M.KUMARASAMY
COLLEGE OF ENGINEERING
NAAC Accredited Autonomous Institution
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ISO 9001:2015 Certified Institution
Thalavapalayam, Karur – 639 113.

A Minor Project Report

on

PETROL BUNK FUEL FRAUD SELF DETECTOR UNIT

Submitted by

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

M.KUMARASAMY COLLEGE OF ENGINEERING

(An Autonomous Institution Affiliated to Anna University, Chennai)

THALAVAPALAYAM, KARUR-639113.

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M.KUMARASAMY COLLEGE OF ENGINEERING

(Autonomous Institution, Affiliated to Anna University, Chennai)

BONAFIDE CERTIFICATE

Certified that this Report titled **"PETROL BUNK FUEL FRAUD SELF DETECTOR UNIT"** is the Bonafide work of **ABISHEK.B(927622BEE002),DINESHKUMAR.J (927622BEE027),FAHMITHA.H(927622BEE031),KASIVISVANATHAN.K (927622BEE054),KARTHICK.R (927622BEE305)** who carried out the work during the academic year (2023-2024) under my supervision. Certified further that to the best of my knowledge the work reported herein does not form part of any other project report.

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Submitted for Minor Project III (18EEP301L) viva-voce Examination held at M.Kumarasamy College of Engineering,Karur-639113 on ……..

DECLARATION

We affirm that the Minor Project report III titled "**PETROL BUNK FUEL FRAUD SELF DETECTOR UNIT"** being submitted in partial fulfillment for the award of **Bachelor of Engineering in Electrical and Electronics Engineering** is the original work carried out by us.

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VISION AND MISSION OF THE INSTITUTION

VISION

- ✓ To emerge as a leader among the top institutions in the field of technical education

MISSION

- ✓ Produce smart technocrats with empirical knowledge who can surmount the global Challenges.
- ✓ Create a diverse, fully-engaged, learner - centric campus environment to provide Quality education to the students.
- ✓ Maintain mutually beneficial partnerships with our alumni, industry, and Professional associations.

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

VISION

To produce smart and dynamic professionals with profound theoretical and practical knowledge comparable with the best in the field.

MISSION

- ✓ Produce hi-tech professionals in the field of Electrical and Electronics Engineering by inculcating core knowledge.
- ✓ Produce highly competent professionals with thrust on research.
- ✓ Provide personalized training to the students for enriching their skills.

PROGRAMME EDUCATIONAL OBJECTIVES(PEOs)

- ✓ **PEO1:** Graduates will have flourishing career in the core areas of Electrical Engineering and also allied disciplines.
- ✓ **PEO2:** Graduates will pursue higher studies and succeed in academic/research careers
- ✓ **PEO3:** Graduates will be a successful entrepreneur in creating jobs related to Electrical and Electronics Engineering /allied disciplines.
- ✓ **PEO4:** Graduates will practice ethics and have habit of continuous learning for their success in the chosen career.

PROGRAMME OUTCOMES(POs)

After the successful completion of the B.E. Electrical and Electronics Engineering degree program, the students will be able to:

PO1: Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design/Development of solutions:

Design solutions for Complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety,and the cultural, societal and environmental considerations.

PO4: Conduct Investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6: The Engineer and Society: Apply reasoning in formed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7: Environment and Sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Individual and Team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multi-disciplinary settings.

PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: Project Management and Finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multi-disciplinary environments.

PO12: Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES(PSOs)

The following are the Program Specific Outcomes of Engineering Students:

- **PSO1:** Apply the basic concepts of mathematics and science to analyse and design circuits, controls, Electrical machines and drives to solve complex problems.
- **PSO2:** Apply relevant models, resources and emerging tools and techniques to provide solutions to power and energy related issues & challenges.
- **PSO3:** Design, Develop and implement methods and concepts to facilitate solutions for electrical and electronics engineering related real-world problems.

Abstract (Key Words)	Mapping of POs and PSOs
• Power supply • Arduino uno • Ultrasonic sensor • LCD display	PO1,PO2,PO3,PO4,PO5,PO6,PO7,PO8,PO9,PO10,PO11,PO12,PSO1,PSO2, PSO3.

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We would like to express my deep gratitude to our Minor Project Guide **Mr.G.Subramaniam M.E., Assistant Professor, Department of Electrical and Electronics Engineering,** for his constant encouragement, kind co-operation, valuable suggestions and support rendered in making our project a success.

We offer our wholehearted thanks to our Minor project coordinator **Ms.B.Sharmiladevi Assistant Professor, Department of Electrical and Electronics Engineering,** for his constant encouragement, kind co-operation and valuable suggestions for making our project a success.

We are glad to thank all the **Faculty Members** of **Department of Electrical and Electronics Engineering** for extending a warm helping hand and valuable suggestions throughout the project.

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ABSTRACT

Fuel fraud is a growing concern in the petrol retail industry, where dishonest practices such as tampering with fuel dispensers or diluting fuel are common. To address this issue, we propose a **Petrol Bunk Fuel Fraud Self-Detector Unit**, a system designed to autonomously detect and prevent fuel fraud at petrol stations. The proposed unit integrates advanced sensors, microcontroller-based processing, and a user interface to monitor and authenticate fuel quality and quantity in real time. The system utilizes **flow sensors** to track fuel dispensing, ensuring that the volume being dispensed matches the indicated amount. Additionally, **temperature sensors** help verify the quality of fuel by detecting any discrepancies caused by dilution or improper storage. A **microcontroller** processes data from these sensors and cross-references it with pre-set parameters for normal fuel dispensing operations. If any anomalies are detected—such as under-dispensing or irregular fuel composition—the system immediately alerts the station operator and records the incident for further investigation.

This fraud detection system enhances transparency and helps establish trust between fuel suppliers and consumers. It also reduces the potential for significant financial losses for both consumers and petrol bunk operators. The unit is easy to install and can be retrofitted into existing fuel dispensers, offering a cost-effective solution for preventing fuel fraud without disrupting daily operations. The Petrol Bunk Fuel Fraud Self-Detector Unit can significantly contribute to maintaining the integrity of fuel distribution systems, promoting fair practices, and ensuring quality assurance at petrol stations.

CHAPTER 2
LITERATURE REVIEW

Paper 1: Fuel Dispenser Accuracy and Calibration

Accurate fuel dispensing is crucial for preventing fraud. Various studies have explored ways to improve the calibration and maintenance of fuel dispensers. Research by Wang et al. (2015) highlighted how modern fuel dispensers can integrate with smart sensors and microcontrollers to improve measurement accuracy, preventing discrepancies between the fuel dispensed and the price paid. Their system focused on flow-rate sensors and pressure monitoring to detect inconsistencies that could point to fraudulent activity.

Paper 2: Detection of Fuel Adulteration

Fuel adulteration, where lower-quality or mixed fuels are sold to consumers, is another common form of fraud. Several studies have focused on methods for detecting adulterated fuel. Jain and Singh (2018) developed a fuel quality sensor system using advanced chemical detection technologies like infrared spectroscopy. The system could accurately distinguish between pure and adulterated fuel, providing a real-time warning to both the consumer and the petrol station operator when a sample did not meet prescribed standards.

Paper 3: Integration of IoT and Real-time Monitoring

The integration of the Internet of Things (IoT) in fuel monitoring systems has gained significant attention in recent years. The use of IoT sensors enables real-time data collection and analysis to detect fraud. In Ravi and Kumar (2020), IoT-based fuel monitoring systems were proposed, where flow sensors, temperature sensors, and pressure sensors collected data continuously. This system was able to send alerts if discrepancies were detected, allowing immediate corrective actions. The researchers highlighted the need for low-cost, efficient sensors that could be easily deployed across existing fuel dispensers.

Paper 4: Machine Learning for Anomaly Detection

As fraud detection systems become more sophisticated, machine learning (ML) has been applied to detect irregularities. Patel et al. (2019) proposed a machine learning model that analyzes fuel flow data and identifies patterns indicative of fraud. The system used historical data on normal fuel dispensing practices to "train" the algorithm, allowing it to recognize fraudulent behaviors such as under-delivery or unusual patterns in the rate of fuel flow.

Paper 5: Consumer Awareness and Mobile Integration

Several studies have emphasized the importance of consumer awareness in preventing fuel fraud. Srinivasan and Ravi (2021) proposed integrating a mobile application with fuel dispensers, allowing consumers to monitor their fuel delivery in real-time. Through this app, consumers could receive alerts if discrepancies were detected in the amount of fuel dispensed or in its quality, promoting transparency and empowering consumers to report fraudulent behavior instantly.

Paper 6: Cost-effective Solutions for Small Petrol Stations

The cost of implementing fraud detection systems can be a barrier for smaller petrol stations. Studies such as Singh et al. (2022) explored low-cost solutions that could be easily adopted by small-scale fuel retailers. Their design utilized basic sensors and microcontroller-based systems, paired with mobile notifications, ensuring that even small stations could afford to implement a fraud detection mechanism without significant financial burden.

CHAPTER 3

PROPOSED METHODOLOGY

3.1 BLOCK DIAGRAM

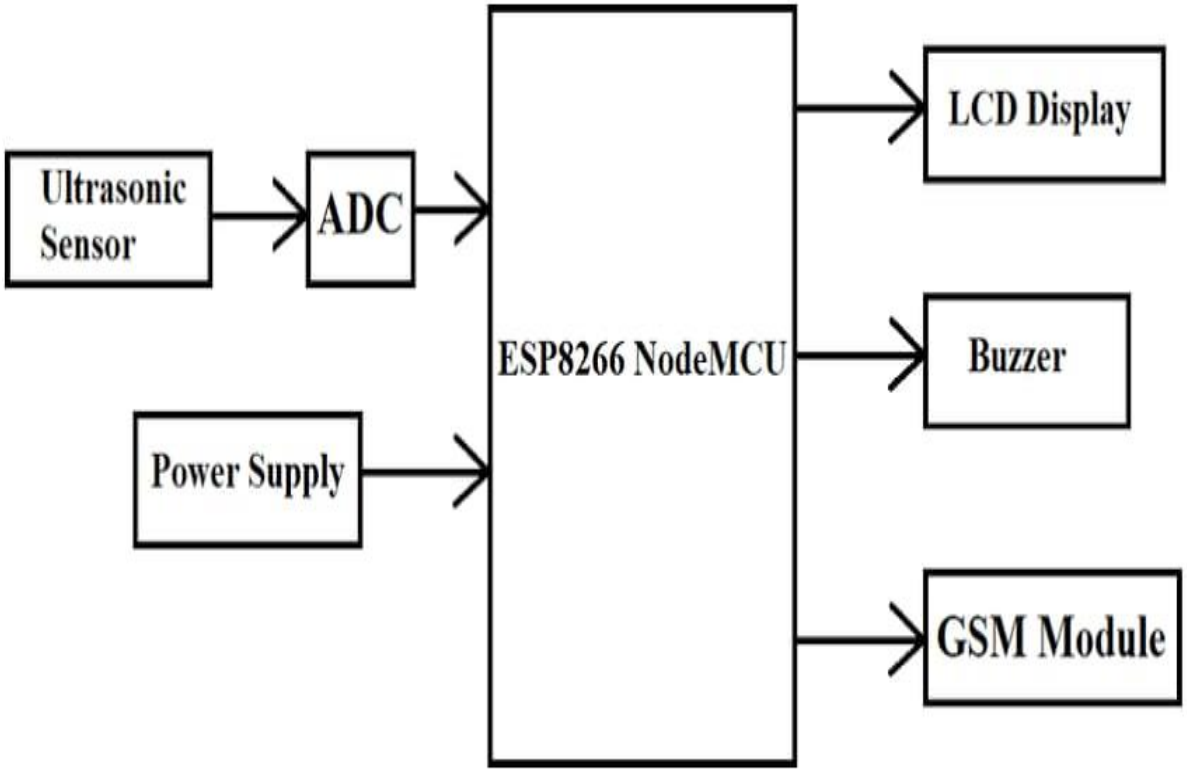

Fig 3.1: BLOCK DIAGRAM OF THE PROJECT

3.2 DESCRIPTION OF PROJECT

The **Petrol Bunk Fuel Fraud Self-Detector Unit** is an advanced system designed to ensure accurate fuel dispensing, prevent fraud, and maintain fuel quality at petrol stations. The unit integrates real-time monitoring of fuel quantity and quality, detecting discrepancies such as under or over-dispensing, tampering, or contamination in the fuel. It features smart alerts, data logging, and remote monitoring capabilities, allowing petrol station owners, customers, and authorities to track transactions and identify fraudulent activities. This system ensures transparency, builds trust, and helps in regulatory compliance, providing a secure and efficient fuel dispensing solution.

3.3 COST OF THE PROJECT

S.NO	COMPONENT DESCRIPTION	QUANTITY	COST
1.	Power supply	1	650
2.	Ultrasonic sensor	1	850
3.	Arduino uno	1	850
4.	LCD display	1	450
5.	GSM module	1	450
		Total	3250

Table 3.3 Project- Total cost

CHAPTER 4

RESULT AND DISCUSSION

4.1 HARDWARE COMPONENTS DESCRIPTION:

ARDUINO UNO

The Arduino Uno is a popular microcontroller board based on the ATmega328P chip. It features 14 digital input/output pins, 6 analog inputs, a USB connection for programming, and a power jack. The Arduino platform allows users to write and upload code using the Arduino IDE, making it accessible for beginners and experienced developers alike.

Fig 4.1 Arduino uno

ULTRASONIC SENSOR

An ultrasonic sensor is a device that uses sound waves at frequencies higher than the audible range to measure distance or detect objects. It emits a burst of ultrasonic sound waves and then listens for the echo that bounces back from nearby objects. By calculating the time it takes for the sound to return, the sensor can determine how far away the object is.

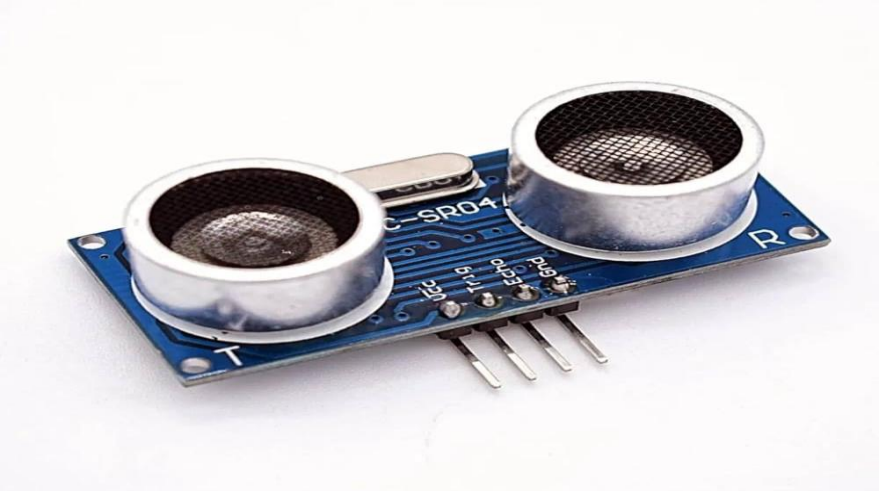

Fig 4.2 Ultrasonic sensor

LCD DISPLAY

LCD (Liquid Crystal Display) is a type of flat panel display which uses liquid crystals in its primary form of operation. LEDs have a large and varying set of use cases for consumers and businesses, as they can be commonly found in smartphones, televisions, computer monitors and instrument panels.

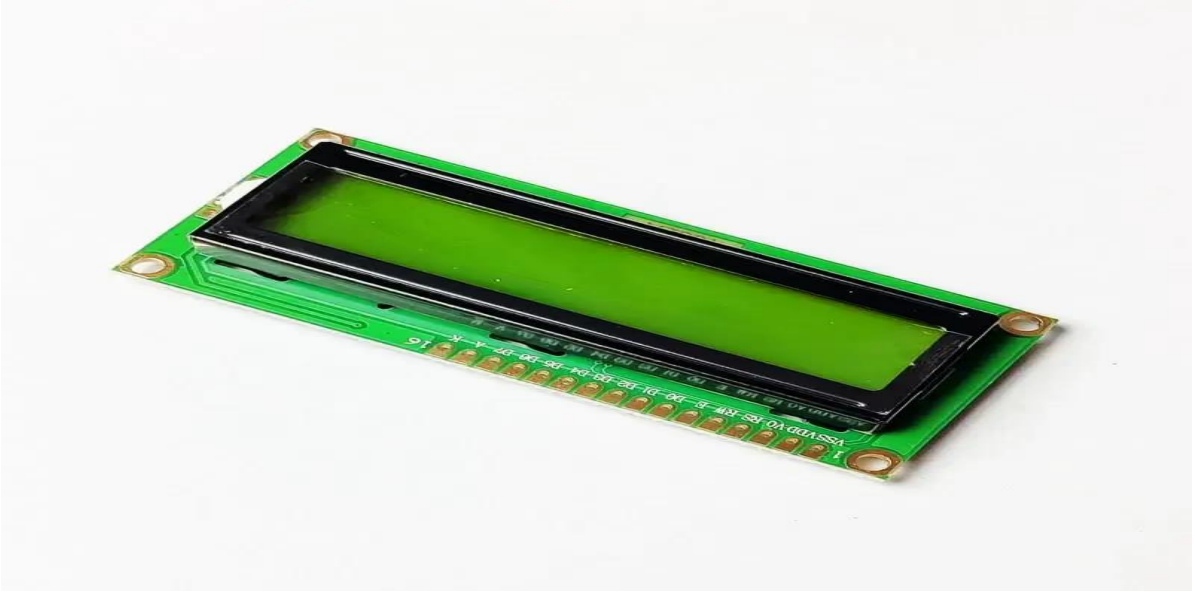

Fig 4.3 LCD display

4.2 HARDWARE KIT

2

4.3 WORKING OF THE PROJECT

A petrol bunk fuel fraud self-detecting unit functions by integrating various sensors and technologies to monitor fuel dispensing in real-time. It utilizes electronic flow meters to accurately measure the amount of fuel dispensed, detecting discrepancies between the volume displayed and the actual amount delivered. Additionally, quality sensors analyse the chemical composition of the fuel to identify any adulteration or contaminants. The unit collects data from these sensors and compares it to predefined thresholds, triggering alerts if any anomalies are detected, such as unusually low fuel volume or poor quality. A user-friendly interface displays real-time data and alerts, enabling operators to quickly address potential fraud.

CHAPTER 5

CONCLUSION

The **Petrol Bunk Fuel Fraud Self-Detector Unit** represents a significant advancement in the fuel dispensing industry, addressing critical challenges related to accuracy, fraud prevention, and fuel quality assurance. By integrating advanced sensors, real-time monitoring, and AI-driven fraud detection, the system ensures that both customers and petrol station operators benefit from transparent and reliable transactions.

This project successfully combines cutting-edge technology with practical solutions to protect consumers from unfair practices, such as under-dispensing or adulteration of fuel. It empowers petrol station owners with the tools to monitor and maintain operational integrity, while also complying with regulatory standards.

The introduction of this system will foster greater trust between customers and fuel stations, reduce operational losses due to fraud, and improve the overall efficiency of fuel dispensing operations. With its potential for scalability and real-time monitoring, the Petrol Bunk Fuel Fraud Self-Detector Unit is poised to revolutionize fuel retail, making it safer, more transparent, and more efficient for all stakeholders involved.

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