Smart fuel level indicator with automatic fuel station navigation system

Dr. Ashwini Barbadekar[1], Karan Late[2], Kaustubh Chavan[3], Faizaan Khan[4]

[1]*Professor, Department of Electronics and Telecommunication, Vishwakarma Institute of Technology, Pune, India*
[2]*Department of Electronics and Telecommunication, Vishwakarma Institute of Technology, Pune, India*
[3]*Department of Electronics and Telecommunication, Vishwakarma Institute of Technology, Pune, India*
[4]*Department of Electronics and Telecommunication, Vishwakarma Institute of Technology, Pune, India*

Abstract—- *Traveling has become an important part of an individual's life be it for work, vacation or daily commute. While on long journeys one constantly has to monitor the fuel levels. But when traveling to unknown destinations it becomes very difficult to find a fuel station when in desperate need of one. Being stranded with no fuel in the tank may lead to adverse safety issues. The proposed system makes it easier for the user to get an accurate reading of the fuel level and how long it will last while on a long journey and if refueling is necessary or not according to the destination and if necessary, the system will redirect you to the nearest fuel station en route.*

Keywords:- *Fuel level, satellite navigation, automation, GPS, Smart Android Screen, Vehicle system, Nearest fuel station.*

I. Introduction

Most of the vehicles use analog fuel indicators that are inaccurate and unreliable. The only two fuel readings that the user gets are F (full) or E (empty). This makes it difficult to judge the range of the vehicle for refueling. Not refueling on time may lead to one being stranded on an unknown road or having to push the vehicle to the nearest petrol station. And in some instances, one can completely forget about the fuel level in the tank and can get stranded. When on a long journey through unknown roads refueling becomes really difficult if one doesn't know the route to the nearest petrol station in case of emergencies [1].

The proposed system gives the drivers an accurate reading about the fuel in the tank and also the range according to the fuel economy of the vehicle. If the fuel levels are so low that the user won't reach their desired destination the system will navigate the user to the nearest fuel station for refueling.

II. Literature Survey

Cars from the beginning were the proud source of travel. Traveling in cars was a comfortable and easy way to commute. Cars also made it possible to travel long distances as per user's time and route. As Cars evolved, many new functions were added to make the user more comfortable while driving. Smart cars have some new extraordinary features which normal commutator cars miss. Many new technologies were also implemented in them. Some extraordinary features which smart cars and supercars have is "Smart fuel station navigation system". These features are only available in high graded smart cars and supercars.

Existing fuel gauge techniques: - The major cause for extending a vehicle's range is the fuel indicator on the dashboard, which leads the driver to believe that they're running short on gasoline when there is enough available. As a result, the conventional method utilized is infamously imprecise; nevertheless, several embedded technologies have been included into the conventional systems to enhance accuracy. The most popular and conventional fuel indication system now in use uses resistive float type sensors to track the amount of gasoline in the tank, and it is composed of two parts [2].

Fuel management system: - A user in the proposed system can verify the availability of fuel from their screen by tapping on any available button. This system also maintains track of who uses it. Admin can also see which pumps are accessible, how much gasoline is in the tank, and how much he reported to the accountant at the end of each day. The administrator may also see how much oil is accessible in a single day. This system also assists administrators in generating records for each pump based on his job and working hours. The gasoline management system will allow you to keep track of, monitor, and regulate fuel access. It is impossible to run machinery in transportation, construction, and other fleet enterprises without gasoline. When the recording procedure must be done manually [4].

A Real-Time Motion Based Fuel Monitoring Technique for Vehicle Tracking Systems: - A unique approach for enhancing the fuel monitoring system of car tracking systems is presented. We include a vehicle's motion data into the tracking device to enhance the precision of the fuel measuring devices. Furthermore, by doing a temporal analysis of the detected gasoline level data, it is possible to

detect suspicious actions such as tank leakage and fuel theft, as well as discern fuel replenishment. We create a hardware module for data gathering and then analyze the acquired data to investigate the link between fuel consumption and vehicle motion factors. The trials show that estimating the proper fuel level measurement is 80% successful and monitoring either refilling and suspect consumption activities is 100% successful [7].

Gps-Gsm Based Vehicle Monitoring & Smart Fuel Measurement System: - The project's purpose is to track the precise position of the car while also measuring the exact amount of fuel within the fuel tank. In this system, the user will be given a specific calling number to which they may call, enter their password, and choose an option. After picking an option, the customer will receive a response through SMS. For vehicle position or location, a GPS module that can communicate with a microcontroller was employed. The controller will analyze the gasoline and relay it to the user through SMS [3] [8].

Objectives

1. Calculate fuel present in the vehicle.
2. Alerting users about critical level fuel.
3. Calculating Range of vehicle with fuel left in the vehicle.
4. Finding the nearest fuel station for getting fuel easily.
5. Suggests the different fuel stations nearby which are low crowded.

Problem Identification

The use of analog systems that are fitted in vehicles are not accurate; they do not give the exact amount of fuel in the vehicle. They only have 2 readings i.e., F (full) or E (empty). Not knowing the exact amount of fuel that is in the vehicle can be very inconvenient when on long journeys so is having to search for the nearest fuel station when low on fuel. Modern vehicles do have systems that give near accurate readings about how far the vehicle will go with the amount of fuel that is in the tank. But they do not predict whether you'll need to refuel while on a long journey. The satellite navigation system and the fuel level indicator do not coordinate to let you know the nearest fuel station when low on fuel [7].

Methodology And Implementation

"Smart fuel level indicator with automatic fuel station navigation system" is a proposed system where the user will get information about the quantity of fuel left in his vehicle, range of vehicle till how long it can travel in this condition and also find out nearest fuel station for getting fuel easily and quickly [8].

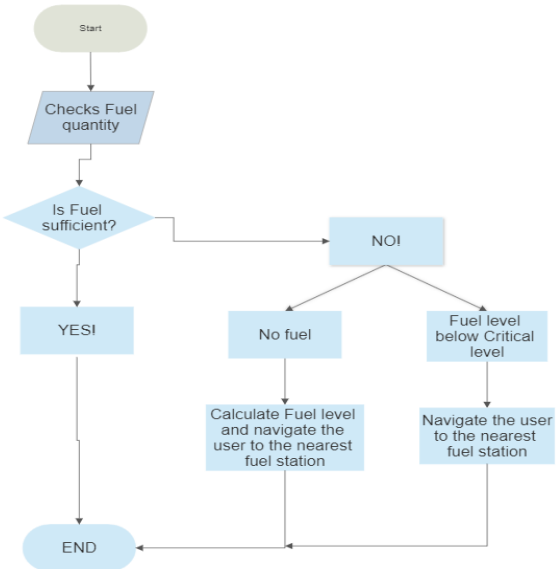

Fig. 1 Flowchart of the proposed system

From fig 1. We can see that the system first calculates the fuel level present in the fuel tank of the vehicle. If the fuel level is full or above critical level, the system would be in a sleepy state. If the fuel level goes below critical level, the system would calculate the range of distance a vehicle can travel in that fuel and also give suggestions of nearest fuel stations or upcoming fuel stations in the traveling route. The user can then select the nearest fuel station or favorite fuel station. Then the built-in GPS comes into action and navigates the user to the desired fuel station. Also, when the vehicle has NO fuel, the system comes into direct action and alerts the user about the nearest fuel station and also navigates him/her to the nearest fuel station. To avoid this NO fuel condition, we have set an alert alarm which alerts the user when the fuel level left in the tank is 500ml [6].

Google API: - Used for feature rich performance of the system. It provides real-time data like date, time, routes, traffic congestion, crowded fuel stations, etc. The API makes the system more informative and easier to use [11].

Fig. 2 Google API

AWS API:- As Google changed its policies in the recent year, we tried for an alternative API. With Amazon Location Service, you can get maps and position services from various suppliers on a budget-friendly, pay-as-you-go basis for a fraction of the cost of typical alternatives. Maps can be shown, addresses may be verified, addresses can be geocoded, devices and parcels can be tracked, etc [10].

Fig 3. AWS API for GPS navigation

2 main features of AWS API were used in this project:

Maps: - Maps were created using data from using the maps feature of Amazon Location Service. Esri and HERE Technologies both offer maps and map styles, with the potential for more maps and designs via such and other partners in the future. Instead of doing this directly, you'll utilise tools like Mapbox GL, Tangram, etc. Place

Indexes:- Esri and HERE both offer indexes that you may select from. The indexes enable the 'Search_Place_Index_For_Position' function, which provides locations such as homes or sites of interest that are close to the position you specify [10].

Resources included:

1) pyttsx3:-It is a text-to-speech conversion library in Python. Unlike alternative libraries, it works offline. Used for giving voice instructions to the user.

2) Datetime:- It is used to display real-time date and time on the console. This library is used when the user ignites the vehicle and starts the screen.

3) Folium:- It is used to create maps of various locations. This feature is enabled in all cars which are equipped with GPS. This feature will enable the user to find the nearest fuel station and the best route to travel there.

In-vehicle infotainment system:

1) Automotive sensors:- Used for fuel level measurement inside the tank of a vehicle.

2) Operating systems:- OS like Android Auto, Windows automotive are used for supporting connectivity and upgradation of software for new feature accessibility.

3) Integrated head display:- A mounted display in the car which displays real time data like time & date, fuel level, routes, nearby fuel stations, etc.

4) Connectivity modules:- These include GPS, Bluetooth and Wi-Fi to provide connectivity and establish internet connection and navigation with our system.

5) CAN:- The electronic components and circuitry with our proposed model use CAN protocol or other communication protocols.

Test Cases:

Start point:- Katraj ghat

Destination:- Satara city

Distance:- 110km

On route Fuel stations:- 4 (3 on highway)

Our car gives a mileage of 50 km.

In case 1, the vehicle has insufficient fuel for traveling the desired distance. As the fuel level indicated in Low, the proposed system indicates the user fuel level present in the tank. And navigates the user to the nearest on route fuel station.

In case 2, the vehicle has sufficient enough fuel the user can continue to drive to the desired destination. And our proposed model stays in ideal state.

Start point:- Koyana Dam Satara

Destination:- Kagal, Kolhapur

Distance:- 141 km

On route fuel station:- 11

In case 1, the vehicle has insufficient fuel for travelling the desired distance. As the fuel level indicated in Low, the proposed system indicates the user fuel level present in the tank. And navigates the user to the nearest on route fuel station.

In case 2, the vehicle has sufficient enough fuel the user can continue to drive to the desired destination. And our proposed model stays in ideal state.

Start point:- Wadia college, Pune

Destination:- Sant Darshan Museum, Hadashi

Distance:- 46 km

On route fuel station:- 4

In case 1, the vehicle has insufficient fuel for travelling the desired distance. As the fuel level indicated in Low, the proposed system indicates the user fuel level present in the tank. And navigates the user to the nearest on route fuel station.

In case 2, the vehicle has sufficient enough fuel the user can continue to drive to the desired destination. And our proposed model stays in ideal state.

RESULT

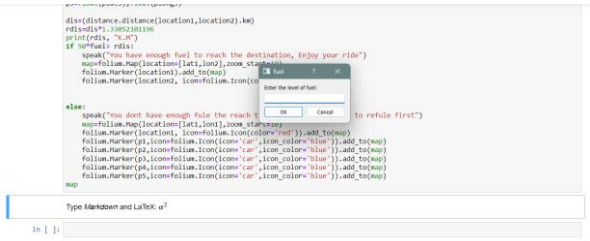

Fig 4. Entering fuel level

Fig.4 shows the first step of the proposed model (To enter fuel level present in the tank). This info will be automatically collected by the system when implanted in the vehicle.

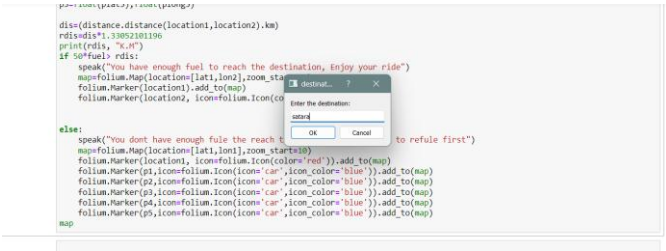

Fig 5. Entering destination

Fig 5. Shows about entering the destination to the user.

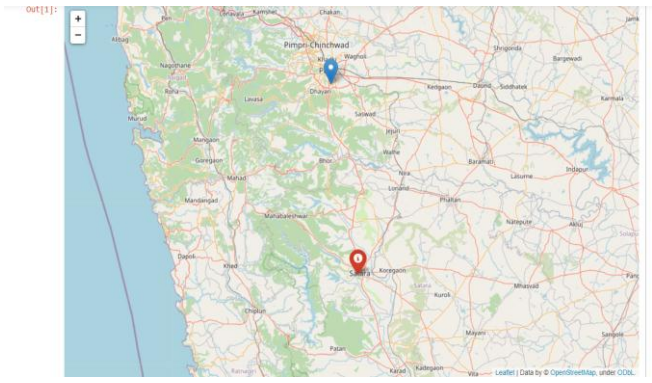

Fig 6. Source to destination distance

In Fig 6. The distance between source and destination is calculated and best route for travelling is shown.

Fig 7. On-route fuel stations available

In Fig 7. The fuel level is calculated and the nearby and on-route fuel stations are shown to the user.

FUTURE SCOPE:

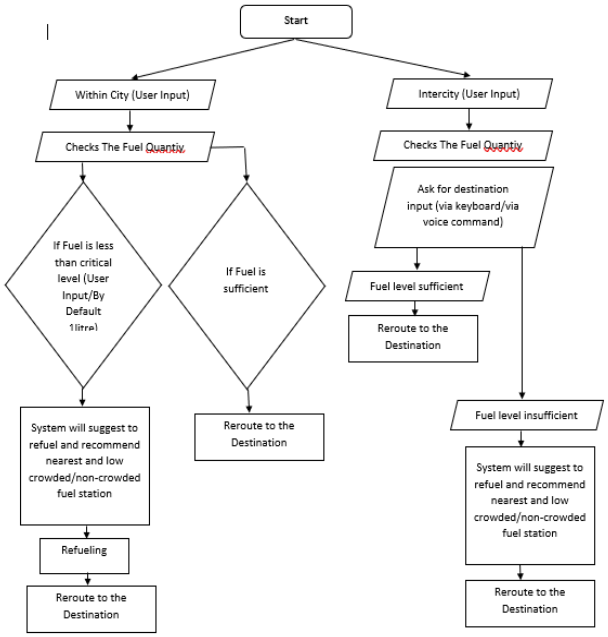

Fig 8. Fuel station navigation system with future advancements

Fig 8. Shows the overall system working through a flowchart.

In future development of the proposed model, we plan to add more functionality through the Google API library. With this API library, we can monitor the real time fuel levels and according to those reading the user can be rerouted to the nearest petrol station with low or moderate crowd but in emergencies these conditions will be ignored. Customer feedback of a specified fuel station will also be shown to the user.

CONCLUSION

This project indicates the exact quantity of fuel in the tank and the range of the vehicle according to the fuel economy

of the vehicle. If the vehicle does not have the required amount of fuel to reach the desired destination the system will navigate the user to the nearest fuel station.

REFERENCES:

[1] Prajakta Gaikwad, Pratiksha Shambharkar, Mrs. Preetee Karmore, "Fuel management system", IJARIIE, Vol.7, issue-3, pp. 327-333, 2021.

[2] Kiran Patil, Dr. C.Y. Patil, "Design and development of fuel level measurement technique for automotive application", IEEE Fourth International Conference on Communication and Electronics Systems, pp. 1300-1303, 2019.

[3] Aditya Jadhav, Sonali Shirsekar, Sahil Sankhe, Savita Lade, "GPS-GSM BASED VEHICLE MONITORING & SMART FUEL MEASUREMENT SYSTEM", International Research Journal of Engineering and Technology (IRJET), Vol.5, issue-4, pp. 826-828, 2018.

[4] Shweta Bhongade, Yamini Dabhane, Sarang Pathak, Saurabh Khajone, "Smart Fuel Level Indicator System", International Journal of Innovative Science and Research Technology, Volume 6, Issue 4, pp. 334-337, 2021.

[5] Faizah Farzana, Md. Miraz Hossain, Mohammad Maruf Imtiaze, Md. Tafsir Hossain, "A Real-Time Motion Based Fuel Monitoring Technique For Vehicle Tracking Systems", IEEE Emerging Technology in Computing, Communication and Electronics (ETCCE), 2021.

[6] Dr Rajani Akula, Bhagavatula Ramya Sai, "Sensor Based Quality Check and Automated Fuel Level Indication System", IEEE International Conference on Recent Developments in Control, Automation & Power Engineering (RDCAPE), pp. 164-168, 2019.

[7] D.Sivaraj, A.Kanadswamy, S.Vetrivel, "Development of Navigation System for Autonomous Vehicle", IEEE International Conference on Machine Vision and Image Processing, pp. 161-165, 2021.

[8] Wan Rahiman and Zafariq Zainal, "An Overview of Development GPS Navigation for Autonomous Car", IEEE 8th Conference on Industrial Electronics and Applications, pp. 1112-1118, 2013.

[9] https://jv-technoton.com/products/dut-e-gsm/

[10]https://aws.amazon.com/blogs/aws/amazon-location-add-maps-and-location-awareness-to-your-applications/

[11]https://mapsplatform.google.com/?utm_source=search&utm_medium=googleads&utm_campaign=brand_core_exa_desk_mobile_in&gclid=CjwKCAiAuOieBhAIEiwAgjCvcmAetaQSEYYdUfB9uZPIcwKe9LjX7Rh-W8VF41J2sMTWxWHHTw-BVRoCc3MQAvD_BwE&gclsrc=aw.ds