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RFID Based Petrol pump Automation System.

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Abstract : Everything is digitized. In many existing systems, almost all gas pumps have a control unit to perform tasks such as driving electric pump, usage indicator, measure current and turn off the electric pump accordingly. But still a person must collect money and there are many human errors. That's it offered a fuel pump automation system, we are Using the RFID card to use petrol stations of different fuel companies country and here we connect all those petrol stations use a single web server. This web server access is protected only by a known password for petrol companies. Whenever we want to fill tank of the oil tank, we just need to set RFID card near the RFID card reader. also, the microcontroller reads data from the RFID card reader and performs the procedure according to the order standard This digital oil pump system as well offers guests security to comply avoiding fuel at fuel stations human participation that reduces risk bring cash with you every time. This fuel pump system consists of an Atmega328 microcontroller, RFID module, LCD screen, Keyboard, Node MCU, Ultrasonic Sensor, GSM module AC pump and alarm. If the RFID reader, reads the card and asks for a 3-digit password when we enter the wrong password more than twice, it will wake up alarm clock And if the correct password is entered, it is turned on system, the system asks for the amount and that also shows the balance amount. Ultrasonic sensor gives available fuel in the tank. To the entrance the engine starts and the fuel fills up from fuel tank. After a message about successful fueling is sent to the address registered mobile phone number via GSM module. If the card has been stolen, the user can close the card Android application. Full event details monitored by Node MCU IoT.

IndexTerms **- RFID, Microcontroller, Dispensing system, Node MCU, Ultrasonic sensor, IOT, Automated Petrol Pump system.**

1.INTRODUCTION

The filling of the oil to enormous number of vehicles at the fuel stations has caused many difficulties in India. The vehicle motorist has to pay for oil with cash and may have to pay further than the quantity of allocated oil due to the lack of small cash change available with station operator. RFID-Based Automatic Gasoline Pump Reduces Natural Labor and Develops a Motorized Environment and Performs Tasks Sequentially Using RFID Technology. These systems are largely dependable and lower time- consuming bias.. The components used in this project are Atmega Microcontroller, RFID tags, Power supply, an LCD display, a Motor driver and an RFID reader. Petrol is the most consuming product in the world. 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 fiscal cost of the product therefore allocated the exigency of radio frequence technology has changed the traditional styles of data collection. Compared to the traditional disbenefit debit & Credit cards.

1.1 WHAT IS RFID

Radio frequency identification(RFID) is an involuntary identification system grounded on data storehouse and remote recapture using RFID cards or cards. This technology requires extended cooperation between the RFID card reader and the RFID cards.
An RFID cards is an item that can be fixed and attached to a product, beast or person to identify and track the existent using radio cards. Some RFID markers can be read from several measures down depending on the strength of their sequence outside the line ofsightofthecardreader.

1.2. COMPONENTS OF RFID

RFID (Radio Frequency Identification) readers consist of several key components that work together to read and communicate with RFID tags. The main components of an RFID reader include:
Antenna: The antenna is the component of the RFID reader that sends out the radio waves and receives signals from the RFID tags. The antenna can be either internal or external depending on the reader type.

Transceiver: The transceiver is responsible for transmitting and receiving data between the reader and the RFID tag. It converts the radio waves received by the antenna into digital data that can be understood by the reader.

Decoder: The decoder is responsible for decoding the digital data received by the transceiver into readable information. It converts the data into a format that can be understood by the computer or other device that is connected to the reader.

Control unit: The control unit is responsible for managing the communication between the reader and the RFID tag. It also controls the operation of the reader and manages the data received from the RFID tag.

Interface: The interface is the connection point between the RFID reader and the computer or other device that is used to process the data. It can be either wired or wireless, depending on the type of reader and the application.

1.3. ADVANTAGES OF RFID OVER CREDIT CARD & DEBIT CARDS

•***Increased efficiency***: RFID technology allows for faster transactions compared to traditional credit cards, as data is transferred wirelessly without the need for physical contact.
•***Improved security***: RFID technology is less susceptible to counterfeiting, skimming and other fraud compared to traditional credit cards and debit cards.
•***Contactless payments***: RFID eliminates the need for physical contact, reducing the risk of spreading germs and increasing hygiene.
•***Greater convenience***: RFID enables faster, more convenient transactions and eliminates the need for carrying cash or multiple cards.
•***Greater data storage***: RFID chips have a larger memory capacity compared to traditional credit cards, allowing for greater storage of personal and financial information.

2. BLOCK DIAGRAM

The microcontroller which is the heart of the system stores details of several cards and data comparison is done by the RFID reader. When both the data of the card and microcontroller are matched, it will send the control signal to the relay so that the motor starts rotating to pump petrol.
In this system we proposed three simple RFID smart cards.one is user card another is admin card and the remaining is invalid card. When the user reaches the petrol station to fill the fuel at the station, firstly he will show the card. If the card is valid, the card reader will accept the card and then it moved to further steps. Then it will ask for the password. If the entered password by the user is valid then it will process and ask for the amount for the petrol to be filled. In such a way this dispenser works.
If suppose the user shows with unauthorized card, then the reader will not able to recognized the card and it will display the error message as the card is unauthorized. so, the system is fully secured. It is done using low cost micro- controller. so the cost of the total system will be reduced.
The block diagram consists of Atmega328 microcontroller, RFID module, LCD display, Keypad, Node MCU, ultra-sonic sensor, GSM module Ac pump and buzzer.

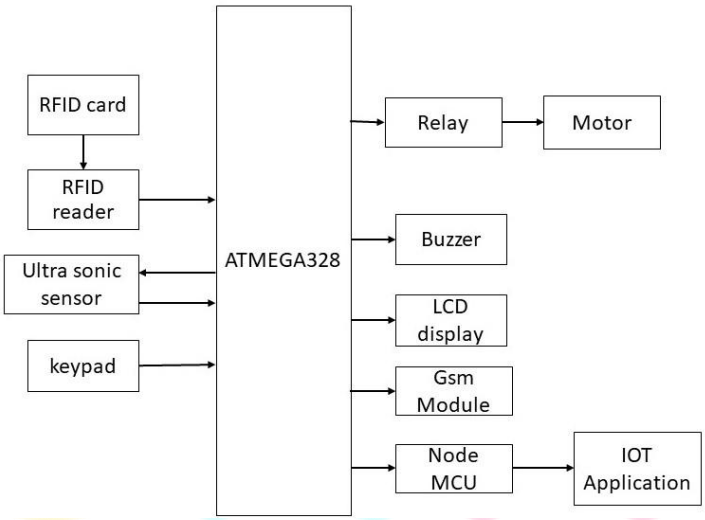


Fig-1:Block Diagram

3.HARDWARE REQUIREMENTS

1.ATMEGA328 Microcontroller
2.RFID tag
3.RFID reader
4.Relay
5.LCD display
6.Keypad
7.Motor
8.Node MCU
9.Buzzer
10.Ultrasonic Sensor
11.GSMModule.

3.1 Atmega328 Microcontroller:

The Atmega328P is a microcontroller from the AVR family of Atmel Corporation. It is widely used in various applications such as industrial automation, robotics, IoT devices, and many more.
Some of its key features are:

- 32KB of flash memory for storage of program
- 2KB of SRAM for data storage
- 1KB of EEPROM
- 20 digital input/output pins, of which 6 can be used for PWM (pulse width modulation) output
- 6 analog inputs
- 16MHz clock speed

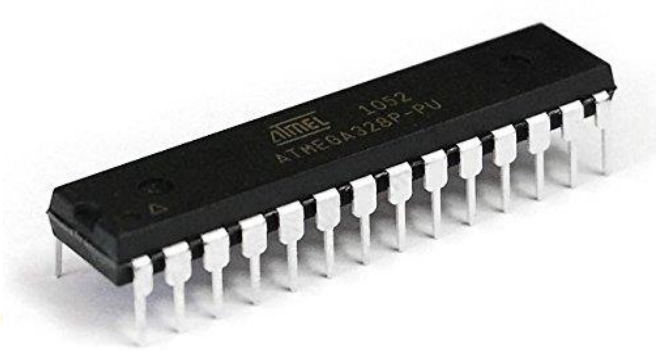


Fig-2: ATMEGA Microprocessor

3.2 RFID Tag

It is a technology that uses radio waves to identify and track objects that are equipped with RFID tags or cards.
RFID tags are small items that can be attached to objects. They contain an antenna and a microchip that stores information about the object. When an RFID reader emits a radio frequency signal, the tag picks up the signal and sends back its stored information.
RFID cards, on the other hand, are similar to credit cards in size and shape. They also contain an RFID chip and an antenna, and are commonly used for access control, payment systems, and other applications where identification is required.

Fig-3: RFID tags &Cards

3.3 RFID Reader

The RC522 RFID reader is a popular low-cost RFID module that is widely used in various applications. It is based on the MFRC522 chip from NXP Semiconductors, which is a highly integrated reader/writer IC for contactless communication at 13.56 MHz. .The RC522 module has several features, including:

- Supports ISO/IEC 14443 A/MIFARE and NTAG.
- Operates at 13.56 MHz frequency.
- Uses SPI communication protocol to communicate with microcontrollers such as Arduino.
- Supports up to 10 MIFARE Classic or MIFARE Ultralight tags at the same time.
- Supports anti-collision function.
- Supports data encryption and decryption.
- Has a built-in voltage regulator.

Fig-4: RC522 RFID reader Module

3.4 Relay

A relay is an electrically operated switch that uses an electromagnet to control the movement of a mechanical armature or contact. It is commonly used in control circuits to switch high currents or voltages using low power signals, such as those generated by microcontrollers or other electronic devices. A typical relay consists of a coil, which when energized, creates a magnetic field that attracts the armature or contact. This movement of the armature then causes the switch contacts to open or close, depending on the type of relay.

When an authorized vehicle with an RFID tag comes near the fuel dispensing pump, the RFID reader reads the tag and sends the information to the microcontroller. The microcontroller then verifies the tag information and checks if the vehicle is authorized to access the fuel pump.If the vehicle is authorized, the microcontroller sends a signal to the relay, which switches on and activates the fuel dispensing pump.

3.5 LCD Display

A 16x2 LCD display is a common type of alphanumeric display module that can display up to 16 characters on each of its 2 rows. It consists of a liquid crystal display (LCD) panel, a controller chip, and a set of driver circuits that control the display. The controller chip typically communicates with a microcontroller using a parallel or serial interface, and provides the necessary signals to control the display.

The 16x2 LCD display module can display text and symbols in a range of sizes and styles, including custom characters. It typically requires a 5V power supply and can operate in a wide range of temperatures.

LCD has one big grid of pixels. It displays about the card balance, Availability of fuel in the tank, display messages like enter the password, invalid password, correct password etc.

First it will display the user to show the RFID card, if the card is valid then it will ask the password and then shows the availability of fuel and balance in the card and then it display the message about amount and then user has to enter the amount. If the card is invalid then it will shows the message as Invalid password. Like this the LCD is used to display the messages.

3.6 Keypad

A keypad is a common input device or make selections using a set of buttons arranged in a grid. The keypad typically consists of a number of buttons or keys, with each key representing a specific character or function. Keypads can be interfaced with a microcontroller or other embedded system using various communication protocols such as parallel, serial, or I2C. The microcontroller can then read the status of each button and use the input to perform a specific action or operation This can be achieved using polling or interrupt-based methods to detect button presses, and then interpreting the input to perform a desired action. In this project the keypad is used to enter the password, amount.

Fig-5:Matrix Keypad

3.7 Motor

Motor is an electromechanical device which rotates motion in response to dc signals. The pump motor is typically connected to the embedded system through a series of wires or cables, and the system sends signals to the motor to control its speed and direction. The microcontroller or microprocessor can be programmed to control the motor based on a range of factors, such as the temperature, pressure, or flow rate of the fluid being pumped. whenever the user enter the valid amount then the motor starts rotating so that the fuel is pumped from the fuel tank to the vehicle through the pipe.

3.8 Node MCU

NodeMCU is an open-source development board based on the ESP8266 Wi-Fi module. It is designed for rapid prototyping and development of Internet of Things (IoT) applications. The NodeMCU board combines the ESP8266 module with a USB-to-serial chip and a voltage regulator, making it easy to program and power the board. NodeMCU features built-in Wi-Fi connectivity, which allows it to connect to the internet and communicate with other devices. It can act as a Wi-Fi access point or a Wi-Fi client, and can be used to send and receive data over the internet.

NodeMCU also features a range of input and output pins, including digital and analog pins, which can be used to connect to sensors, actuators, and other devices. It also features a built-in micro-USB port for power and programming.

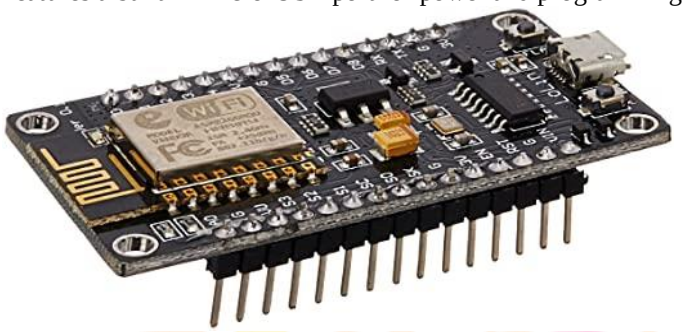


Fig-6: Node MCU

With the help of node MCU the petrol filling stations can monitor the number of transactions. And an android application is build, if the rfid card is stolen the user can block the card through the application. If the card is showed to the reader, it displays the message as invalid card.

3.9 Buzzer

A buzzer is a common electronic component used in embedded systems to provide audible alerts or notifications. It is an electromechanical device that produces a buzzing or beeping sound when an electrical signal is applied to it. A buzzer is typically connected to a microcontroller or other electronic device and is controlled through software. The software can turn the buzzer on or off, adjust its frequency or tone, and vary its volume or intensity.Buzzers are an important component of many embedded systems, providing a simple and effective way to provide audible feedbackto users or alert them to important events.

Fig-7: Buzzer

3.10 Ultrasonic sensor

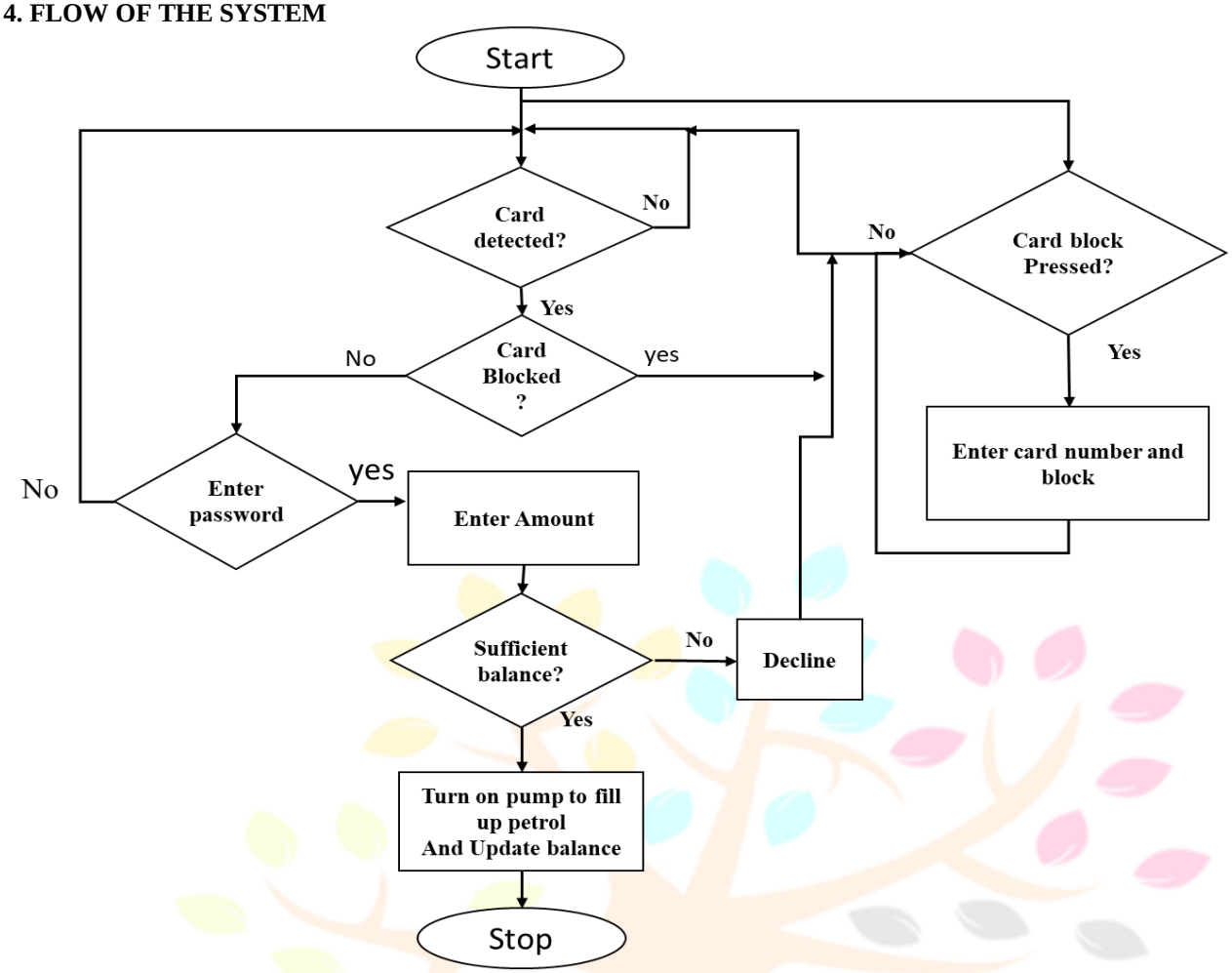
An ultrasonic sensor is a type of electronic sensor that uses ultrasonic sound waves to detect the distance of an object or obstacle. It works by emitting high-frequency sound waves that bounce off an object and return to the sensor. The sensor then measures the time it takes for the sound waves to travel back, and uses this information to calculate the distance between the sensor and the object. Ultrasonic sensors can be either analog or digital. Analog sensors provide continuous readings of distance, while digital sensors provide discrete readings and are easier to interface with microcontrollers and other electronic devices.

Fig-8: Ultrasonic Sensor

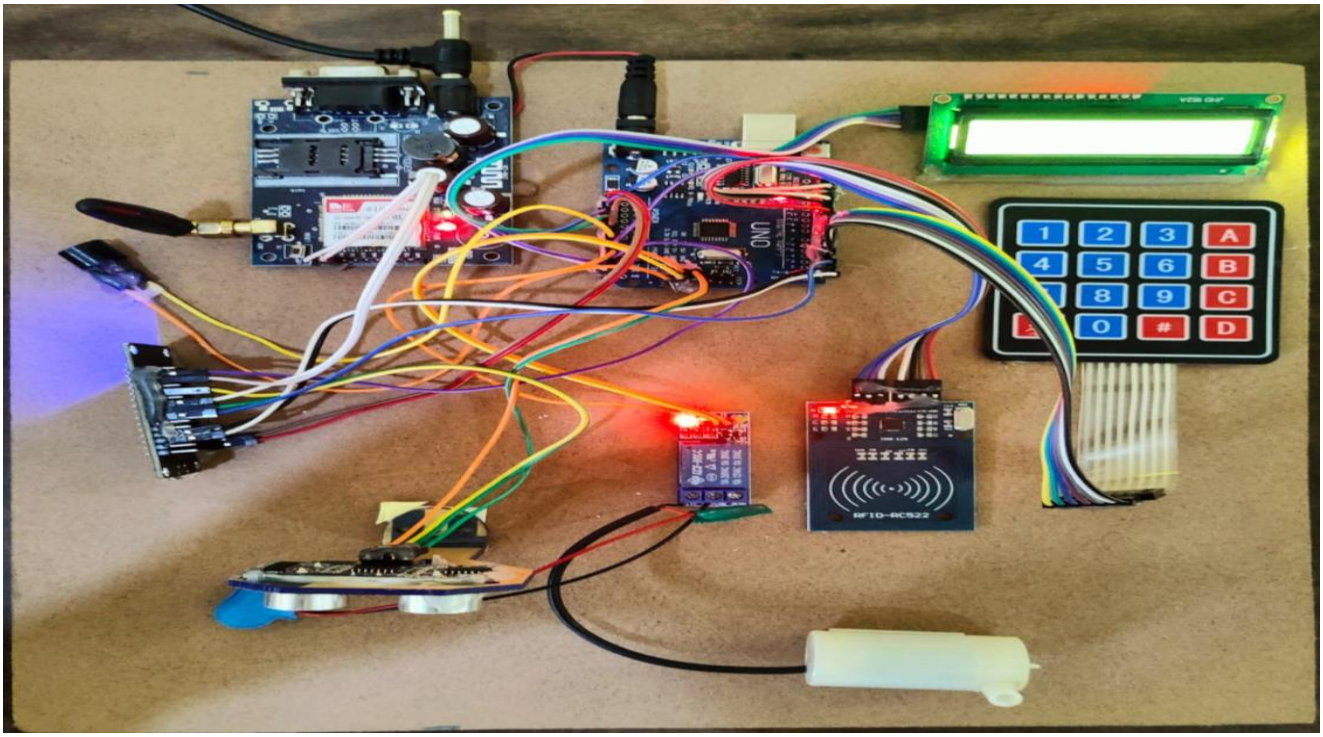
3.11 GSM module

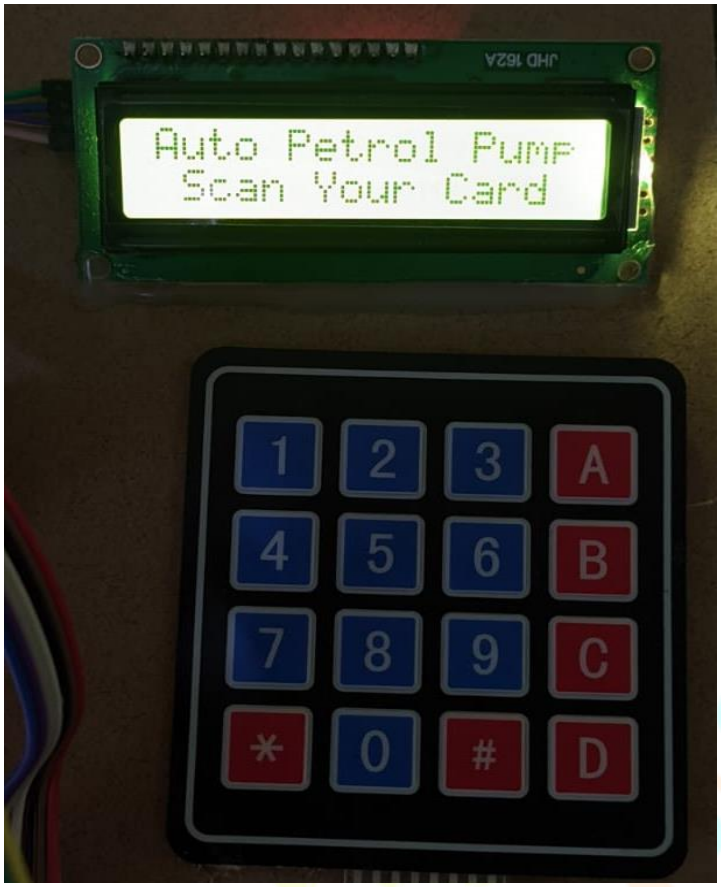
The Acronym for GSM is Global System for Mobile Communications, is a cellular technology used to transmit voice and data between mobile devices . It is one of the most widely used mobile communication standards in the world, with over 80% of the world's mobile devices using the GSM standard Mobile devices that use GSM technology require a SIM card, or Subscriber Identity Module, which stores the user's identification and network access credentials. The SIM card allows users to switch between different devices and carriers while retaining their network access and personal data.

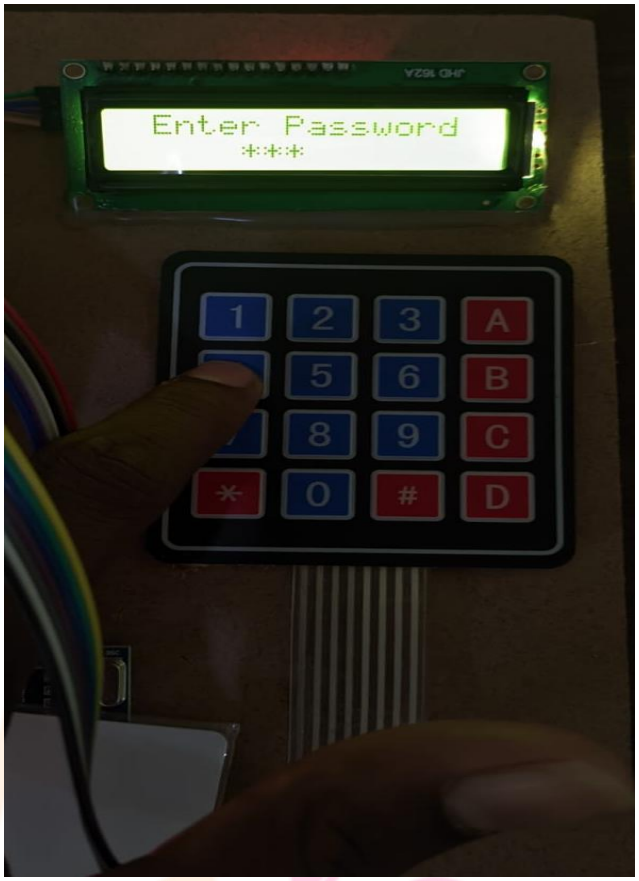
4. FLOW OF THE SYSTEM



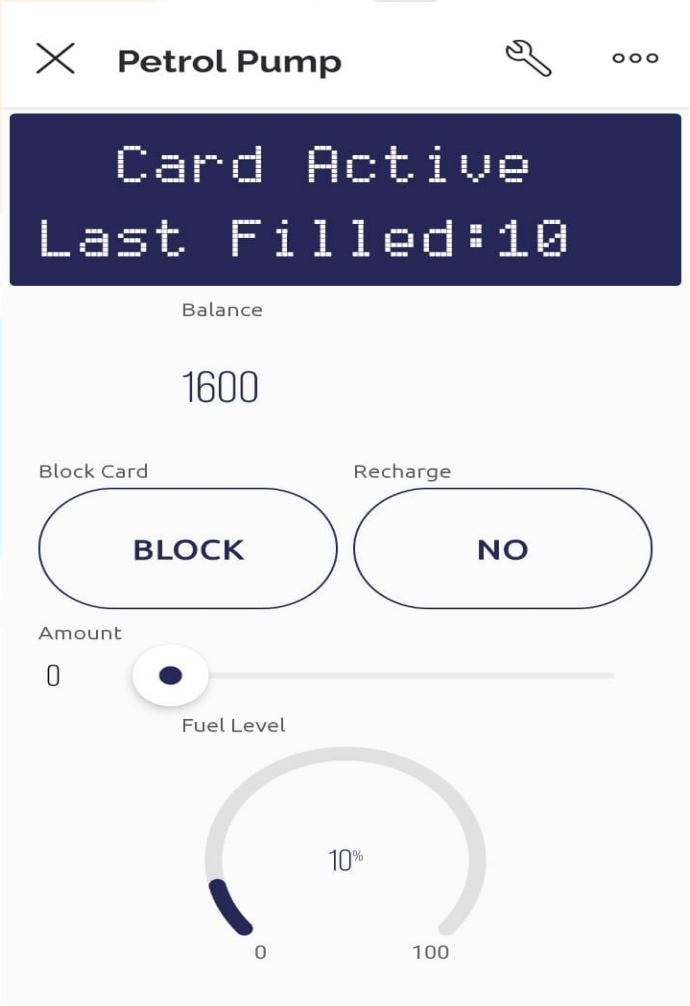
5. RESULT




Auto Petrol Pump
Scan Your Card
1 2 3 A
4 5 6 B
7 8 9 C
* 0 # D


Enter Password
***
1 2 3 A
5 6 B
8 9 C
* 0 # D


Avble Blnce:1600
Enter Amnt:
1 2 3 A
4 5 6 B
7 8 9 C
* 0 # D


Petrol Pump
Card Active
Last Filled:10
Balance
1600
Block Card
Recharge
BLOCK
NO
Amount
0
Fuel Level
10%
0
100

6.ADVANTAGES

1] Because of automated self-service manpower is reduced
2]Robbery of the fuel from the station is avoided.
3] less time consumption
4] Low power consumption
5] Accuracy is maximum.
6] High sensitivity.

7. CONCLUSION

RFID based petrol pump automation systems offer a range of benefits, including increased efficiency, improved accuracy, and enhanced security. By automating the fuel dispensing process, these systems can help reduce errors, minimize fuel wastage, and improve customer satisfaction. One of the key advantages of RFID-based petrol pump automation systems is that they eliminate the need for manual entry of information. This reduces the risk of errors and ensures that accurate data is recorded for each transaction. The systems also provide real-time data on fuel levels and sales, which can help petrol pump owners make informed decisions about inventory management and pricing.. RFID-based petrol pump automation systems offer several advantages over traditional manual systems. They provide a more efficient and secure way of fuel dispensing, monitoring, and payment. Additionally, RFID-based systems can also help prevent fuel theft and fraud, as they enable real-time monitoring of fuel dispensing and transactions. Overall, RFID-based petrol pump automation systems are a reliable and cost-effective solution for improving the efficiency and security of fuel dispensing and payment systems.

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