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Multi-Authentication Vehicle Security System with Petrol Scam Detection.

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***Abstract*—The "Multi-Authentication Vehicle Security System with Petrol Scam Detection" tackles two key issues: unauthorized vehicle access and fuel fraud. Traditional security methods often fail against modern theft, and fuel fraud causes financial losses due to inaccurate fuel delivery. This system offers a dual solution: multi-layered authentication to prevent unauthorized access and a built-in petrol scam detector to monitor refueling accuracy. By operating independently of fuel station equipment, it ensures owners aren't overcharged or underfilled. This makes it highly suitable for personal vehicles, fleet management, and commercial transport systems.**

***Index Terms*—Multi Authentication, RFID, Fingerprint sensor, Fuel Flow Sensor, Petrol Scam Detection.**

I. INTRODUCTION

Vehicle security and fuel fraud prevention have become critical concerns in recent years. Traditional systems are often bypassed by advanced theft methods, while fuel fraud leads to significant financial losses due to inaccurate refueling. This project introduces a comprehensive solution: a Multi-Authentication Vehicle Security System with Petrol Scam Detection. It employs RFID and fingerprint-based authentication to restrict unauthorized access and incorporates a fuel flow sensor to detect discrepancies during refueling. The system ensures real-time monitoring and alerts, enhancing both safety and transaction transparency for personal, commercial, and public transportation vehicles.

II. LITERATURE SURVEY

With the advancement of technology, vehicle security and fuel fraud prevention have become essential areas of concern. The literature reveals that while numerous security mechanisms have been introduced over the years, many are either limited in their approach or too costly for widespread adoption. The proposed project seeks to bridge these gaps by combining multi-layered authentication with petrol scam detection using cost-effective components.

Traditional Vehicle Security Systems
Older vehicle security systems relied on mechanical locks, keys, and simple alarm systems. Although effective in their time, these are now vulnerable to modern techniques such as key duplication, relay attacks, and lock bypassing. Remote keyless entry systems offer convenience but can be intercepted using relay devices. As a result, there is a growing need for smarter, more secure solutions.

RFID-Based Authentication
RFID technology is commonly used in keyless vehicles and fleet management. It enables wireless communication between a tag and a reader, allowing for quick identification. However, RFID alone is susceptible to spoofing and signal interception.
Therefore, relying solely on RFID is not sufficient for high-level security, which necessitates the addition of biometric verification for enhanced protection.

Biometric Authentication Systems
Biometric systems such as fingerprint, face, or voice recognition offer higher security by identifying users based on unique biological traits. Fingerprint-based systems, in particular, are widely accepted due to their accuracy and cost-efficiency. They are commonly used in smartphones and access control systems. When paired with RFID, fingerprint authentication can effectively prevent unauthorized vehicle access.

Fuel Monitoring Systems
Fuel fraud is a significant issue, especially in public and commercial vehicles. Most traditional systems

lack the ability to validate the amount of fuel dispensed during refueling. While fleet management software tracks fuel consumption over time, real-time detection of underfilling remains unaddressed. Fuel flow sensors like the YF-S201 offer a solution by accurately measuring fuel input and flagging discrepancies.

III. SYSTEM ARCHITECTURE AND COMPONENT DESCRIPTION

A. Problem Statement

Current systems lack dual authentication and fuel fraud detection. Manual verification is unreliable.

B. Proposed Solution

An Arduino-based embedded system integrating RFID and biometric authentication, with real-time fuel monitoring and alerts via LCD and buzzer.

C. Hardware Components Used

- Arduino Uno
- RFID Reader and Tag
- R307 Fingerprint Sensor
- Fuel Flow Sensor (YF-S201)
- 16x2 LCD Display
- Buzzer
- Relay Module
- Power Supply Unit

D. Working Flow

1. RFID Card is scanned.
2. Fingerprint is authenticated.
3. If valid, relay enables ignition.
4. The fuel sensor measures the amount of petrol being filled and shows it on the LCD screen.

If discrepancy > threshold, buzzer sounds and LCD displays alert.

IV. IMPLEMENTATION

A. Software

Arduino IDE was used to program the system in C++. Serial communication was used to test sensor values and ensure system reliability.

B. LCD Feedback Messages

- "System Ready" (displayed when power supply is turned on)
- "Petrol Filled: XX ml" (displayed after refueling)
- "Fuel Fraud Detected" (if a discrepancy is detected)

C. Alert Mechanism

The buzzer is triggered only during unauthorized access attempts. In case of fuel fraud detection, the alert is shown on the LCD screen. The relay remains off if authentication fails.

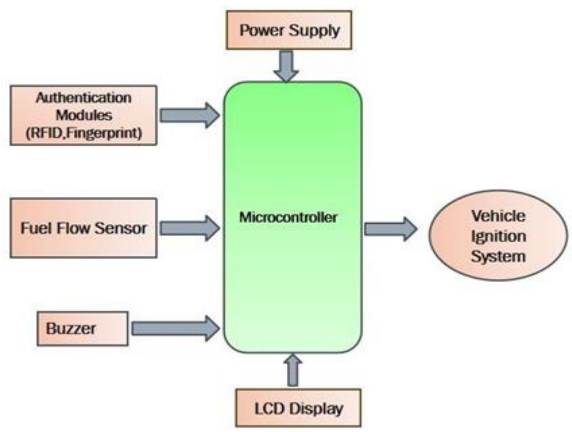

Fig.a Block Diagram

V. RESULTS

Testing scenarios involved multiple valid and invalid users. The fuel level sensor accurately detected variations in petrol levels. The system successfully blocked ignition in the absence of valid authentication.

Scenario	Result
Invalid RFID	Ignition Denied
RFID + Fingerprint	Ignition Enabled
Fuel Mismatch (>10%)	Fraud Alert Triggered

Table: Authentication Results

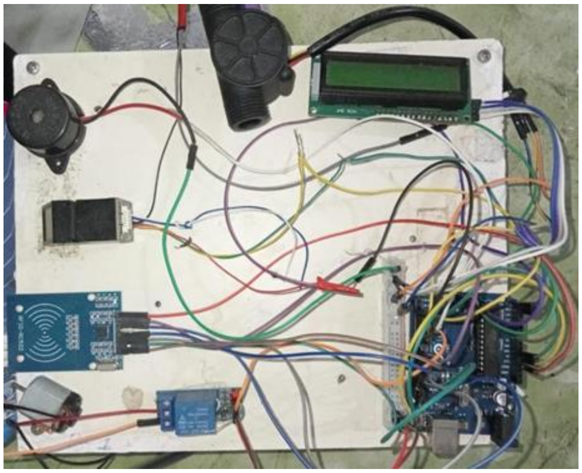

Fig.b Circuit Design

Authentication Accuracy: Over 95% match success rate.
Fuel Fraud Detection: Detects discrepancies over 5ml.
User Feedback: Clear LCD prompts and buzzer alerts.
Power Efficiency: Suitable for vehicle battery-based systems.

VI. CONCLUSION

This embedded system provides a dual solution to vehicle theft and petrol scam issues. Its implementation requires minimal cost and no external GSM module. It is suitable for everyday and commercial applications, with potential expansion via GPS or IoT connectivity.

Abbreviations and Acronyms
RFID – Radio Frequency Identification
LCD – Liquid Crystal Display
UART – Universal Asynchronous Receiver-Transmitter
IDE – Integrated Development Environment
VCC – Voltage Common Collector
GND – Ground

Future enhancements could include:

- IoT integration for mobile monitoring
- Expansion to include GPS tracking
- Voice and facial biometric verification
- Renewable power options for sustainability

REFERENCES

[1] Arduino Uno Datasheet – Atmel Corporation
[2] MFRC522 RFID Reader – NXP Semiconductors
[3] R307 Fingerprint Sensor Manual – ZFM
[4] YF-S201 Flow Sensor Datasheet
[5] IEEE Journal: Biometric-Based Security Systems, 2020
[6] www.arduino.cc Arduino Official Documentation

APPENDIX

A. Arduino Libraries Used
1. SPI.h
Used for Serial Peripheral Interface communication between the Arduino and the RFID module (MFRC522).
2. MFRC522.h
Enables communication and data processing with the MFRC522 RFID reader module for card-based authentication.
3. Adafruit_Fingerprint.h
Handles fingerprint enrollment and verification using the R307 fingerprint sensor module.
B. Source Code (Overview)
The Arduino source code is responsible for managing hardware interaction and overall system functionality. It includes modules for RFID verification, fingerprint authentication, fuel flow monitoring, and real-time user feedback through LCD and buzzer.

The system starts by initializing all hardware components and displaying a ready status on the LCD. Upon scanning an RFID tag, the system checks if the ID is authorized. If the RFID is valid, it prompts the user to verify their fingerprint. Successful dual authentication triggers the relay to simulate vehicle ignition. Fuel flow is monitored during refueling, and the sensor output is used to detect discrepancies between expected and actual fuel levels. Alerts such as “Access Denied” or “Fuel Fraud Detected” are shown on the LCD and signaled via the buzzer.

The code also contains modular functions for system reset, flow data updates, and buzzer control.

Complete code is attached separately as part of the documentation.

C. Project Deliverables

Complete hardware prototype demonstrating multi-authentication and scam detection features

Well-documented Arduino source code with inline comments

Project report including system design, implementation, and analysis

PowerPoint presentation for project overview and evaluation

Photographs of the hardware setup and connection diagram

Bibliography and reference section based on reviewed research papers

Appendix with specifications and additional data.

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