iJRASET
International Journal For Research in
Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 12 **Issue:** V **Month of publication:** May 2024

DOI: https://doi.org/10.22214/ijraset.2024.62590

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 12 Issue V May 2024- Available at www.ijraset.com

Diesel Level Monitoring System

Dr. Shilpa Sondkar[1], Omkar Patil[2], Paras Bhosale[3], Poonam Nyahalde[4]
Department of Instrumentation Engineering Vishwakarma Institute of Technology Pune, India

Abstract: The ultimate objective of this project is to create a wireless diesel tank monitoring system that employs WebSocket protocol to connect fuel sensors and a mobile app in remote areas in real time. Through the use of Wi-Fi networks, customers can obtain consumption information, monitor the current diesel levels in various tanks, and log in to the mobile app, which has a straightforward interface. Diesel levels are shown as a percentage, translated from voltage readings, and alerts are delivered by the system when levels drop below preset limits. The goal of this effective and user-friendly technology is to maximize the use of diesel and make timely refills in distant places easier. A reliable and smooth solution for diesel level monitoring is made possible by the integration of the ESP32 microcontroller, WebSocket connection, and capacitive fuel level sensor. Accurate mapping of sensor readings to ESP32 values is made possible by the use of a 20k ohm potentiometer, which guarantees accurate and dependable data transfer. This work advances the area of remote monitoring systems by providing a workable and expandable method for monitoring diesel level in a variety of applications.
Keywords: WebSocket, Android app, Diesel, Monitor, ESP32.

I. INTRODUCTION

Accurate and ongoing diesel level monitoring is a major difficulty in many businesses where efficient fuel management is essential. Though they may appear simple, conventional techniques like manual inspections and float-based systems frequently fall short in terms of accuracy, reliability, and efficiency. Decision-making and effective fuel management are hampered by these techniques' inability to offer real-time data, continual manual monitoring requirements, and error-proneness. This cutting-edge technology is based on the basic idea of capacitance. By carefully measuring and electrically converting this change in capacitance into a matching level number, real-time and very accurate statistics on the fuel status within the tank are provided. In order to provide smooth communication between the ESP32 microcontroller and an Android Studio-based client, the system creates a WebSocket connection. Through the usage of the Arduino IDE, the ESP32 communicates data on diesel level as a percentage, allowing users to remotely monitor fuel levels via an easy-to-use interface. This research presents a workable and scalable technique for diesel level monitoring, which advances remote monitoring systems. The suggested system is more dependable and efficient since it incorporates WebSocket communication, microcontroller interface, and sensor technology. Fuel management is a critical area where the Diesel Level Monitoring System fills a need as industry look more and more for automated and remote monitoring solutions. This work explores the design and implementation of a high-precision capacitive sensor-based system that is reliable and economical. This project aims to address the shortcomings of conventional methods and set a new standard for effective and dependable fuel management through careful sensor selection, the development of sophisticated electronic circuits for accurate measurement, the implementation of sophisticated software for signal processing and level conversion, and the creation of an intuitive user interface for real-time data visualization.

II. LITERATURE REVIEW

1) R. Krishnasamy proposed a project [1] that employed smart devices to automate fuel level measurement in order to prevent driver fuel theft and guarantee precise gasoline delivery at gas bunks. GSM modules and intelligent fuel sensors are used in the system. It has an alarm system that sounds when gasoline levels vary abnormally, perhaps indicating theft or abnormalities in the pace at which fuel is consumed. The concept may be used to several types of cars because it also uses a low-cost technological approach. The system's overall goal is to improve fuel management's security, accountability, and transparency.
2) Obikoya and Gbenga have suggested a system [2] with the goal of creating a fuel-level monitoring system that combines an Aplicom 12 GSM module configuration with a developed sensor. This enables control signals transmitted from a mobile device to enable remote fuel monitoring. The work is in line with previously published research on mobile phone-based control systems, GSM module integration, and fuel-level monitoring. The innovative aspect of the concept is how these components are combined to provide a thorough and user-friendly real-time fuel monitoring system.

3) Rahul Gogawale has put out a project [3] that suggests utilizing Internet of Things (IoT) technology to solve the problem; more precisely, it recommends the use of a controller implanted in construction equipment in conjunction with a capacitive sensor. With the use of GPRS radio modules providing global location information, the controller provides real-time fuel monitoring data, allowing construction businesses to watch vehicle movements and manage fuel usage, therefore reducing short- and long-term operational and financial issues.

III. METHODOLOGY

A. System description

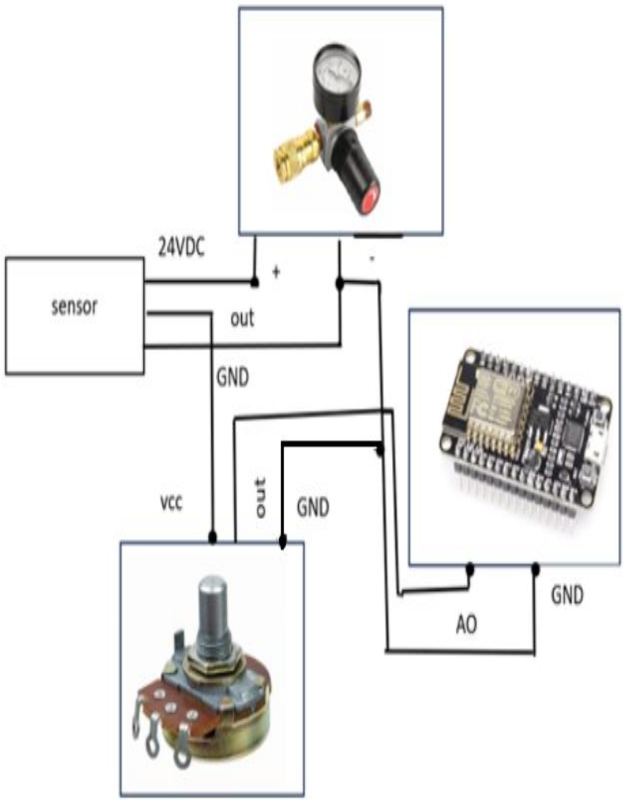


Figure 1: Block schematic of proposed system.

The Diesel Level Monitoring System (depicted in Figure 1) uses a capacitive type sensor and an ESP8266 microprocessor to monitor and regulate the diesel levels in a tank. The project makes use of a WebSocket server-client architecture, where the server interface is built in Java for a mobile application and the client interface is created in the Arduino IDE. The main goal is to enable smooth communication between the ESP8266 and the smartphone app, enabling real-time diesel level monitoring.

First, a capacitive fuel level sensor—which is intended to provide precise readings of the diesel level—is integrated into the Diesel Level Monitoring System. These sensors respond to differences in liquid level by detecting changes in capacitance between two electrodes. The quantity of electricity that can be stored between two electrodes is measured by their capacitance, which changes with the distance and material between them. The diesel level sensor contains two electrodes separated by a tiny layer of air; the distance between them changes depending on the amount of diesel fuel in the engine. By doing this, the capacitance will change, which the sensor can use to convert into a voltage that represents the fuel level. DC power supply with a 24V output range of 0–9V. In order to minimize any fluctuations that can affect the accuracy of the sensor readings, a voltage regulator is used to provide a steady and controlled power supply. A 20k ohm potentiometer is included to enable smooth integration with the ESP8266 microprocessor, which runs within an input range of 0-3.3V. As a voltage divider, the potentiometer is positioned in the circuit between the sensor output and the ESP8266 analog input (A0).

The outcomes of these tests, which are covered in depth in the sections that follow, offer a comprehensive evaluation of the system's functionality, precision, and dependability.

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 12 Issue V May 2024- Available at www.ijraset.com

B. Flowchart

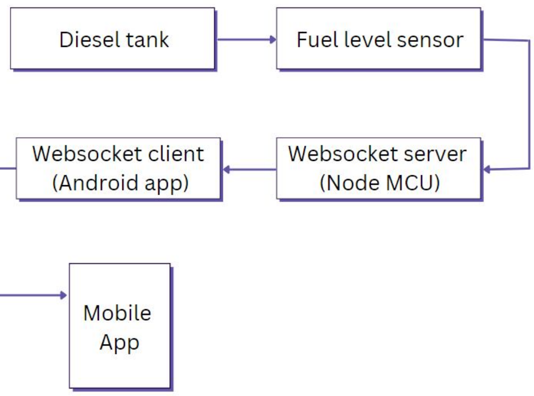


Figure 1: Flowchart of the system

1) Fuel Level Detection
2) Data Transmission to WebSocket Server
3) WebSocket Server Reception and Broadcasting
4) WebSocket Client Update on Mobile App
5) Integration and Implication.

IV. EXPERIMENT AND RESULT

The application of a strong fuel management system with extremely sensitive capacitive sensors has produced encouraging outcomes. The primary objective of the project was to develop and execute a financially viable resolution that tackles the drawbacks of conventional techniques for diesel level monitoring. The following summarizes the project's main findings:

A. Accuracy and error:

The diesel levels in the tank were measured with an unprecedented degree of accuracy thanks to the capacitive sensors. The real-time data with low variance was supplied by the continuous monitoring capabilities, which exceeded the accuracy of conventional approaches.

Table I: Error calculation.

Sr.no	Sensor measure (in Percentage.)	Mechanical measure (in Percentage.)	Error Rate (in %)
01.	10.76%	10%	+7.6%
02.	22.37%	21.25%	+5.27%
03.	30.825%	32.5%	-3.2%
04.	44.44%	45%	-1.24%
05.	77.75%	75%	+3.6%
06.	98.1%	100%	-1.9%

To find the accuracy and overall error rate, we need to calculate the average error and the accuracy of each measurement. The accuracy can be calculated using the formula:

$$Accuracy = 100\% - Error\ Rate$$

Average accuracy and overall error rate:

$Accuracy1 = 100\% - (7.6\%) = 92.4\%$
$Accuracy2 = 100\% - (5.27\%) = 94.73\%$
$Accuracy3 = 100\% - (3.2\%) = 96.8\%$

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 12 Issue V May 2024- Available at www.ijraset.com

$Accuracy4 = 100\% - (1.24\%) = 98.76\%$
$Accuracy5 = 100\% - (3.6\%) = 96.4\%$
$Accuracy6 = 100\% - (1.9\%) = 98.1\%$

Therefore, average accuracy is:

$$Average\ accuracy = \frac{92.4 + 94.73 + 96.8 + 98.76 + 96.4 + 98.1}{6} = 96.19\%$$

And average error rate is:

$$Error\ Rate = 100\% - 96.19\% = 3.81\%$$

Therefore, this diesel level measurement system has demonstrated commendable accuracy in recent evaluations. The average accuracy calculated from sensor stands at approximately 96.19% and error rate is 3.81%. This implies that, on average, our sensor readings closely align with mechanical measurements, showcasing the system's accuracy and reliability.

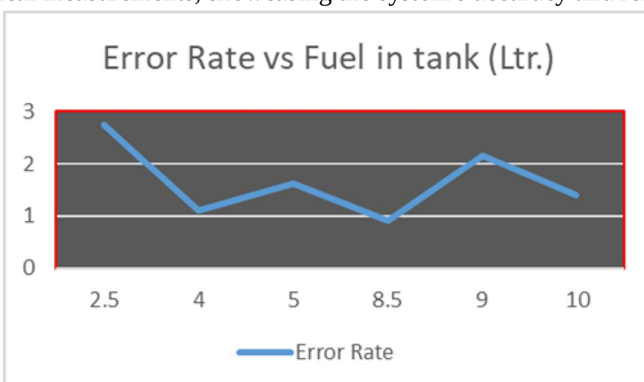


Figure 3: Graphical representation of error rate vs fuel in tank

Most of the time, both the positive and negative mistakes fall into a narrow range. The inaccuracies show a fair degree of regularity in measurement disparities, ranging from +0.91% to +2.75%. Environmental variables seem to have an impact on the constant mistakes in the readings. This implies that there could be an environmental mistake influencing the measuring procedure. To improve measurement accuracy, think about looking into and taking care of certain environmental factors.

B. Efficiency gains:

The activities were expedited as a consequence of the capacitive sensors' continuous monitoring capabilities, which removed the requirement for frequent manual intervention. This efficiency increase contributes to increased overall production and is especially noteworthy in businesses where fuel management is a crucial element of everyday operations.

C. Low-maintenance system:

The capacitive sensors' lack of moving parts made them a low-maintenance device. This feature reduced operating expenses related to maintenance and repairs by minimizing downtime. The experiment effectively shown that a dependable and reasonably priced gasoline monitoring system is feasible.

D. User-Interface

For a mobile application, a user interface has been created that effectively conveys information about the level of the diesel tank. Through the use of WebSocket technology, the app's simple UI and large start button allow users to connect to the sensor with ease. The program instantly obtains and presents real-time diesel level readings upon launch.

In order to improve customers' capacity to obtain precise and fast information on the status of their diesel tank for well-informed decision-making, this solution attempts to offer a smooth and user-friendly experience.

Figure 4: mobile app interface.

V. CONCLUSION

The Diesel Level Monitoring System that is being presented offers a reliable way to track the quantity of diesel fuel. in manufacturing processes in the present moment. Compatibility between the sensing device and microcontroller is guaranteed by the voltage mapping method, and data transfer to an Android Studio-based client is made easy by the WebSocket interaction framework. Steady sensor operation and exact data interpretation are facilitated by the regulated power supply and correct voltage mapping. The client program gives customers a user-friendly interface for remote monitoring, enabling them to make well-informed decisions. This system offers a scalable solution with potential uses in other commercial contexts, in addition to meeting the current demand for diesel level tracking. The results open up new avenues for sensor-based technology development and wider applications in controlling fluids across sectors.

VI. FUTURE SCOPE

As this fuel level monitoring system using a capacitive sensor becomes more popular, its potential applications will grow into a number of important fields, advancing efficiency, sustainability, and safety. Potential future advancements and uses include the following:

1) Integration of Cloud Computing with Internet of Things: Using Internet of Things (IoT) capabilities for centralized monitoring across several sites, allowing for data-driven decision-making, predictive maintenance, and real-time data analysis.
2) Machine Learning for Predictive Analysis: Using machine learning algorithms to improve forecasting abilities, examine past data, project fuel usage in the future, and optimize refueling plans.
3) Enhanced Security Measures: Adding cutting-edge security elements to protect the confidentiality and integrity of data under observation, such as multi-factor authentication and encryption algorithms.

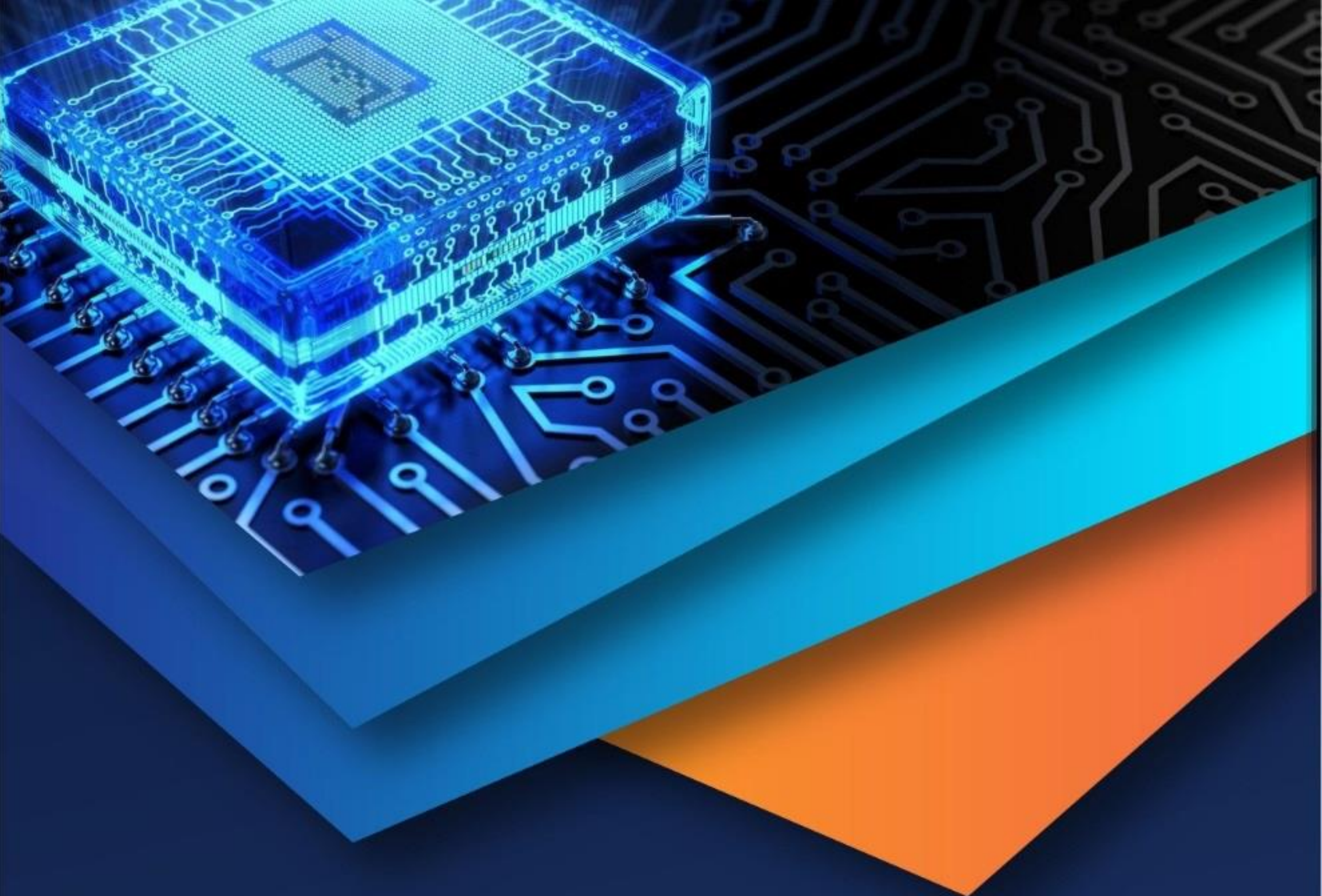
REFERENCES

[1] R. Krishnasamy, R. Aathi, B. Jayapalan, K. Karthikeyen, and M. Nowfal, "Automatic fuel monitoring system", Int. J. Recent Technol. Eng., vol. 8, 2019, page no. 1–5.

[2] Obikoya, Gbenga, "Design, construction, and implementation of a remote fuel-level monitoring system", EURASIP Journal on Wireless Communications and Networking, 2014, page no. 76.

[3] Raj Patel, Hitesh Pungalia, Saurabh Mahajan," Flow Meter and Arduino Based Fuel Gauge for Automotive Vehicles", IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE) e-ISSN: 2278-1684, Volume 13, Issue 5 Ver. VII (Sep. - Oct. 2016), PP 85-92

[4] K S Balasubramani, S Thangavel, S Vignesh and Sathish R." Embedded System Based Digital Fuel Gauge for Automobiles", International Conference on Information Engineering, Management and Security 2016 [ICIEMS], Vol 1.



10.22214/IJRASET

INDEX COPERNICUS

45.98

IMPACT FACTOR: 7.129

TOGETHER WE REACH THE GOAL

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY