follows:

Raspbian Operating System. The Raspbian OS is specifically designed for the Raspberry Pi. Its repository, comprising over 35,000 packages, provides comprehensive support for the Raspberry Pi environment. This operating system is freely available for download from the internet, commonly referred to as NOOBS, and can be subsequently transferred onto a 16GB (or larger) RAM stick.

Python and Libraries. Python is a popular general-purpose programming language. First developed in 1991. It lets programmers express ideas in fewer lines than C or Java. Python is a dynamic system that allows object-oriented, functional, and procedural programming with automated memory management. Python code can execute on many operating systems owing to its extensive and comprehensive standard libraries and Python interpreters.

Assumptions Made. To perform the Software and hardware modules what are the main assumptions have been considered needed to represent at the start of the results and discussion. The Fuel and Ultrasound Sensors are properly connected, interfaces with GSM and GPS are established, and all hardware configuration settings are set up. Additionally, it is assumed that the required Python libraries are available to implement this experiment.

7. Fuel Sensor Sensing with Level Measurement Implementation and Applications. The steps are the followings:

1. Import necessary GPS and GSM sensor packages in Raspberry Pi, for example, import RPi.GPIO as GPIO package.
2. Define the GPIO pins of the Raspberry Pi to connect it to a mobile.
3. Initialize the variable.
4. Capturing is done as follows: For distance inside the Fuel tank.
5. Compute the Fuel Consumption, Distance travelled, and Balance Fuel in the vehicle.
6. If any fuel is misused, stolen, or lost, send an SMS or the Fuel info message daily.
7. Find any route deviation using Google Maps.
8. Generate Reports.

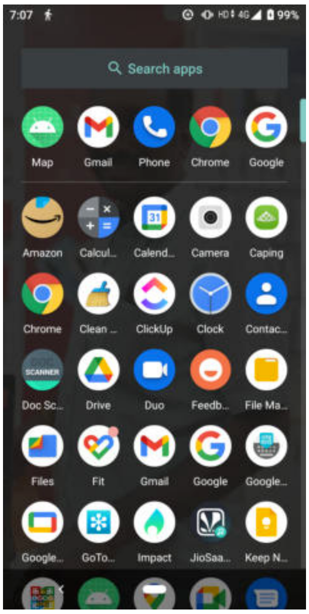
   For Example: Find distance using an ultrasonic sensor as follows:

```
dist = round(dist, 2)
distance = avgdistance + dist
if avgdistance < 15:
    stop()
    backward()
else:
    forward()
```

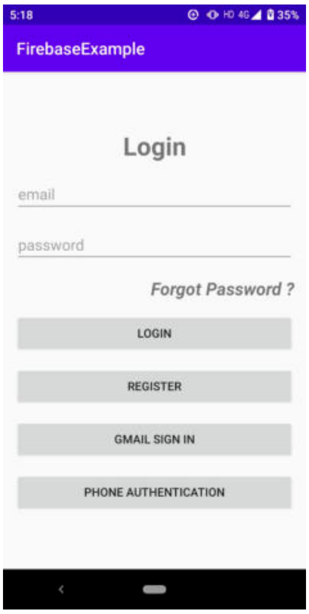
8. Experimental Results and Discussion. To begin the process of managing the four DC motors that are installed on the mobile robot, the first step is to connect each motor to the A (Out 1 & Out 2) and B (Out 3 & Out 4) connectors that are located on the L298N module. The L298N module is then powered by two 9V batteries once this step has been completed. In the meanwhile, the Raspberry Pi requires a 5V intelligent supply to function properly.

The Raspberry Pi utilizes six GPIO pins for motor control. GPIO10 controls motor A, GPIO09 controls motor B, and the input pins (IN1, IN2, IN3, and IN4) of the L298N driver are linked to GPIO22, GPIO18, GPIO16, and GPIO12 of the Raspberry Pi, respectively. The Ultrasonic sensor consists of four pins: VCC, which is linked to GPIO 5V (pin 2); GND, which is connected to GPIO GND (pin 6); TRIG, which serves as the output pin; and ECHO, which serves as the input pin. The hand gesture recognition system controls the motor movements, enabling navigation in four directions: Forward, Backward, Left, and Right, as well as a Stop command. The technology has reached a recognition accuracy of 98%. The system's whole cost amounts to around $200, and it has shown efficient functionality in a pristine setting.

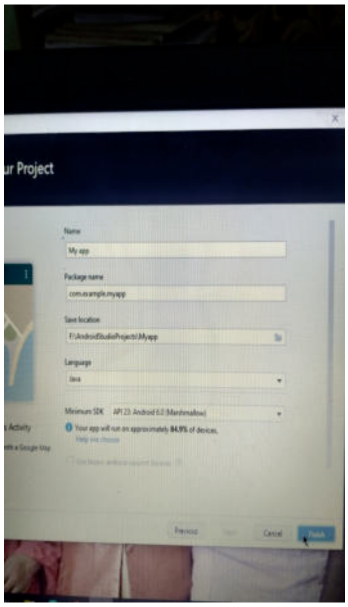
In Figures 8.1b and 8.1c depict the details of the user login screen of the implemented mobile application.Once the Scrren opens up we can initially add a route , update a route as path. A Route can be fixed by providing prior Source and destination details on the Mobile.This route is fixed for particular vehicle and the



(a) Android Mobile Application with navigation details



(b) Login Screen and Authentication



(c) Opening screen of Mobile Application

Fig. 8.1: Screenshots

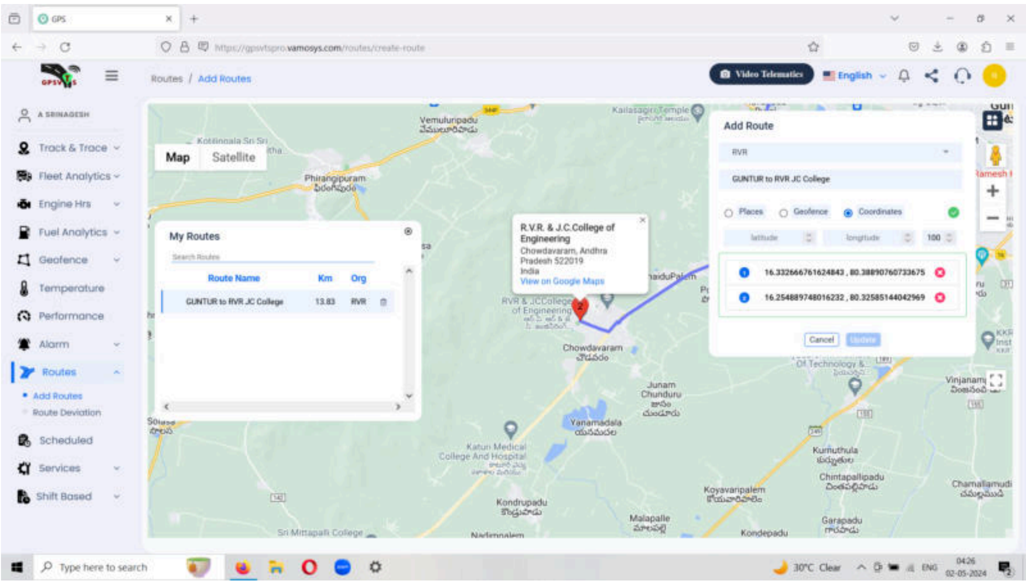


Fig. 8.2: Route Created from Guntur City to RVR & JC College of Engineering

The obtained results are shown in Figueres 8.1b-reff8 and the trip details are can stored in the Firebase using a API key specially generated for a user for a given amount of time to access the Google Maps API.

A legitimate driver is validated with the Authentication Module by confirming his details with the Owner's

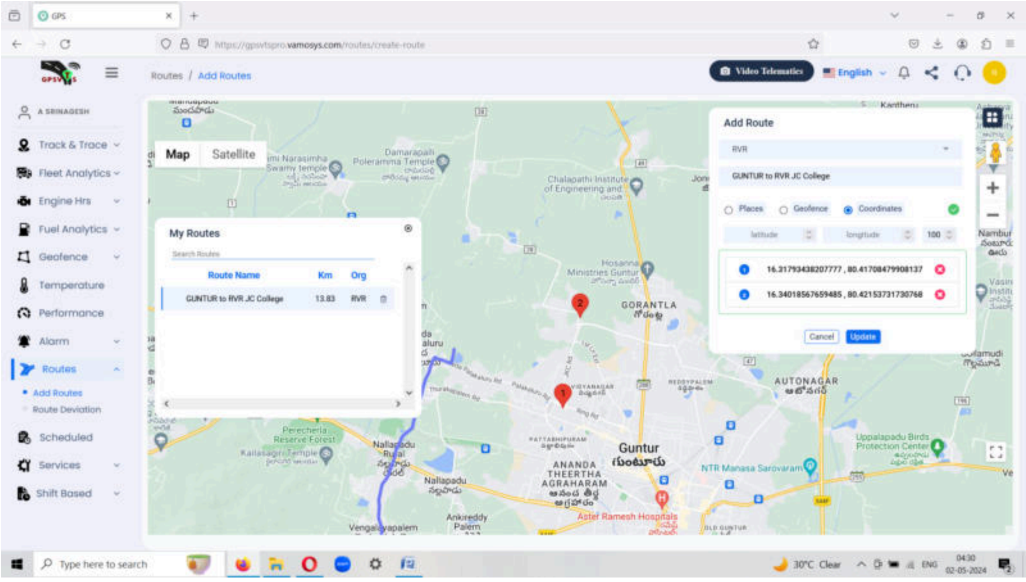


Fig. 8.3: Route Update option with Google Maps Coordinates

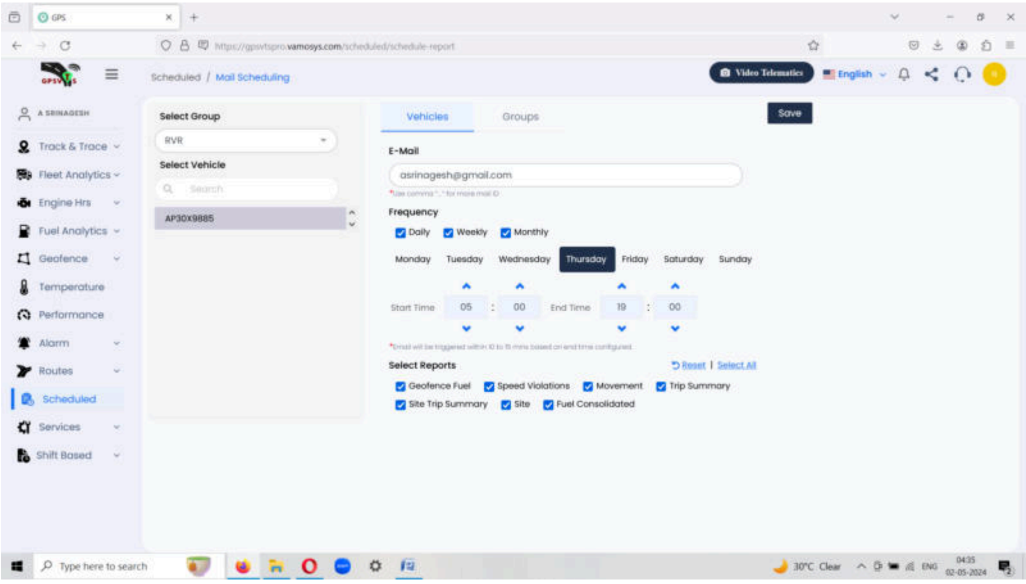


Fig. 8.4: Details of the trip saved and sent to the Owner

Firebase database.URL Module is implemented to track the live status and send or notify the server to which the system is connected.Sample code of Search Module to get nearby places using Google Maps.It is possible to record the current location of the vehicle in real-time [13]. Using the search module, one can look for a nearby gas bunk. This feature can also be employed in the event of an unexpected sudden incident, such as punctures, or sudden car breakdown. With the search module, one can look for a nearby gas bunk. This feature can also be employed in the event of an unexpected sudden incident, such as a vehicle breaking down, or any form of puncture.

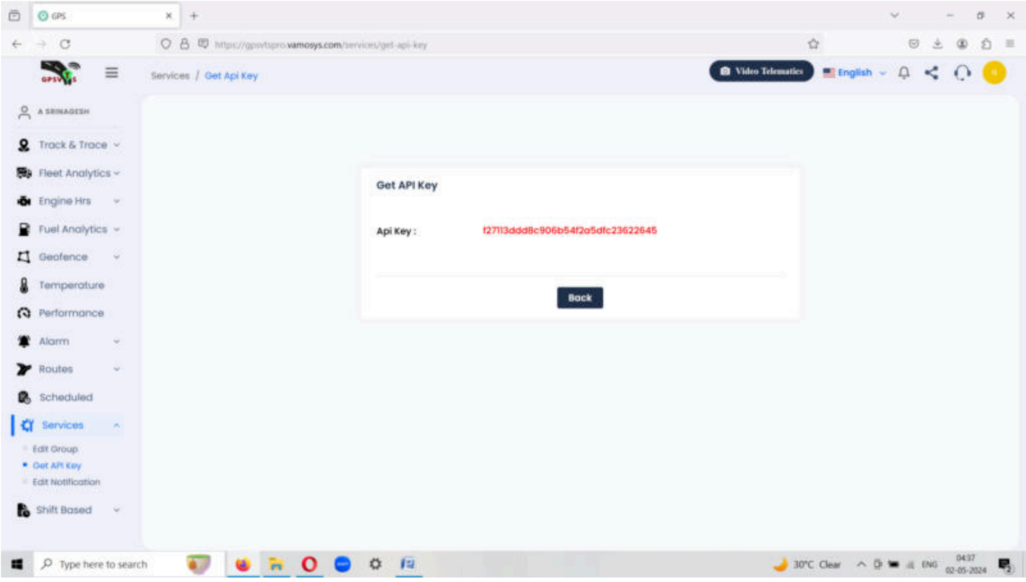


Fig. 8.5: Generate API Key to access the Cloud data

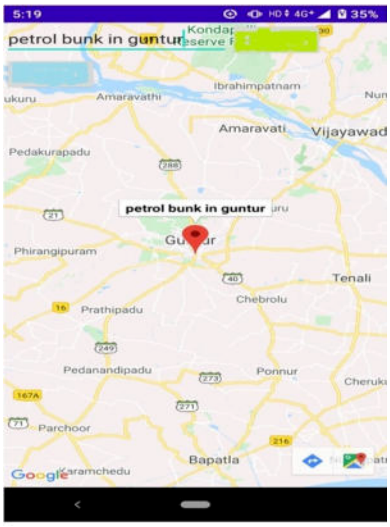


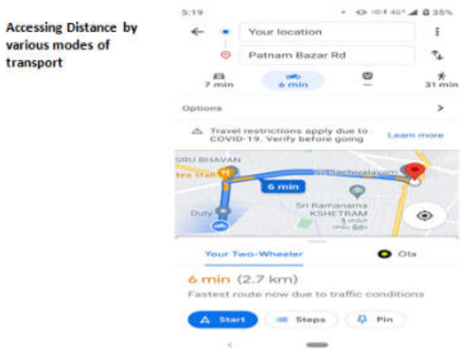
Fig. 8.6: Accessing our location and Searching Petrol bunk option

The details captured in each trip as trip summary by the GPS Fuel Sensor is presented in Table 8.1.

This GPS-based Fuel sensor makes it possible to trace the route information, path deviations, timestamps, and other important details in the Navigation module. The details of the trip summary can be recorded as shown in Table 8.1.

The fuel statistics chart with updated fuel status in the fuel tank (dynamic level-daily) and the distance travelled in kilometres are presented in detail in the above figure. It makes it simple to understand every element of the consumption pattern.

9. Conclusion. This work addresses the pressing issue of fuel consumption and theft in vehicles, which has become increasingly critical in the face of rising fuel costs. The proposed solution employs pre-fitted fuel



(a) A clear description of the Proposed Route using Google Maps

(b) Distance travelled and Route path Information with Navigation details.

Fig. 8.7: Route path

Table 8.1: Sample Fuel Analytics Data

Vehicle Number	AP30X9885
Vehicle Mode	Moving Vehicle
Engine Status	Voltage + Ignition (0.0)
Tank Size (L)	242
Current Fuel (L)	119.39
Minimum Fill (L)	5
Minimum Theft (L)	5
Total Distance (km)	433.43
Start Fuel Level (L)	70.61
End Fuel Level (L)	177.05
Total Fuel Fill (L)	179.11
Total Fuel Theft (L)	0
Total Fuel Consumption (L)	72.67
Kmpl	5.96
Type	Fill
From Time	22-01-2024 08:22:00
To Time	22-01-2024 08:55:25
Previous Fuel (L)	62.89
Current Fuel (L)	242
Fuel (L)	179.11
Nearest Location	Agraharam, GNT, Guntur, Andhra Pradesh, India, 522004

sensors and a fleet management system to monitor fuel usage and routes, offering a range of features such as sensor activation during fueling, data storage in a mobile application for tracking and theft prevention, and immediate alerts to vehicle owners based on consumption patterns. The researchers also suggest a low-cost Vehicle Tracking System (VTS) with Fuel Detection that utilizes ultrasound-based fuel sensing to compare consumption with the traveled route, enabling text alerts for the owner. The results obtained demonstrate the effectiveness of the system, with an average distance traveled for March 2024 of 1958.06 Km, total fuel consumed of 368.02 liters, and Liters per hour value of 90.57. These values are presented in Table 10 of

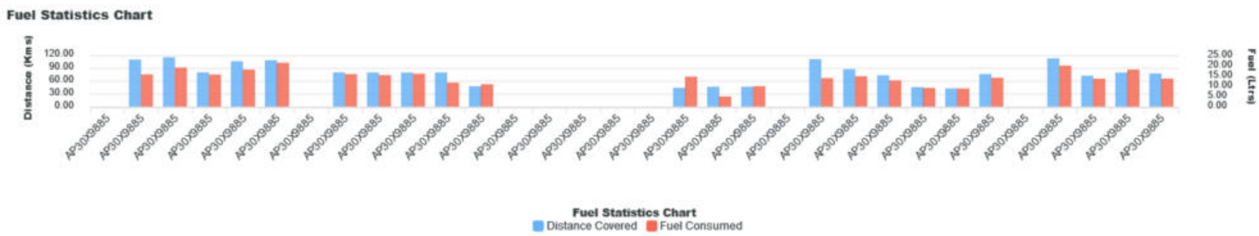


Fig. 8.8: Fuel Statistics chart

Table 8.2: Comparison of Fuel Consumption every month with Kmpl and Filled dates

S.No	Month	Distance (km)	Fuel (L)	Filled Fuel Consumed (L)	Kmpl	No. Fills	of Fuel (L) Date	Filled Analysis with		
1	April-2023	1919.86	172.86	346.88	5.53	1	172.86			
2	May-2023	1467.27	346.35	270.84	5.42	3	185.03 2023]	[01-05- 102.99 2023]	[12-05- 58.33 2023]	[25-05-
3	June-2023	1750.86	273.25	327.94	5.34	2	109.17 2023]	[07-06- 164.08 2023]	[20-06-	
4	July-2023	2028.12	363.92	373.73	5.43	2	178.89 2023]	[03-07- 185.03 2023]	[15-07-	
5	August-2023	1767.76	357.80	340.06	5.2	3	173.89 2023]	[03-08- 128.9 2023]	[21-08- 55.01 2023]	[30-08-
6	September-2023	2375.47	443.82	455.58	5.21	3	160.51 2023]	[01-09- 127.2 2023]	[09-09- 156.11 2023]	[22-09-
7	October-2023	1999.14	341.55	359.15	5.57	2	158.49 2023]	[03-10- 183.06 2023]	[13-10-	
8	November-2023	2524.81	473.79	450.38	5.61	3	175.11 2023]	[01-11- 148.94 2023]	[10-11- 154.14 2023]	[22-11-
9	December-2023	2015.59	363.07	377.34	5.34	3	182.61 2023]	[02-12- 132.77 2023]	[13-12- 47.69 2023]	[28-12-
10	January-2024	1714.17	351.68	311.94	5.5	2	172.57 2024]	[02-01- 179.11 2024]	[22-01-	
11	February-2024									
12	March-2024									

Table 8.3: Sample GPS Analytics Report - RVR (02-05-2024 05:01)

S.No	Vehicle Name	Engine Mode	Moving	Parked	Idle	No Data	Stoppage	Distance (Km)	Avg Speed (Km/h)
1	AP30X9885	Voltage + Ignition (0.0)	68h:34m	695h:23m	21h:9m	6m:0s	716h:32m	1958.06	27

the paper, highlighting the system's ability to address the critical challenges of fuel consumption and theft in vehicles. The GPS-enabled Fuel Sensor-based Vehicle Tracking System for Fleet Management using the Internet of Things is an efficient and comprehensive solution to monitor fuel usage and combat fuel theft, particularly beneficial for fleet management systems. Its implementation can significantly enhance fuel efficiency, reduce costs, and improve overall fleet management.

The system provides real-time monitoring of fuel consumption, route deviations, driving habits, breakdown details, vehicle maintenance conditions, and other vital performance details of a Heavy vehicle, which enables vehicle owners to receive real-time reports on their mobile devices. In addition, the system's real-time analysis of Vehicle Performance and Fuel Analytics can provide valuable insights for vehicle owners. Although the

Table 8.4: Total Distance Covered during March 2024

S.No	Date	Distance	Date	Distance	Date	Distance
1	01-Mar-24	110.96	11-Mar-24	107.56	21-Mar-24	72.48
2	02-Mar-24	111.42	12-Mar-24	78.49	22-Mar-24	106.86
3	03-Mar-24	0	13-Mar-24	23	23-Mar-24	109.32
4	04-Mar-24	111.2	14-Mar-24	74.61	24-Mar-24	0
5	05-Mar-24	109.13	15-Mar-24	71.24	25-Mar-24	0
6	06-Mar-24	109.61	16-Mar-24	72.37	26-Mar-24	72.362
7	07-Mar-24	110.35	17-Mar-24	0	27-Mar-24	74.45
8	08-Mar-24	0	18-Mar-24	74.9	28-Mar-24	105.8
9	09-Mar-24	0	19-Mar-24	75	29-Mar-24	0
10	10-Mar-24	0	20-Mar-24	71.29	30-Mar-24	105.4
			31-Mar-24	0	**Total Distance Covered**	**1958.06 Kms**

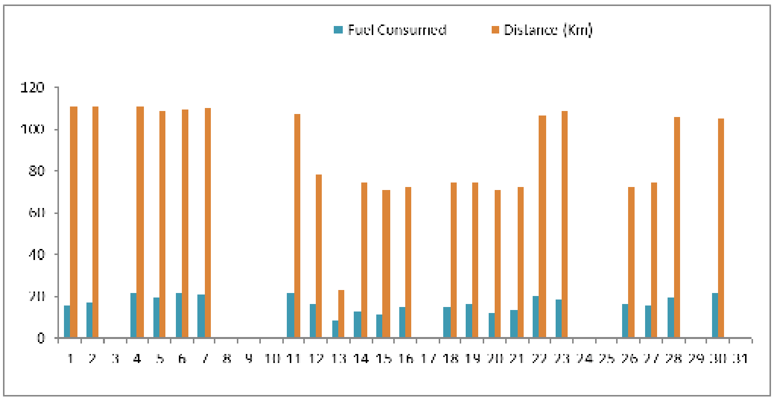


Fig. 8.9: Fuel Consumed and Distance Travelled in March 2024 Statistics chart

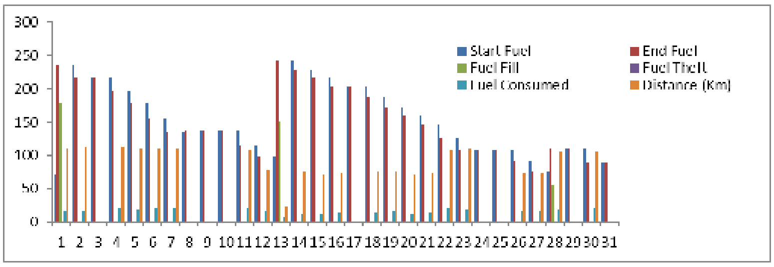


Fig. 8.10: Fuel Details with Distance Travelled in March 2024 Statistics chart

system has some limitations, such as interference factors, it can still be developed and improved in the future to provide even more accurate and comprehensive data analysis. Overall, the GPS-enabled Fuel Sensor-based Vehicle Tracking System for Fleet Management using the Internet of Things is a reliable and effective solution that can benefit vehicle owners and fleet managers in various industries.

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Table 8.5: Day-Wise Distance Travelled and Fuel Consumed for the Vehicle for March 2024

S.No	Fuel Consumed (Litres)	Distance (Km)	KMPL	(L/H)
1	15.42	110.96	7.2	3.1
2	16.81	111.42	6.6	3.55
3	0	0	0	0
4	21.29	111.2	5.2	4.33
5	18.99	109.13	5.7	4.11
6	21.41	109.61	5.1	4.24
7	20.57	110.35	5.4	4.17
8	0	0	0	0
9	0	0	0	0
10	0	0	0	0
11	21.7	107.56	5	4.37
12	16.09	78.49	4.9	4.2
13	8.18	23	2.8	3.1
14	12.73	74.61	5.9	3.81
15	11.59	71.24	6.1	3.49
16	15.01	72.37	4.8	4.35
17	0	0	0	0
18	14.67	74.9	5.1	4.31
19	16.09	75	4.7	4.53
20	11.85	71.29	6	3.55
21	13.69	72.48	5.3	4.2
22	20.31	106.86	5.3	4.31
23	18.69	109.32	5.8	3.96
24	0	0	0	0
25	0	0	0	0
26	16.32	72.62	4.4	5.4
27	15.76	74.45	4.7	4.66
28	19.21	105.8	5.5	3.96
29	0	0	0	0
30	21.64	105.4	4.9	4.87
31	0	0	0	0
Total	368.02	1958.06	116.4	90.57
Average	11.87	63.16	3.75	3.1

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