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Detection and Navigation of Nearest Fuel Station Using IRNSS with IoT

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Abstract: *Many times people may get stuck in the middle of the roads due to lack of fuel in the automobile. Our research aims to eliminate this problem by detecting and navigation to the nearest fuel stations. This can be solved by using advanced technologies like NavIC and IoT. By using the Indian Regional Navigation Satellite System (IRNSS) with an accuracy of 10 metre, the nearby fuel stations can be located. The above stated problem can be overcome by using a hardware system which is fixed with the automobile .Using the fuel gauge, we can know the fuel level and if it goes below the reserve point then the device will automatically open up the application to find the nearby fuel station and it will help in navigation of fuel station. This device and the fuel gauge will communicate with each other by the means of wireless communication called wireless fidelity. If there is a condition of fuel theft or leakage, the fuel gauge can find the rapid decrease in the fuel level and it has the capability to denote the fuel level in percentage. This entire system works over the Internet.*
Keyword: *Fuel Gauge, Fuel Station, Internet of Things (IoT), IRNSS, NavIC.*

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I. Introduction

In the current scenario, an automobile has become part of every person's life. People can't tolerate in one situation when they stuck up in the middle of the road due to the lack of fuel. This kind of problem will affect the passionate riders as well as common people. This problem may arise due to many factors like rider's unawareness, due to some leakage and fuel theft. The rider may unaware of many of these problems or how to react to this situation, so by helping or guiding them by a constant reminder or giving them a correct solution this problem can be easily solved.

Whenever the petrol level goes down or lack of petrol condition arises, they are in a need to search for a fuel station. People can't assume or estimate a rough distance that how much they have to travel for finding a fuel station. So, we have designed a solution for this most needed problem solution. Our "NavIC Locator" will suggest the rider to find the nearest fuel station and navigate to the selected destination. This may reduce 90% of the burden from this solution. This system also detects fuel theft or leakage through these technologies. The theft of fuel can be intimated through via SMS or an Intimation call which can be triggered using a GSM module (SIM900A). At last the total volume of fuel consumed, remaining and the kilometer driven can be calculated and displayed in the digital display which is fitted along with the device. Whenever this happens an alarm will be triggered in the application along with vibrations on the phone.

II. Literature Survey

Author [1] suggests that in all over the world the most vehicles are having an analog fuel meter. This meter indicates three states of fuel level which are empty, half and Full. So we cannot judge the actual fuel present in the fuel tank. But due to this, we do not get proper idea about the fuel level present in a fuel tank. Due to improper knowledge of fuel present in the tank, we can undergo in trouble due to low fuel.

As considering the previous analog system we are going to implement an advanced system. In our system, we are doing digital fuel meter and theft detection. In digital fuel meter, we are indicating the amount of fuel in the tank in percentage.

III. Related Work

Many apps have been made that find petrol pumps in the vicinity of a neighborhood. Some of them are -

- Nearest Petrol Pump Finder
- Gas Station Finder
- Petrol Pump Finder
- Nearest Gas/Petrol Stations

Also, many other apps are there that track car expenses, auto service, your fill-ups, fuel consumption such as –
• Fuelio: Gas Log and Costs
• FillUp: Gas Mileage Log
• Drivvo: Car management
• Fuel Manager (Consumption)

IV. Methodology

To we have designed a solution for this most needed problem solution. Our "NavIC Locator" will suggest the rider to find the nearest fuel station and navigate to the selected destination. We have used reliable components such as fuel gauge to detect the fuel level, Arduino board to communicate with the fuel gauge and the device, Wi-Fi (ESP 8266) module as hardware, and software components such as Android studio.

This application [2][3] can make a big turn over in the industrial market for the accuracy of navigational purposes and for the detection of petrol theft by intimating it through an Intimation call and by via SMS using the GSM module. Due to the high accuracy of the satellite, most of them will prefer this NavIC based application to avoid error or false data which may have a chance to appear in the existing navigational outcomes and this will be more useful for passionate riders to avoid inconsistency in the fuel level.

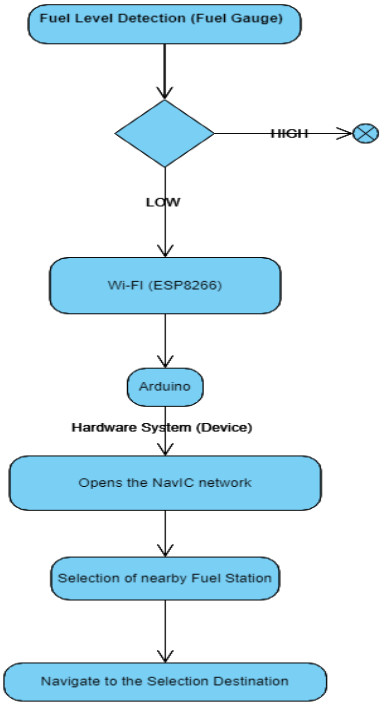

Fig.1 flowchart of fuel detection and navigation

Initially, the petrol level is sensed and checked whether the process should continue to the next step or not. If the level of the fuel is less than the reserve point it must proceed to the next step of the process. If not, the current process should be terminated. The Wi-Fi Bridge (ESP8266) plays a major role in communication as a bridge to the application and the hardware components. The Wi-Fi can be embed with an Arduino board. The navigational network NavIC will be automatically triggered, to turn ON the navigation (with latitude and longitude) and it will be searching for the nearby fuel stations with the help of navigational satellite. After the selection marked by the rider, the device will automatically navigate to the destination.

1. System Design

The solution implementation can be done two ways: Hardware and Software

5.1 Hardware

Arduino UNO [8], Wi-Fi module [ESP8266], Fuel Gauge are the hardware components used here. We have been used a Fuel Gauge to detect the fuel level. The value obtained by the fuel gauge is passed to the Arduino through Wi-Fi module and it checks the value should be processed or not. If yes, it automatically redirected to the NavIC network. If not, the process will be terminated. The network NavIC which is constantly

connected to the satellite IRNSS will act as a bridge to navigate the rider to the destination. The selection of fuel stations is displayed in a screen which displays all kinds of information's related to the navigation. This device is connected to a battery for a power source for the uninterrupted navigational system. The NavIC network was expected to be operational from early 2019 after a system check.

5.2 IRNSS

The Indian Regional Navigation Satellite System (IRNSS), with an operational name of NavIC, is an autonomous regional satellite navigation system that provides accurate real-time positioning and timing services. It covers India and a region extending 1,500 km (930 miles) around it, with plans for further extension. An Extended Service Area lies between the primary service area and a rectangle area enclosed by the 30th parallel south to the 50th parallel north and the 30th meridian east to the 130th meridian east, 1,500–6,000 km beyond borders. The system at present consists of a constellation of seven satellites, with two additional satellites on the ground as stand-by.

NavIC will provide two levels of service, the "standard positioning service", which will be open for civilian use, and a "restricted service" (an encrypted one) for authorized users (including military). Due to the failures of one of the satellites and its replacement, no new date for operational status has been set.

Some applications of IRNSS are Terrestrial, Aerial and Marine Navigation, Disaster Management, Vehicle tracking and fleet management, Integration with mobile phones, Precise Timing, Mapping and Geodetic data capture, and Terrestrial navigation aid for hikers and travelers, Visual and voice navigation for riders[3].

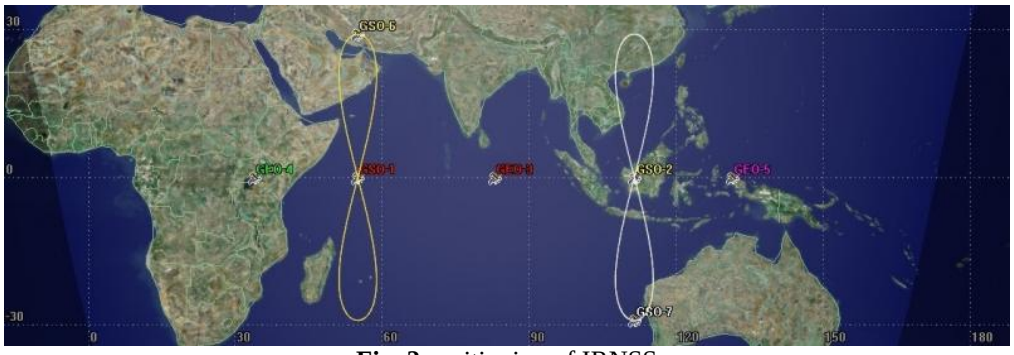

Fig .2 positioning of IRNSS

The Global Positioning System, commonly known as GPS, is a network of about 31 satellites orbiting the Earth at an altitude of 20,000 km. The system was originally developed by the US government for military navigation but now anyone with a GPS device can receive the signals and use it. Each satellite of the GPS constellation circles the Earth twice a day. It depends on only 24 satellites to provide an accurate location, the rest of the satellites are spare ones. IRNSS comprises of space and ground segments. The space segment consists of seven satellites, with three in geostationary orbit and four in inclined geosynchronous orbit. IRNSS-1A, 1B and 1C, the first three satellites of the IRNSS constellation, have already started functioning from their designated orbital slot after extensive on-orbit test and evaluation to confirm their satisfactory performance. People may think that our existing GPS system is better than that of IRNSS, but in case of accuracy and true data values, we can acquire a perfect navigational system. So from this positioning of IRNSS, we can achieve the above-mentioned things [4].

5.3 Arduino

Arduino is a simple microcontroller for building digital devices and interactive objects that can sense and control both physically and digitally. This hardware component contains no architecture, so making this as a main, any input can be given and the required output can be obtained. It is mostly used as a small electronic component (Embedded systems) to obtain the required output.

5.4 Wi-Fi Module

The Wi-Fi Module is a low-cost Wi-Fi microchip with full TCP/IP
stack and microcontroller capability. This acts as a Hotspot area as well as a Wi-Fi bridge to the users. This feature can be used by enabling the Wi-Fi with 0 and 1. This Wi-Fi bridge is a user-friendly device to use this in a place wherever and whenever the user wants.

5.5 Android Studio

Android studio is a platform to develop android applications in a certain way that it can be designed by the user's specification. It consists of a drag and drop solution to develop applications. Whenever the user develops the application the XML code will be automatically generates and the optimization of the programming code will be based upon the JavaScript. The certain conditions likes buttons and other specifications can be optimized through the Java code.

5.6 Fuel Gauge

Fuel Gauge is a sensor like device which is used to detect the level of fuel. Nowadays analog fuel gauge is drastically changes over into digital system as the world is also moving towards the advanced technologies. This works in the principle that change in the resistance is equal to the detection of fuel level. A resistor has a responsibility to take care of the detection of fuel level by continuously making much iteration to check out whether the value obtained is true or false.

5.7 Fuel Theft

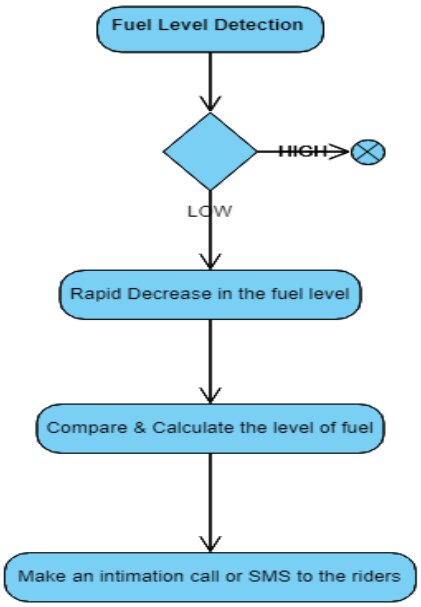

Fig.3 flowchart for detection of fuel theft or leakage

Fuel theft is defined as the larceny of fuel from the automobiles without the knowledge of the rider. Sometimes this remains unnoticed by the rider, to prevent this type of problem our system can be used. This hardware system notice the rapid decrease in the level of fuel and intimate the rider via SMS by GSM module that there is a leakage or theft of fuel in the automobile with a short span of time so that this problem can be eliminated via our solution[6].

5.8 App Screenshots

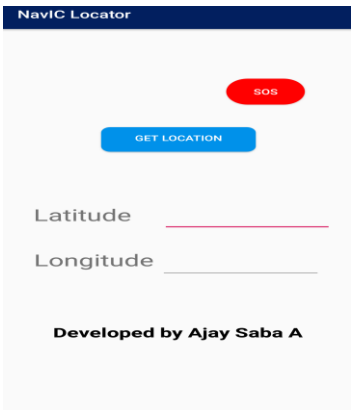

Fig.4 current location can be obtained

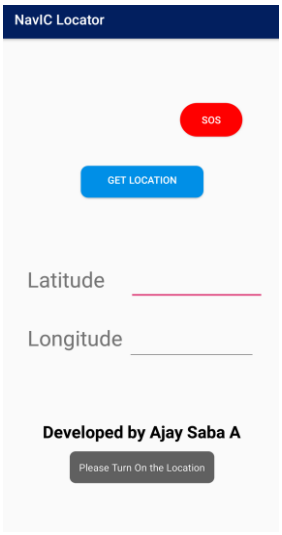

Fig.5 location should be turned ON while using this app

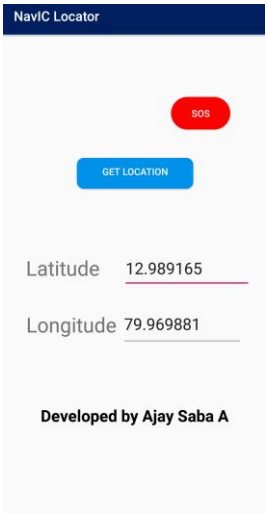

Fig.6 current location is obtained

This app is in the development stage since the full network of NavIC will be launched in the year 2019 after testing the particular system.

V. Conclusion

Our solution design makes this problem statement simple for finding and navigating to the nearest fuel station. We had overcome with many testing's to make sure that whether the rider reaches the destination correctly or not. Initially, our approach is based upon by using existing system for the navigational system. It does not have high accuracy as well as it has a chance to provide false data (Location data) to the rider since it is developed from another country. For India, it has its own satellite for navigation satellite. After combining all the 7 satellites, it forms a network of NavIC. And it ensures the true location data for sharing to others.

Using IRNSS and after establishing the navigational system it works most efficiently to overcome all sorts of navigational inconsistencies. To avoid fuel theft or leakage is also one of the majorly needed solutions. This concept is also embedded in our hardware system. Our research successfully eliminated the problems which have been defined in our problem statement.

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