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AUTOMATED PETROL PUMP SYSTEM

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Abstract: Petroleum products are one of nature's unique and valuable creations, thus it is important to use and distribute them properly. The project's goal is to develop an RFID-based system that can automatically deduct the amount of petrol dispensed from the user card. The fuel systems are currently manually controlled. These petrol pumps are time-consuming and labour-intensive. Simply place the RFID card close to the RFID reader whenever we wish to fill the tank from the fuel dispenser. The microcontroller then reads the information from the RFID reader and executes the action in accordance with the demands of the consumer. By eliminating human intervention, this automated petrol pump system also offers customers security when filling up at petrol stations, lowering the risk of carrying cash constantly. When RFID reader reads the card, the system asks for the amount and it also shows the balance amount. On entering the amount, the motor starts and petrol gets filled in the petrol tank from the fuel dispenser.

Keywords: RFID, Microcontroller, Fuel Dispensing System, Automation.

I. INTRODUCTION

The increase in the number of vehicles in India in recent years has led to congestion and traffic jams in almost all cities of India. The dispensing of the fuel to such a huge number of vehicles at the fuel stations has caused many complications in India. The vehicle driver has to pay for fuel and sometimes, they may have to pay more than the amount of dispensed fuel due to the lack of change available with station operator. Everything has been digitized. In many existing systems, almost all petrol pumps have a controlling unit to perform the tasks like managing the electrical pump, drive the display, measure the flow & accordingly turn OFF the electrical pump. But still a person is required to collect the money and there is a possibility of many human errors. RFID Based Automatic Petrol Pump is used to reduce human work, to develop an auto-guided mechanism and to implement the task sequentially by RFID technology. These dispensing systems are highly reliable and less time-consuming devices. This petrol pump system consists of 8051 microcontroller, RFID module, LCD display, push buttons, keypad, smoke sensor, moisture sensor, relay and an AC pump.

II. RFID TECHNOLOGY

An object, animal, or human can be individually identified using RFID (radio frequency identification), a type of wireless communication that uses electromagnetic or electrostatic coupling in the radio frequency region of the electromagnetic spectrum. A scanning antenna, a transceiver, and a transponder are the three parts of every RFID system. An RFID reader or interrogator is the name given to the device that combines the scanning antenna and transceiver. RFID readers come in two different varieties: fixed readers and mobile readers. The RFID reader is a portable or permanently fixed network-connected device. The signals that turn on the tag are sent via radio waves. When a tag is activated, it transmits a wave back to the antenna, where it is converted into information. The RFID tag is the built-in transponder. The type of tag, reader, RFID frequency, and interference from other RFID tags and readers are some of the variables that affect the read range of RFID tags. The read range of stronger power source tags is also longer.

An integrated circuit (IC), an antenna, and a substrate make up RFID tags. The RFID inlay is the area of an RFID tag that encodes personal data. In every RFID system, low-power, embedded non-volatile memory is crucial. RFID tags typically contain a unique identifier/serial number and less than 2,000 KB of data. Tags can be read-only or read-write, allowing the reader to add new data or overwrite already existing data.

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RFID reader type, RFID frequency, tag type, and interference from other RFID tags and readers are some of the variables that affect the read range for RFID tags. Due to their more powerful power supply, active RFID tags have a greater reading range than passive RFID tags. Simple RFID tags are smart labels. These labels have an adhesive label with a barcode and an integrated RFID tag. Readers that scan barcodes and RFID tags can also use them.

III. BLOCK DIAGRAM

The basic block diagram of the proposed system includes the 8051 microcontroller-AT89S52, which is the central decision-making unit, RFID tags, which act as the prepaid card for the user (we use one valid card and one invalid card for demonstration), RFID reader module, which reads the content from the tags, MQ2 smoke sensor, to detect smoke and halt the dispensation, soil moisture sensor, to detect when the tank is full, a buzzer, relay, AC pump, keypad, push buttons, and an LCD.

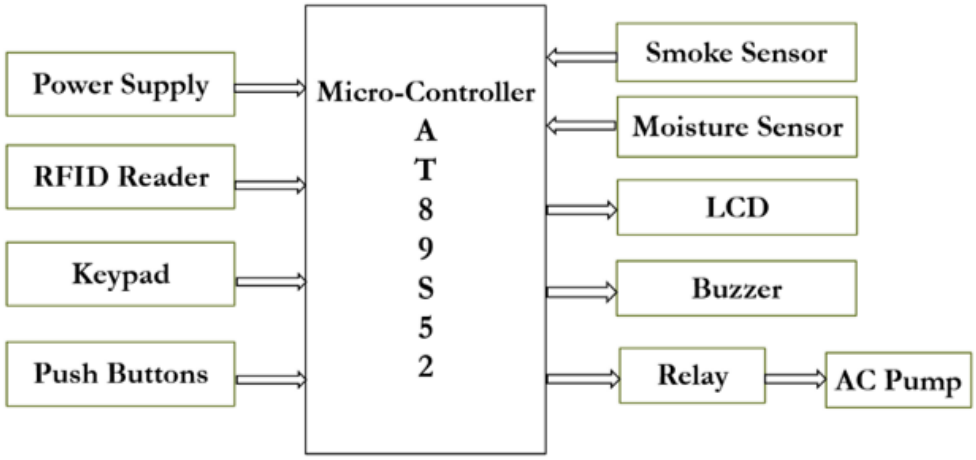

Figure 3.1: Block Diagram of Automated Petrol Pump System

IV.HARDWARE DESCRIPTION

The hardware components used in Automated Petrol Pump System are as follows:

- Transformer (230 V – 12 V AC)
- Voltage Regulator (LM 7805)
- Rectifier
- 8051 Micro Controller
- LEDs
- Resistors
- Capacitors
- RFID Reader And Tags
- Relay
- AC Pump
- Push Buttons
- LCD
- Push Buttons
- MQ2 Smoke Sensor
- Buzzer
- Moisture Sensor

4.1 Microcontroller

The 8051-microcontroller used in the Automated Petrol Pump System is an AT89S52 microcontroller. It is an 8-bit CMOS microcontroller with 8KB of ISP flash memory that is low-power and high-performing. The system is compatible with the 80C51 instruction set and pinout, which is an industry standard, and employs microchip's high-density non-volatile memory technology. The program memory can be updated in-system or using a typical non-volatile memory programmer thanks to on-chip flash. numerous embedded control applications are suitable for this robust

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microcontroller. The 8051 Microcontroller has two buses: one for the program and one for the data. It therefore contains two 64K by 8 storage chambers for both programs and data. The microcontroller has an 8-bit processor unit and an 8-bit accumulator. Additionally, it includes 8-bit B registers, which are key functional blocks. Several other 8-bit and 16-bit registers are also included. The microcontroller 8051 has an integrated built-in RAM for internal processing. It is used to store temporary data and is prime memory. It is an erratic memory, meaning that data loss when the power to the microcontroller is shut OFF is possible. This microcontroller has a low cost, a simplistic architecture, and a limited set of instructions.

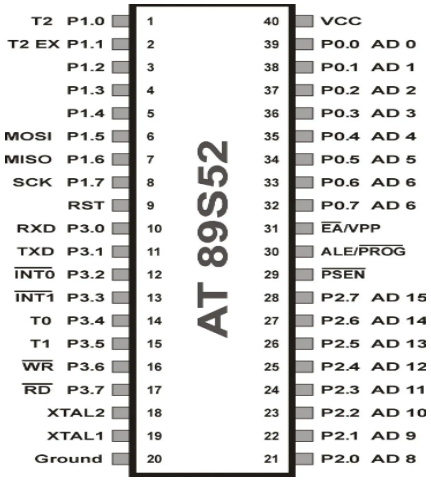

Figure 4.1: Pin Diagram of Microcontroller AT89S52

4.2 EM-18 RFID Reader

The 125 KHz-frequency EM-18 RFID Reader module is in use. This reader is an accessible and affordable option for your RFID-based application. An on-chip antenna and a 5V nominal power supply are also included with the Reader module. The module will start to initialize as soon as we turn it on and link its built-in transmit pin to the microcontroller's reception pin. The card number is then output at the display area once you present your card inside the reading range. The module has an optional output configuration option in addition to source detection.

Figure 4.2: EM-18 Reader Module

4.3 AC Pump

A hermetically sealed motor is tightly connected to the pump body in a submersible AC pump, also known as an electric submersible pump (ESP). The entire assembly is dipped in the liquid that has to be pumped. This kind of pump's key benefit is that it doesn't cause pump cavitation, which is a problem brought on by a large elevation difference between the pump and the fluid surface. In contrast to jet pumps, which generate a vacuum and rely on atmospheric

Figure 4.3: Submersible AC Pump

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pressure, submersible pumps force fluid to the surface. Submersibles are utilized in heavy oil applications with hot water as the motive fluid and employ pressurised fluid from the surface to drive a hydraulic motor downhole as opposed to an electronic motor.

4.4 MQ-2 Smoke Sensor

The MQ2 gas sensor is inexpensive and ideal for a variety of applications. It may be used to detect the presence of LPG, Propane, and Hydrogen as well as Methane and other flammable gases. The sensor is sensitive to smoke and combustible gases. The smoke sensor is powered by 5 volts.

Figure 4.4: MQ-2 Gas Sensor

4.5 Moisture Sensor

One type of sensor used to determine the volumetric content of water in the soil is the soil moisture sensor. As the soil moisture straight, gravimetric dimension needs to be removed, dried, as well as sample weighting. These sensors measure the volumetric water content indirectly using the electrical resistance, neutron interaction, dielectric constant, and other soil laws as well as replacement of the moisture content.

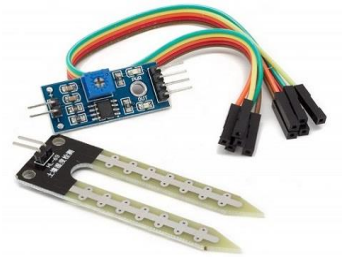

Figure 4.5: Moisture Sensor

V. SOFTWARE DESCRIPTION

The various software used in Automated Petrol Pump System are Keil Micro Vision (version 5), Proteus software, for simulation and UC Flash.

5.1 Keil Micro Vision 5

Free software called Keil Micro Vision 5 addresses many of the problems faced by developers of embedded programs. An integrated development environment (IDE) is a piece of software that includes a text editor for writing programs, a compiler, and the ability to convert source code to hex files.

To get started using Keil, which may be used to write programs in C/C++ or Assembly language, follow these basic instructions:

- Compiling and Assembling Programs
- Debugging program
- Creating Hex file
- Testing your program without Available real Hardware (Simulator Mode)

5.2 Proteus Software

The Proteus Design Suite is a proprietary software tool suite used primarily for electronic design automation. The software is used mainly by electronic design engineers and technicians to create schematics and electronic prints for manufacturing printed circuit boards.

VI. IMPLEMENTATION

The microcontroller, which is the main processor of the system, stores several cards details and compares the data given by the RFID reader. When both the details of the card and microcontroller match, it sends the control signals to the relay so that the motor operates to pump petrol. If the card is authorized, RFID card reader will accept the card and then it moved

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to further steps. If the card is unauthorized, an error message will be displayed. Then it will ask for the pin number to the customer. If the entered pin number by the customer is correct, then it will process and ask for the amount for the petrol to be dispensed. In such a way the system is fully secured. If the presence of smoke is detected by the smoke sensor, the dispensing will be stopped. Also, the moisture sensor detects when the tank is full, and even then, the process of dispensing comes to halt.

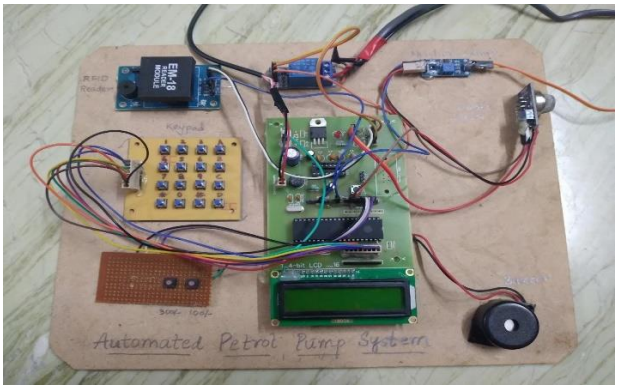

Figure 6.1: Hardware Connections of Automated Petrol Pump System

VII. RESULTS AND DISCUSSIONS

In the Automated Petrol Pump system, initially we will be asked to place a card. Whenever we place an RFID tag in front of the EM-18 RFID reader, the balance in the card will be displayed. This will be followed by asking the user to select an amount. This selection can be done by making use of the push buttons available. Then, the amount which has selected will be displayed on the LCD. According to the amount selected using push buttons, the AC pump will be switched on and dispenses the petrol. This will be indicated by a message displayed on the LCD. After the dispensing of the fuel, the amount will be deducted accordingly from the available balance, and the remaining balance will be displayed to the user.

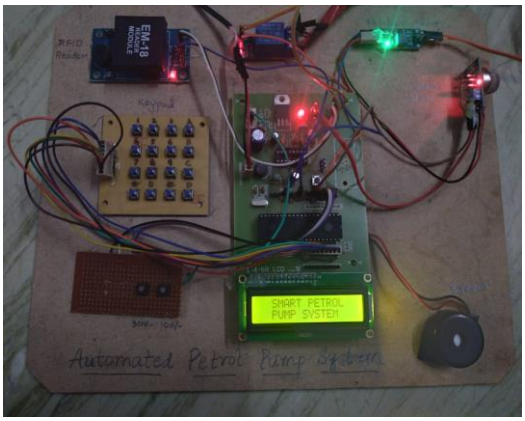

Figure 7.1: Welcome message

Initially, when the system is powered on, a message saying ‘Smart Petrol Pump System’ has been displayed on the LCD, which is the welcome message that will appear as soon as we start the system, as shown in Fig 7.1.

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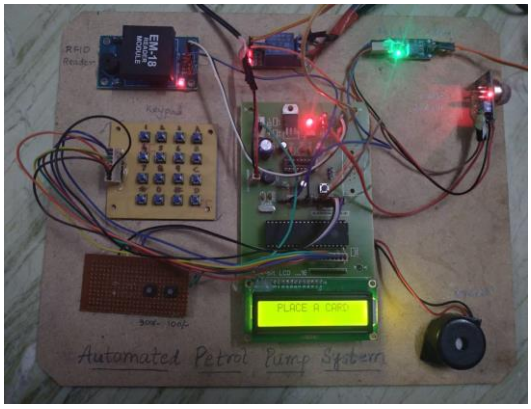

Figure 7.2: Customer is asked to place the card

In the next step, the user is asked to place his RFID card. The message 'Place a Card' has been displayed on the LCD, during which the customer has to place his/her card which is the RFID card, to be scanned by the RFID reader, as shown in Fig 7.2.

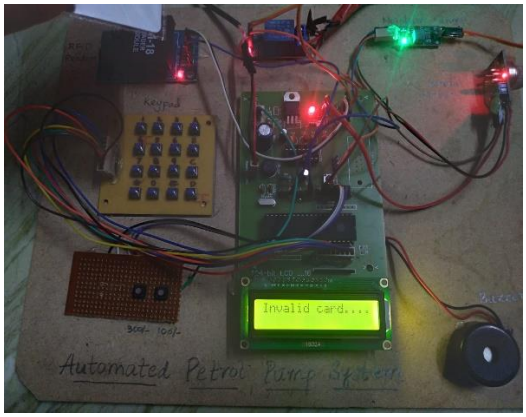

Figure 7.3: If the card placed is INVALID

Next, the system checks if the card placed by the user is valid or not. When an invalid card is placed, the message 'Invalid card' has been displayed on the LCD, as shown in Fig 7.3.

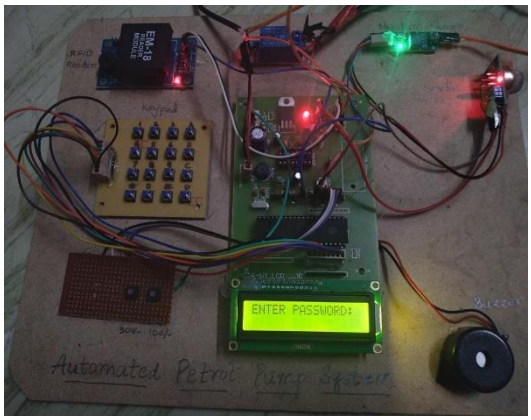

Figure 7.4: If the card placed is VALID

If the card is valid, the user is asked to enter the password, and likewise, the message 'Enter Password, has been displayed, as shown in Fig 7.4.

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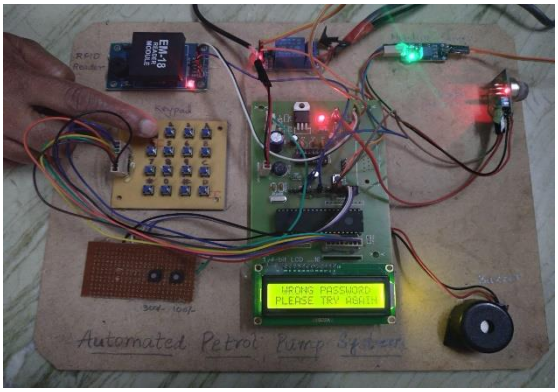

Figure 7.5: If the password entered is WRONG

If the password entered is wrong, the customer is asked to enter the password again. The message 'Wrong password, Please Try Again' will be displayed, as shown in Fig 7.5

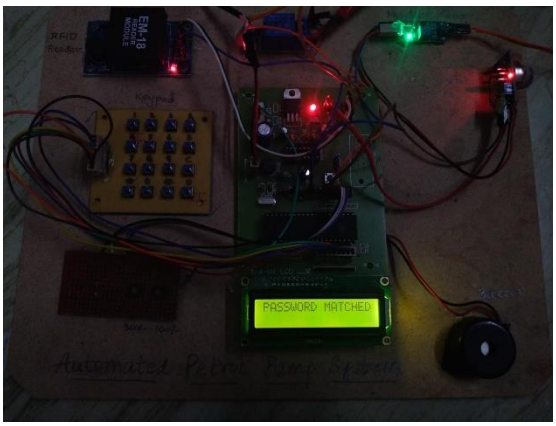

Figure 7.6: If the password entered is CORRECT

If the password entered by the user is correct, then the message 'Password Matched' will be displayed, as shown in Fig 7.6.

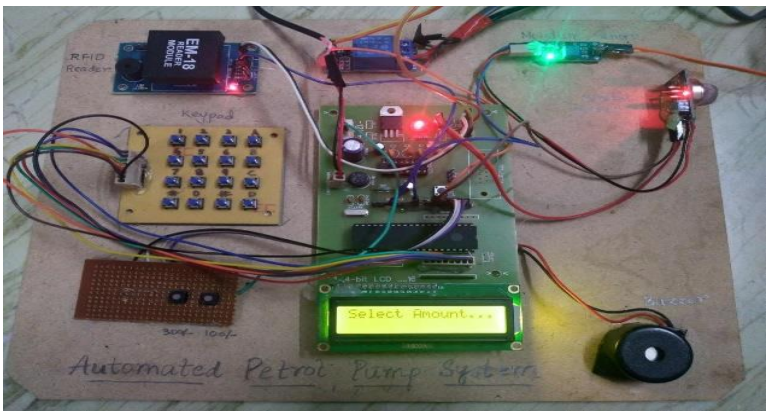

Figure 7.7: Customer is asked to select the amount

After validating the password, the system asks the customer to select the amount, which is done using the push buttons provided. Themessage 'Select Amount' will be displayed, as shown in Fig 7.7

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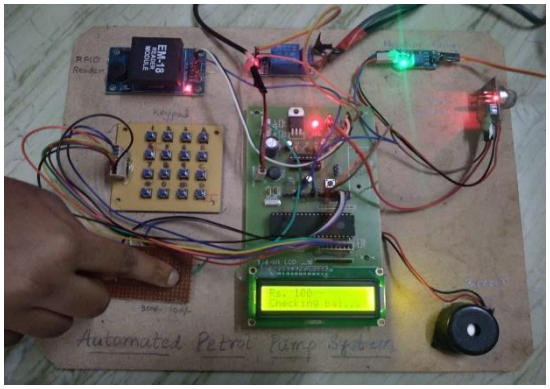

Figure 7.8: Balance is checked

After selecting the amount, the system will check the balance amount in the card. Themessage 'Checking Balance' will be displayed, as shown in Fig 7.8

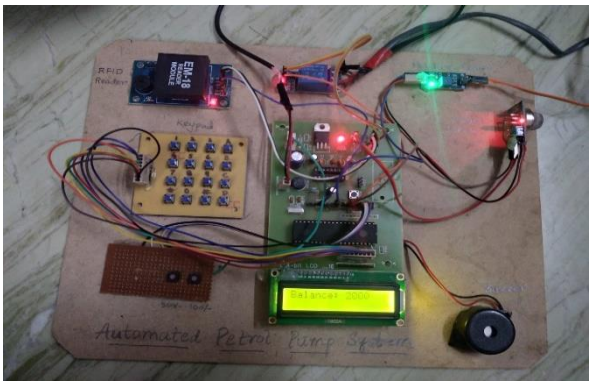

Figure 7.9: Balance is displayed

After checking the balance in the card, the balance which is remaining in the card will be displayed on the LCD. The message balance amount will be displayed, as shown in Fig 7.9

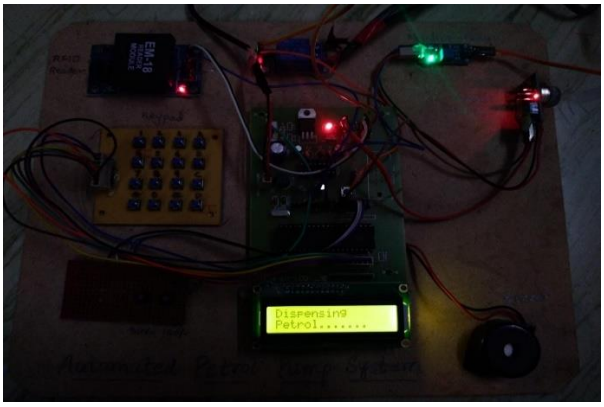

Figure 7.10: Petrol being dispensed

If the balance is sufficient, the dispensing starts. The message 'Dispensing Petrol' will be displayed on the LCD, as shown in Fig 7.10

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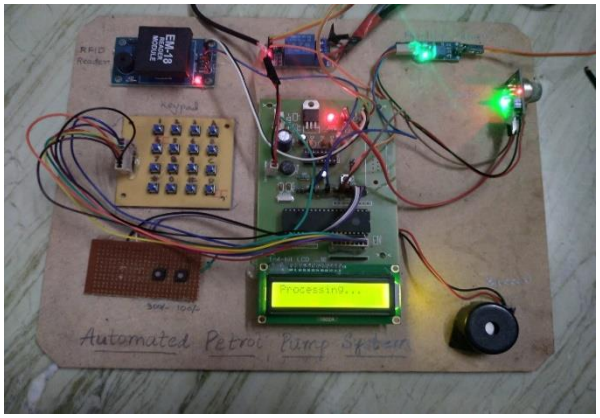

Figure 7.11: The dispensed amount will be deducted

After the petrol has been dispensed, that equivalent amount will be deducted from the user's card, as shown in Fig 7.11.

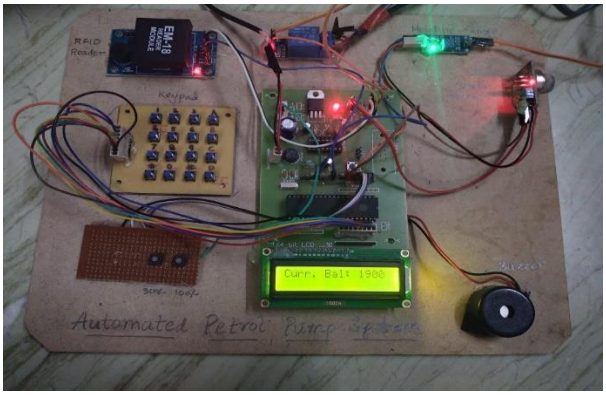

Figure 7.12: Remaining amount displayed as current balance

After deducting the amount from the card, remaining balance is displayed on the LCD, asshown in Fig 7.12.

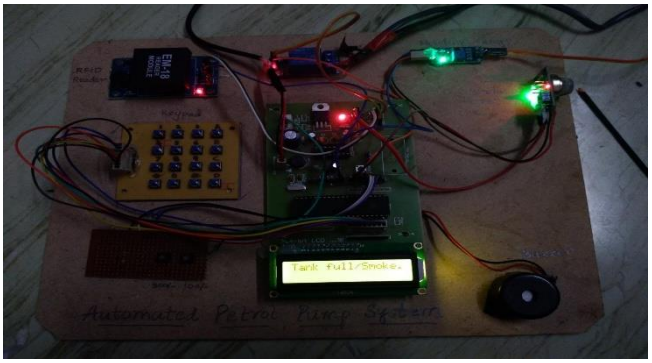

Figure 7.13: If tank is full or smoke is detected

During dispensing, if the tank is full or smoke is detected, dispensing is stopped with buzzer sound, and an alert message will be displayed on the LCD, as shown in Fig 7.13.

VIII. ADVANTAGES

- Man power is reduced because of automated self-service.
- This system does not require any high performance and costly micro-controller. It is done using low cost microcontroller which indirectly reduces the cost of the total system.
- Due to use of RFID system robbery of the fuel is avoided.

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- Power is saved as pumps are activated only during fuel dispense.

IX. DISADVANTAGES

- Fuel dispenser workers will be unemployed
- If network fails, the whole system will collapse
- If the card is lost, the balance amount in the card will also be lost

X. CONCLUSION

RFID is a flexible technology that is simple to utilize and effective for real-time applications. The objectives of this system include ensuring that the correct amount of gasoline is distributed and eliminating human mistake through the use of RFID cards. These systems are more time and cost efficient than more conventional ones, and they also use less energy, which is a crucial benchmark in the current environment. The government could connect a full chain of fuel bunkers if they were interested in doing so. With this link, the user can see which fuel bunk is closest to him or has an adequate supply of fuel. Providing biometric-based authentication can improve security. Conducting density testing using hydrometers can help keep adulterations at petrol stations under control.

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