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MULTI PURPOSE FUEL DISPENSER AND EV CHARGING FOR VEHICLES

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ABSTRACT

This project presents a hybrid fuel station system based on the ESP32 microcontroller, integrating both petrol and electric vehicle (EV) charging options. The system uses RFID for user authentication and a keypad for input, ensuring secure and personalized access. A voltage sensor monitors the EV battery charging process, while a relay module facilitates switching between petrol and EV modes. An LCD displays transaction and status information in real-time. A buzzer provides alerts and feedback to the user. Data is transmitted to the cloud via IoT for monitoring and analytics. The regulated power supply ensures stable operation. This smart solution supports seamless hybrid fueling, enhancing user convenience and energy efficiency.

Keywords: Hybrid Fuel Station, ESP32 Microcontroller, EV Charging, Voltage Sensor, IoT Monitoring.

1. INTRODUCTION

The dispensing of the fuel to huge number of vehicles at the fuel stations has caused many complications in India. The vehicle driver has to pay for fuel with cash money and may have to pay more than the amount of dispensed fuel due to the lack of small money change available with station operator. RFID Based Automated Petrol Pump is to reduce human work and develop an auto-guided mechanism and to implement the task sequentially by using RFID technology. These systems are highly reliable and less time-consuming devices. The components used in this project are 8051 Microcontroller, RFID tags, Power supply, an LCD display, a Motor driver and an RFID reader. Petroleum products are one of the valuable and rare creations of the nature. The proper use and distribution are an important task to survive these products. A fuel station is a facility which sells fuel and lubricants via fuel dispensers which themselves are used to pump gasoline, Diesel, kerosene, etc. into vehicles and to calculate the financial cost of the product thus dispensed the emergency of radio frequency technology has changed the traditional methods of data collection. Compared to the traditional bar code, magnetic card and IC cards, RFID tags.

2. LITERATURE SURVEY

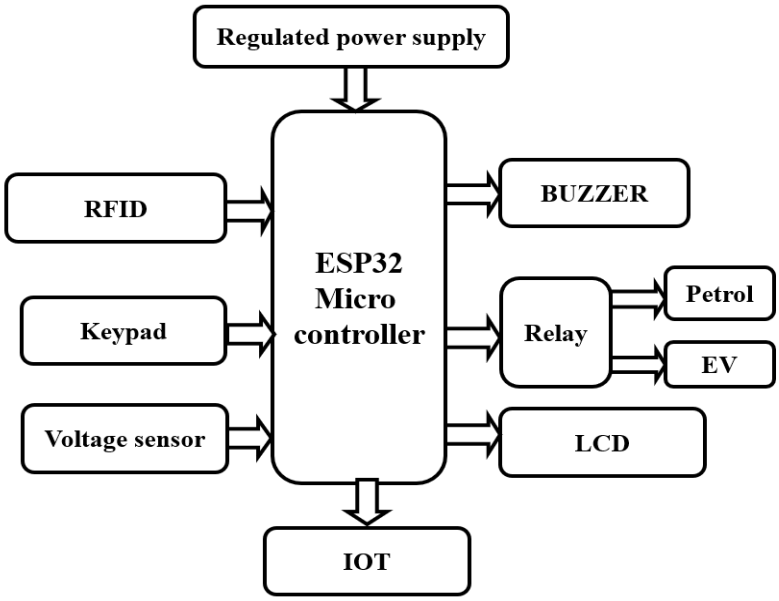
Petroleum products are one of the valuable and rare creations of the nature. The proper use and distribution is an important task to survive these products [1]. A fuel station is a facility which sells fuel and lubricants via fuel dispensers or otherwise called browers which themselves are used to pump gasoline, Diesel, kerosene, etc. into vehicles and to calculate the financial cost of the product thus dispensed [1]. Enterprises engaged in urban and suburban public transport as well as other transport enterprises big fuel consumers, need control of fuel delivery to prevent or at least minimize the misuse of the fuel [2]. The emergency of radio frequency technology has changed the traditional methods of data collection. Compared to the traditional bar code, magnetic card and IC cards, RFID tags have the features of non-contact, reading speed, no wear, long life, user friendly and the security function [7]. The use of RFID for vehicle identification, toll collection, traffic

management have already been experimented with extensively [8]. This paper proposes the implementation of RFID technology in controlling fuel dispensing for an Indian cities.

Internet of Things (IoT) is the network of joined devices, mechanical and digital machines, automobiles, home appliances and other things inserted with sensors, software, control keys and connectivity which allow these things to attach to a network and gather and exchange data [1, 2]. Smart petrol pump is a petrol pump based on internet of things [3-5], where the rise in the number of cars in Iraq in current years has guided to the congestion and traffic jams in almost all cities of Iraq[6- 9]. The supply of the fuel to this enormous number of automobiles at the fuel stations has produced many difficulties in Iraq. The automobile driver has to pay for fuel with cash money and may have to pay above than the amount of distributed fuel because of the lack of small money change unused with station worker. The role of the software and hardware that base the Arduino program is to reduce problems when working on an electronic project [10, 11]. ATmega2560 is an electronic circuit board that support you make shared objects by evaluating information from the real world, treating these information, and then getting action in the world suitably [12-13].

3. PROPOSED SYSTEM

The main aim of the project is to design a system which is capable of automatically deducting the amount of petrol dispensed from user card based on RFID technology. Liquid dispensing systems are quite commonly found in our daily life in different places like offices, Bus stands, Railway stations, Petrol pumps. Here we are going to present modern era petrol dispensing system which is meant to be operated with prepaid card using RFID technology. The project mainly aims in designing a prepaid card for petrol bunk system and also petrol dispensing system using RFID technology. In current days the petrol stations are operated manually. These petrol pumps are time consuming and require more man power. To place petrol stations in distant area is very costly to provide excellent facility to the consumers. All these problems are sorted out by the use of unmanned power pump which requires less time to operate and it is effective and can be installed anywhere. The customer self-going to avail the service has to done the payment by electronic clearing system.



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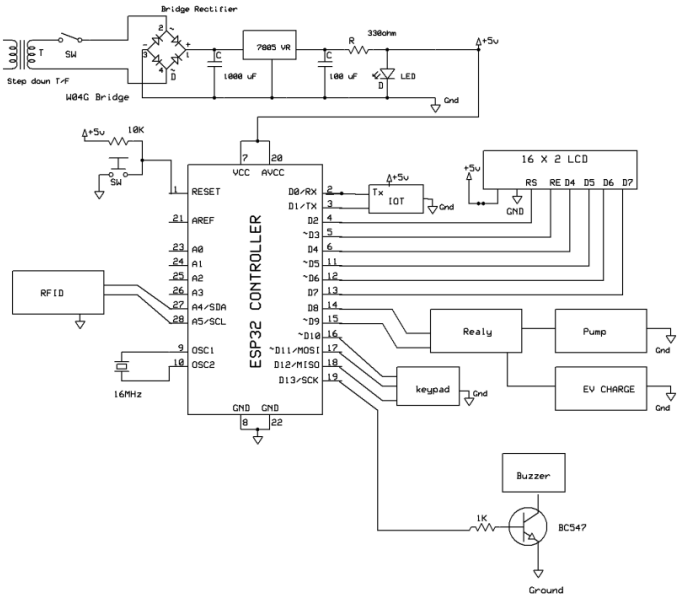
AC pump/ DC EV charge station operated by relay which is connected to Arduino digital pin. 4X4 matrix keypad connected to Arduino digital pins. In this project initially we have to swipe RFID card and need to enter password. If password is correct then it asks amount. After entering amount Petrol pump or EV charge machine will ON and fuel will dispense according to amount.

Schematic Diagram



In this proposed petrol pump automation system, we are using RFID card to access petrol at different petrol stations of different petrol companies across the country and here, we are connecting all these petrol stations. Whenever we want to fill the tank from the fuel dispenser, we just have to place the RFID card near the RFID reader. Then the microcontroller reads the data from the RFID reader and performs the action according to the customer requirements. This digital petrol pump system also provides the security for the customers for filling petrol at the Petrol stations by avoiding the involvement of human beings, hence reduces the risk of carrying money every time. This petrol pump system consists of Atmega328 microcontroller, RFID module, LCD display, Ac pump and alarm.

This is the pin diagram where all the hardware components are been connected components. this ARDUINO microcontroller having 28 pins. In which 14 GPIO pins as digital pins and 6 GPIO pins. 16MHz crystal oscillator connected internally. The step down transformer, Bridge rectifier capacitor with 1000f Resisters and led are connected in Regulated power supply which provide the 5v to the Arduino and all input/output modules.

16*2 LCD Monitor has connected with the Digital pins 2, 3, 4,5,6,7.

RFID has connected to Digital Pins D0, D1 internal Transmitter and receiver pins.

DHT11 connected to A0 pins of the Arduino micro controller.

Keypad connected to digital pin 9,10,11

Fire sensor connected to digital pin 8

Buzzer alarm connected to digital pin 13

Logic Explanation

This Arduino sketch appears to be designed for a fuel dispenser system, involving a keypad, card reading, and relay control. Here's an explanation of the major parts of the code:

Libraries and Global Variables: The code includes the LiquidCrystal library and defines a LiquidCrystal object to control an LCD screen. Various global variables are declared to manage pins, including pins for switches, relays, a buzzer, and variables for storing card input and password.

keypad() Function: This function handles user input using three switches (swi, swe, swd) to select options and input a password. The user can increment, decrement, and enter digits to create a password.

Fuel Type Variable: fuel_type is a character variable ('x' by default) used to store the selected fuel type ('e' for electric or 'p' for petrol).

setup() Function: The setup() function initializes various components, including setting pin modes and initializing the LCD. It also initializes serial communication with both the primary Serial and a SoftwareSerial instance (mySerial). Relays, the buzzer, and the switches are set to their initial states.

loop() Function: The main logic of the code resides in the loop() function. It listens for input data from a card reader or keypad.

Card Reading Logic: If a card with the code "180081F24229" is detected, it enters a validation loop. The user is prompted to select the fuel type ('e' for electric or 'p' for petrol). The user is then prompted to enter a password using the keypad. If the entered password is correct (1234), the code proceeds to select the amount of fuel to dispense. The selected amount is deducted from the initial amount (amount1), and the appropriate relay (relay1 for electric, relay2 for petrol) is activated for the duration of the fuel dispense. After the dispense is complete, the relay is turned off.

Invalid Card Logic: If a card with the code "1900673A83C7" is detected, it indicates an invalid card, and the buzzer is activated.

String Handling and Serial Communication: The code relies on serial communication to receive input data from external devices (such as a card reader). The serialEvent() function processes incoming serial data and stores it in the inputString variable. When a complete card code is received (12 characters), stringComplete is set to true, indicating that the code can be processed.

Conversion Functions: Several conversion functions (converts(), converts1(), convertl(), and convertk()) are used to convert integers to characters for displaying on the LCD.

LCD Display: The LCD screen displays various messages and user prompts throughout the program.

Infinite Loop and Restart: The code uses a label (mn1) and a goto statement to create an infinite loop. After processing a card, it clears the inputString and restarts the loop.

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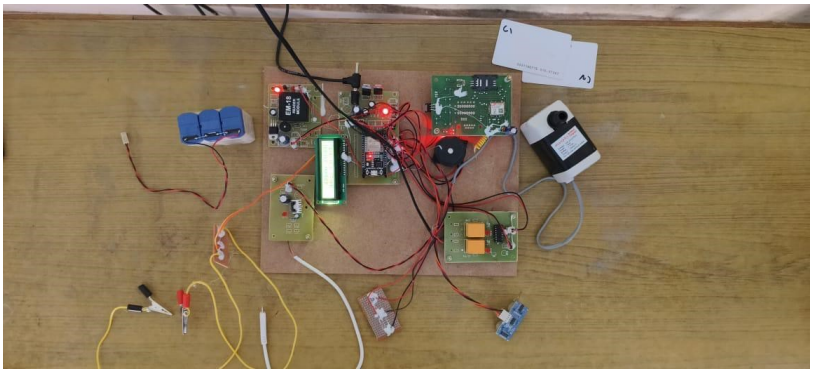
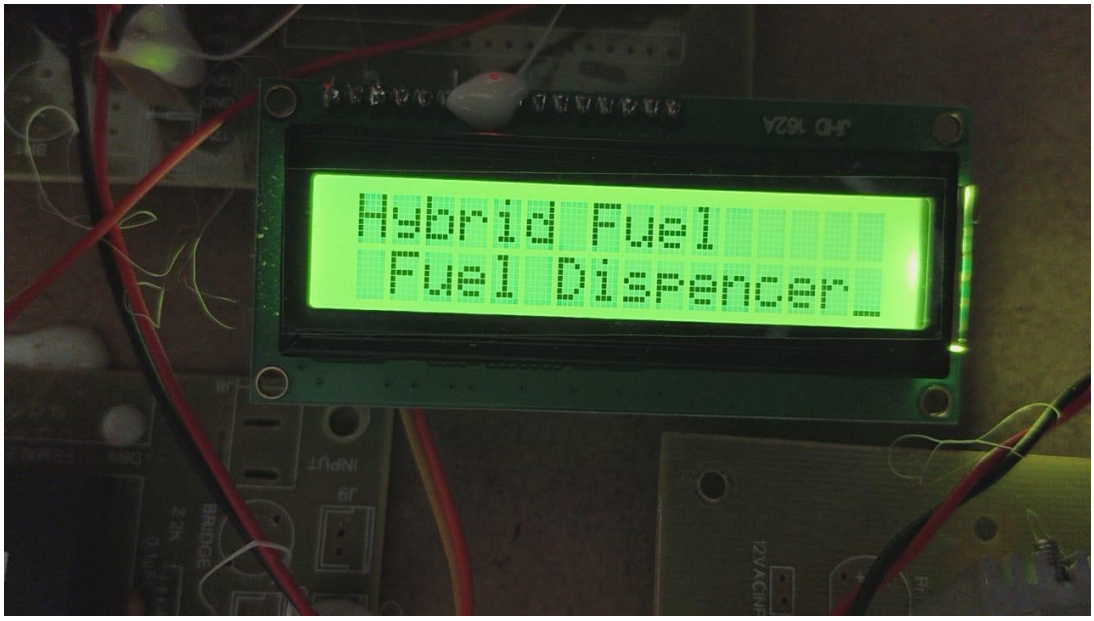
Buzzer Feedback: The buzzer is used for auditory feedback, such as indicating an invalid card.

4. RESULTS





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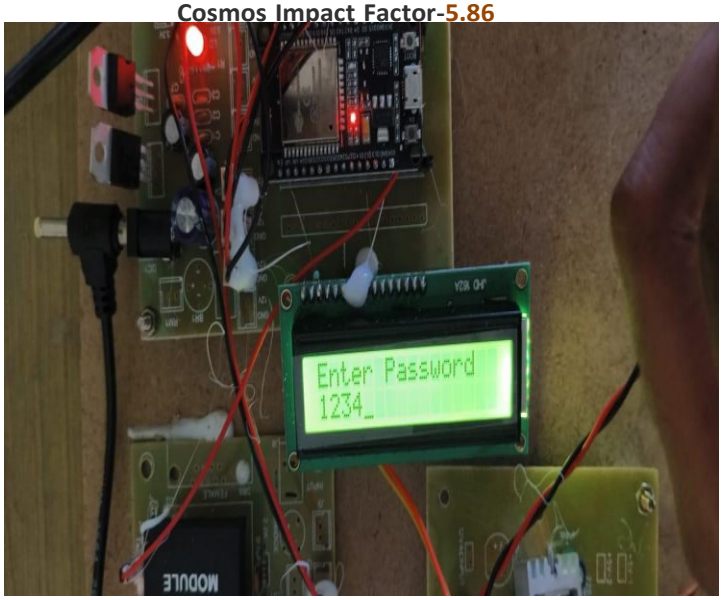

S.No	Fuel_Dispencer_System	Level_status	Battery	Date
1		U:800_Low_Level	12.64	2025-04-22 18:40:05
2	Fuel_Type_EV_Correct_Password_Blc_0	U:2_Normal_Level	12.64	2025-04-22 18:39:22
3	Fuel_Type_Petrol_Correct_Password_Blc_200	U:3_Normal_Level	12.61	2025-04-22 18:36:09
4	Fuel_Type_Petrol_Wrong_Password_	U:3_Normal_Level	12.63	2025-04-22 18:29:14
5	Invalid_Card_	U:3_Normal_Level	12.64	2025-04-22 18:26:34
6	Fuel_Type_Petrol_Correct_Password_	U:5_Normal_Level	12.61	2025-04-22 18:25:42
7		U:4_Normal_Level	0.00	2025-04-22 18:18:42
8		U:3_Normal_Level	0.00	2025-04-22 18:17:46
9		U:5_Normal_Level	0.00	2025-04-22 18:17:03
10		U:16_Normal_Level	0.00	2025-04-22 18:16:20
11	Fuel_Type_Petrol_Correct_Password_Blc_330	U:4_Normal_Level		2025-04-21 15:53:01
12		U:153_Low_Level		2025-04-21 15:50:33
13	Fuel_Type_Petrol_Correct_Password_Blc_410	U:4_Normal_Level		2025-04-21 15:49:33
14	Fuel_Type_Petrol_Wrong_Password_	U:5_Normal_Level		2025-04-21 15:46:57
15		U:150_Low_Level		2025-04-21 15:44:48
16	Fuel_Type_EV_Correct_Password_	U:4_Normal_Level		2025-04-21 15:44:06
17		U:150_Low_Level		2025-04-21 15:40:31

5. CONCLUSION

This project is meant for security systems whose access is only for respected authorities. Using a microcontroller, the petrol pump is equipped with a smart card reader/write. At the Petrol Pump, the driver swaps the card and the smart card reader reads the amount in the card and will display it on the LCD. The driver then enters the quantity of petrol that has to be filled using a keypad. The corresponding amount is calculated & deducted from his petro card. The electrical pump is then turned ON according to the entered amount, fills the tank and automatically turns OFF. Our electronic system performed as expected. We were able to implement all the functions specified in our proposal. The biggest hurdle we had to overcome with this project was interfacing the micro controller with the hardware components. We feel that this electronic system is very marketable because it is easy to use, comparatively inexpensive due to low power consumption, and highly reliable. By using this project one can design a secured system. For filling petrol to vehicles at the petrol bunks using Smart Card based Accessing System.

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