RFID BASED SMART FUEL DISPENSING SYSTEM

A PROJECT REPORT

Submitted by

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BONAFIDE CERTIFICATE

Certified that this project report titled "**RFID BASED SMART FUEL DISPENSING SYSTEM**" is the bonafide work of "**G. SAIRAM SUMANTH [Reg No: RA1811004010232], MOHAN REDDIM [Reg No: RA1811004010497] K.RAJA [Reg No: RA1811004010535]**", who carried out the project work under my supervision. Certified further, that to the best of my knowledge the work reported herein does not form any other project report or dissertation on the basis of which a degree or award was conferred on an earlier occasion on this or any other candidate.

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ABSTRACT

The main aim of the fuel dispensing system and how a user might make use of RFID technology in today's fuel stations. The suggested approach ensures that the fuelling process runs smoothly. Making it simpler and more secure, the system operates similarly to that of a debit card, but instead of a debit card, a separate card (RFID tag) will be used by the user which can be recharged with money. In the bunk, the consumer swipes his or her card on the RFID reader. It's a reader with passive tags. It reads the information present in the card and cross-checks information present in the microcontroller. In the fuel station, the user has to enter the amount of fuel he/she needs and the appropriate money will be debited from the person's card and a message will be sent to his/her mobile phone with the assistance of the GSM module which is integrated to an Arduino board. In Fuel stations, the workload for humans is reduced and no additional manpower is required to fill fuel. Through this project, it is possible to achieve the dream of digital fuel stations. It avoids the involvement of manual labor and also averts the use of carrying money around in people's wallets, which will reduce the risk of it being stolen by someone. This technology is applicable in many different fields. It is reliable, economical, and efficient.

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K.RAJA

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ABBREVIATIONS

UART	Universal Asynchronous Receiver-Transmitter
SIM	Subscriber Identity Module
IDE	Integrated Development Environment
MCU	Microcontroller Unit
GPRS	General Packet Radio Services
MIPS	Million Instructions Per Second
USART	Universal Synchronous Asynchronous Receiver Transmitter
EPROM	Erasable Programmable Read-Only Memory
LCD	liquid crystal display
RFID	Radio Frequency Identification
GSM	Global System for Mobile communication
IOT	Internet of Things
SMS	Short Message Service

CHAPTER 1

INTRODUCTION

1.1 Introduction to Radio-frequency Identification

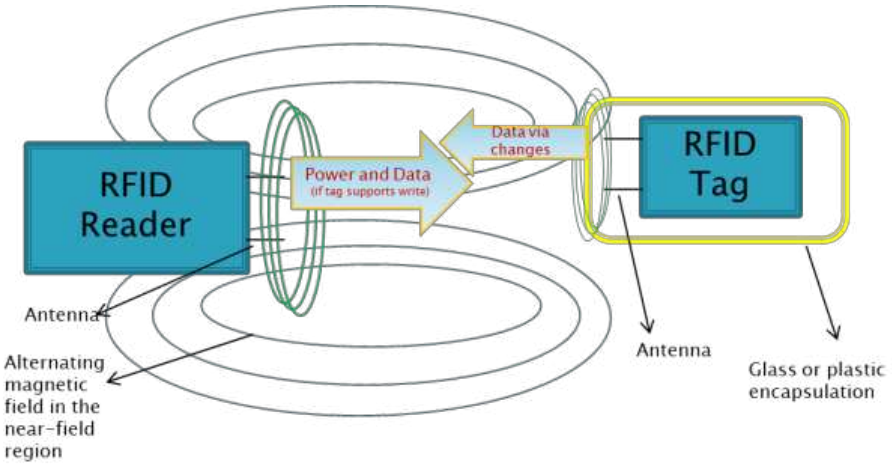

Figure 1.1: Power/communication mechanism of tags

Radio Frequency Identification (RFID)(radio-frequency identification)) is a technique for detecting items based on their radiofrequency signature. When electromagnetic waves are used to identify and track things, tags affixed to items may be automatically detected and tracked. It is possible that the tags include information that has been preserved in an electronic manner. The energy acquired by passive tags is provided by the probing radio signals of a nearby RFID scanner, which may be detected by passive tags. Because active tags are fueled locally by a mobile phone, they may function hundreds of yards away from the RFID reader. Despite codes, which must be in direct view of the scanner, RFID tags can be placed with in thing being monitored without causing a problem. Radio Frequency is a technology that may be used to automate data collection and identification. It is currently under development. RFID tags are widely utilised in a wide range of sectors and may be found in a number of sizes, depending on the application. An vehicle with a radio frequency identification tag (RFID) applied during manufacture may be tracked as it moves through the assembly line; similarly,

drugs with RFID tags may be tracked as they go through the manufacturing process as well. It is possible to employ RFID microchips, which are implanted in cattle and pets, to positively identify the animals in question. Affirming the fact that RFID tags may be affixed to currency, clothes and personal goods, as well as implanted in organisms. Given that RFID tags may be attached to currencies, clothing, and personal belongings, in addition to being implanted in animals and humans, the idea of reading personally-identifying information without authorization has raised serious privacy concerns. The development of standard criteria for privacy and security has occurred as a consequence of these concerns standards utlisied cryptographic technology to provide protection. The standard format for a radio frequency and serial number that verifies the authenticity of the details, the source of the matters, of the reading matter. Techniques for the collecting and identification of data automatically Shops may also make use of tags to expedite the checkout process and deter customer fraud. RFID sales reached 5.73 billion dollar in 2014, up from 6.53 billion dollar in 2016 and USD 3.43 billion in 2012. The worldwide RFID market reached USD 8.89 billion in 2012. The statistic used ids, scanners, and services for Radio Frerquency cards and any other form changes that use Radio Frequency technology. Fig1.1 depicts an estimate of the market value in 2026: USD 18.68 billion (USD 18.68 billion by 2026).

1.2 Applications

RFID tags may be connected to objects and used to monitor and manage items such as products, resources, people, and other people and things, among other things. It may be found on a variety of goods such as autos, laptops, books, cell phones, and other such items. When compared to manual techniques or bar code scanning, RFID offers a number of advantages. So if the tag is obscured with an item or is not visible, it may be read if the item is passed close enough to a reader. Instead of a single barcode being scanned, hundreds of it is possible to read several radiofrequency ids at the same time within a item, such as a container with a bag and pack. At the moment, you can only read one bar code at a time with existing technology. Passive tags may be purchased for as low as USD 0.09 per tag in 2011, but special tags, such as those requried for a placed radiation sterilisation, could cost as much as USD five dollars. RFID tags

used for tracking containers, medicinal products, and monitoring environmental conditions in cloud services cost between USD 50 and USD 100 per tag, depending on their functionality. Battery-Assisted Passive (BAP) tags, which feature temperature and humidity sensors, cost around 310 dollars. RFID use increased significantly during 2010, thanks to a fall in the expenses ,ids, improved quality that reached 99.9 percent reliability, and the introduction of a solid global norm for Ultra high-frequency passive Radio Frequency.

1.2.1 Commerce/Retail:

RFID enables organization's to recognition and control inventory, equipment among other things, not the need to manually input data into a computer system. Manufacturing products such as automobiles and textiles that can be traced from the point of manufacturing to the point of sale are examples of manufactured goods. Inventory systems may benefit from RFID-based automated identification fig1.2. In order to improve supply chain management, many corporations have begun requiring that RFID tags be installed on all shipments by their vendors. As an additional safeguard from fraud from consumers and employees , this system includes electrical item monitoring as well as a self-checkout method for customers. Following the purchase of a product, tags of various sorts may be drawn away with the use of a specialized tool or deactivated electronically, depending on the manufacturer.In order to exit the shop, customers must pass by an RFID detector. If they have items with active RFID tags, an alarm sounds, notifying them that they have an unpaid-for item as well as specifying whatever the item was.

Figure 1.2: RFID Retail Tag Uses

1.2.2 Transportation payments:

Tag may be utlisized to pay for bus, train, or subway tickets, as well as collect tolls on roads, in a variety of nations across the world. Certain bike locks need the usage of RFID cards that have been provided to specified users fig1.3. Prepaid cards are needed to unlock and access a facilities , as well as to monitor and charge for the length of time a bicycle is left parked in a facility . RFID cards are used by the Zipcar car-sharing company to open and lock autos, as well as to identify and track the movement of its members. In Singapore, RFID has taken the role of the old Season Parking Ticket (SPT).

Figure 1.3: Bus ticket validator

1.2.3 Animal identification:

Using RFID, an animal monitoring system can be used to trace all types of animals, which can help to improve exotic animal disease control and supervision, protect native species, ensure the safety of multinational animal product trade, improve the ability to diagnose animal diseases, and respond quickly to animal out from any location fig1.4.

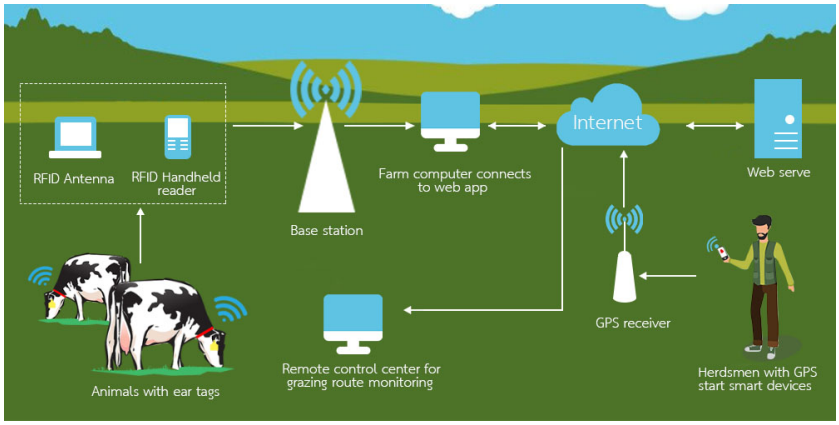

Figure 1.4: Identification of Animals Using RFID Tag

1.2.4 Transportation and logistics:

It is utilised in the management of yards , shipping, freight, and storage and transportation centres. Chips installed on engines and moving equipment within a railroad industry verify a user by giving an identifying number based on the equipment's features and characteristics. When used in combination with a, the may be used to identify the commodities being carried, as well as their bill of lading, point of origin, and final destination. RFID is utilised in commercial aviation to help maintenance on commercial aircraft. Several airports and airlines employ RFID tags to identify luggage and cargo fig 1.5. RFID is being used in several countries for automobile registration and enforcement. RFID can assist in the detection and recovery of stolen vehicles.

Figure 1.5: RFID Tag in Logistics

1.3 Existing System

In today's world, almost all gasoline pumps are equipped with a microcontroller that regulates the power pump, measures the amount, and shuts down the power pump as appropriate. Someone, however, must still be in charge of collecting the funds. Our proposal aims to eliminate the need for this type of human connection, so that no one is necessary to fill the gas tank. All drivers are issued an RFID card, which may be recharged at various locations around the system. The petrol station is equipped with an RFID scanner, which reads the value of the card and displays it on the liquid crystal display (LCD) screen.

1.4 Proposed System

The modern style of the petrol bunks has been enhanced by automated. The petrol machines have given the city a new face, with automated systems entering this sector as well. Using GSM technology, one can now access up-to-date information on their mobile phone. This allows customers to know exactly how much gasoline they need to fill up, eliminating the problem of customers foregoing minor change, which is often pocketed by the workers at the bunks. For proper gasoline filling, the traditional antique pumps have been replaced by more modern EMP Petrol Pumps.It not only assures accuracy, and also saved both consumers and workers a significant amount of time.Avoids misunderstandings and disagreements. To demonstrate this as a project, we created a Petrol Bunk Automation System based on the ATMega328p Microcontroller.

CHAPTER 2

LITERATURE SURVEY

Aishwarya (2017)In,the primary purpose of the project is to build a system in which the amount of gasoline used may be automatically deducted from the account.Issuance of a user card based on RFID technology. Liquid gas pumps are widely used in our daily lives in various places such as offices, bus stops, railroads, and so on. Gasoline station, here, we will introduce the latest gasoline dispenser of the era. Comes with a prepaid card that uses RFID technology. The is also a dispenser with RFID technology. At present days fuel station is currently manually operated these are time-consuming and require more people. It is very difficult to build a gas station in a remote area. Providing excellent facilities to consumers is costly. Use unmanned energy to solve all these problems. An effective pump with a short operating time Can be installed anywhere. Customers who want to use the service on their own will have to pay electronically to the clearing system[1].

The current scenario replaces human effort Became huge with an automated and digitized mechanism Growth factor. Mankind has become much more independent than before. (R.Gnanavel, 2016) In each field Achieved the goal of ease of use. People are controlled by software. However, this is not the case Used at most gas stations. Usually, at a gas station, there is a person-to-person interaction. Our project is to Overcome this phenomenon by bringing about interactions Between humans and software. Through this mechanism below we can avoid people and avoiding people fraudulent activity that plays a worker in his job. Our project ideas are to make the entire process of human worker in gasoline station automatic digitized mechanism for small mistakes fraud that can be done by their workers-by-workers to Owner. Gasoline station consists of RFID Readers and for all vehicles' people swipe their card RFID Card [2].

Zahra'a M. Baqir (2021) The goal of this task is to build an automated gasoline delivery system that makes use of IoT technology.RFID, and web application development and users will contain login details to access their login. To check the balance of the card

the person and also recharge their card in the online portal of the petrol bunk website which is built by Internet of Things (IOT) technology. Throw this project we overcome to save a lot of money and time-consuming. And it has taken a lot of safety measures and this project is user-friendly project [3].

Adeyemi and Ithnin (2012)An access monitoring system has been a hot topic and study area in recent years. Zigbee-based access control systems are used in a variety of applications, including industrial and commercial, consumer electronics, home automation, and HVAC lighting closures. Wireless technologies are used in these systems to communicate vital indicators for access. This article discusses a Zig-Bee-based wireless sensor network that is primarily used to determine whether or not clients are permitted at each sensor node. Many technologies, such as Bluetooth and Wi-Fi modules, are used in wireless sensor networks applications for access control systems. Wi-Fi has a greater range than Zigbee, but it is also more costly. Even though Bluetooth has a faster communication rate than ZigBee, ZigBee has a lower power usage. As a result, ZigBee is widely used.Monitors communication transmission networks. In comparison to Bluetooth, ZigBee has a greater number of nodes and a longer transmission range while consuming less power. The growth of such systems is enabled by a large number of nodes. Wireless networks based on ZigBee technology have recently been put to the test in a variety of applications. The system is a wireless monitoring and access control system employed at the Parliamentary Campus in this case. This system is based on IEEE 802.15.4 wireless Zigbee technology, which offers a low-cost solution. In this case, cooperative communication is also crucial in ensuring that Zigbee nodes are constantly within the range of the ZigbeeCoordinator. The system is designed to be convenient and efficient, increasing contact between sensor nodes at each building and the coordinator at the central office [4].

Al-Naima and Hasan (2015) A Gasoline smart System based on Radio frequency Technology and IOT is presented in this study. The technology can make the fueling procedure considerably easier, more secure, and more dependable.It prevents illegal fueling by designating a particular fuel to each registered vehicle.based on their personality traits With its passive tax, it employs the EM18 RFID Reader. The hardware is made from of microcontroller, relay, LCD, speaker module, and ZigbeeTransmitter and

Transceiver for automobiles .It is connected to a traditional solenoid valve in order to make them operate under the influence of alcohol.RFID stands for Radio Frequency Identification [5].

Thangadharsni et al. (2018) Given that gasoline pumps are operated manually, dispensing and filling fuel is a time-consuming operation. We were able to build an automated gasoline pump by combining GSM and RFID technology.. By using this framework, it is possible to make the filling process simpler, more solid, and more secure. Unauthorized users and customers with a history of driving offences would not be provided with fuel. There are a variety of charging stations for the RFID cards that are used by all users in this system. The gas station is fitted with a smart card reader that detects the quantity of gas in the card as well as all of the private data and shows it on the LCD screen in real time. The required amount of gasoline will be delivered in accordance with the quantity entered [6].

Srinivasan and Roy (2015) presented an idea intended pay for excessive use of fuel in vehicles and, consequently, to promote people to utilise public transit and/or carpooling as alternatives Here is a plain and unambiguous example. The establishment of a fair fuel distribution and regulatory structure for the transportation of gasoline. The great majority of those who use the system. In a gasoline machine with an electric motor, the conception and execution of the piece take place. It is possible to connect an app chip to a web database that holds critical information regarding fuel. Every car owner who has legally registered with this system and whose vehicle has been modified since registering will be able to use it. For the vehicle, a monthly fuel restriction has been established. Real-time data retrieval and modification are accomplished via the use of RFID technology by a specific user [7].

Rao and Prasad (2017) Many research have been undertaken in various regions of the world to automate the refuelling mechanism throughout the years. A number of scholars have proposed several sorts of designs to enhance refuelling operations, each focused on a different aspect is an example of significant work. The authors employed RFID and GSM technologies to automate the petrol bunk refilling mechanism in this suggested design. The RFID is used in the same way as a gasoline card. Users can scan their petro cards via the RFID reader in order to refill their tanks. After that, he or she will

be prompted for a password and a quantity. If everything goes well and the petro card has sufficient funds to complete the transaction. The filling of the gasoline tank begins automatically. Felling will come to an end after the task is completed. The user may recharge the card by sending a message to the Gsm network located at the recharging facility.This suggested model also includes fuel level and smoke monitoring, and if the fuel level within the bed is low, it sends an SMS to the bunk owner [8].

Pranto et al. (2019)Pranto, Md Badiuzzaman, Rahman, and Md Mahidur have also done notable work. They've also automated the system with RFID and GSM technologies. In this case, the RFID card also serves as a prepaid card. When the card's balance is low, the user must recharge it. Pump stations are where he may reload his card. The gasoline delivery process is nearly identical to the design . The customer should scan the RFID card in the direction of the scanner on the fuel bunk. Afterwards, customer will be invited to provide a passcode and to determine the quantity of gasoline that will be necessary. If all goes according to plan, the fuel will be supplied automatically. They employed GSM technology to send the user a notification about the most recent transaction.They've also put in place a web server for storing user information Any gas pump in the globe may connect to this server. Any user cannot access the server [9].

CHAPTER 3

METHODOLOGY

RFID cards, often known as fuel cards, can be issued to anyone who wishes to utilize them. This should be verified as soon as you arrive at the gas station. The petrol station is equipped with an RFID card reader that can display the initialization via a liquid crystal display (LCD) and Global System for Mobile Communication (GSM) unit. The user will realize that the equipment is functioning if all techniques are shown and maintained as designed. The RFID card is displayed on the LCD screen, and the user is prepared to swipe it. fig.3.1.

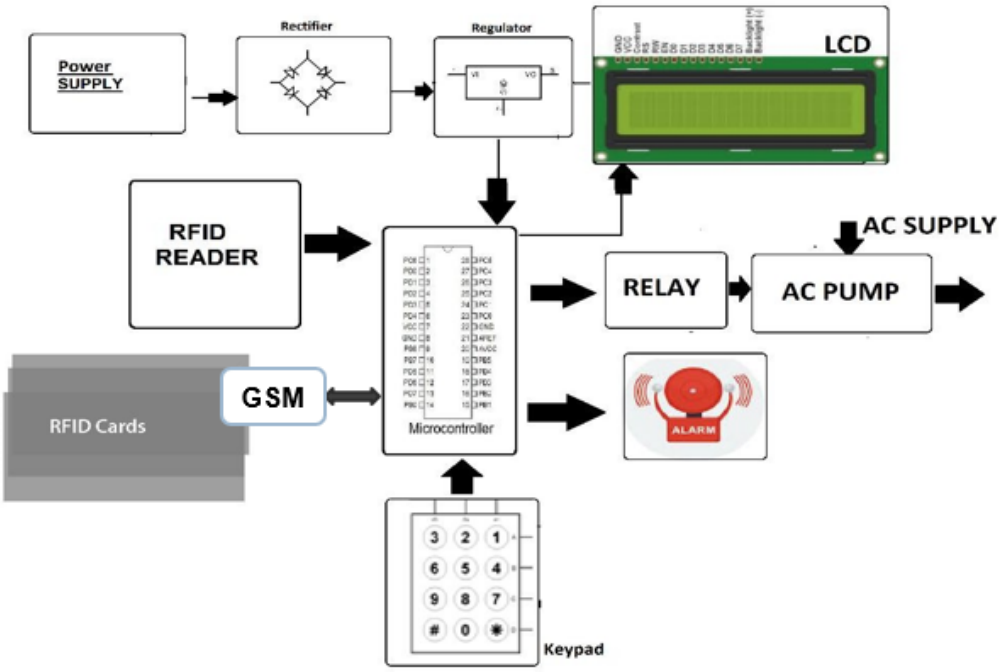

Figure 3.1: Proposed Architecture System

The RFID card password will be displayed as a result of this. In this section, you'll see the password that you created.There is a problem with the password that the user has typed. LCD The warning "invalid password" appears on the screen. A beeping sound is produced by the buzzer.

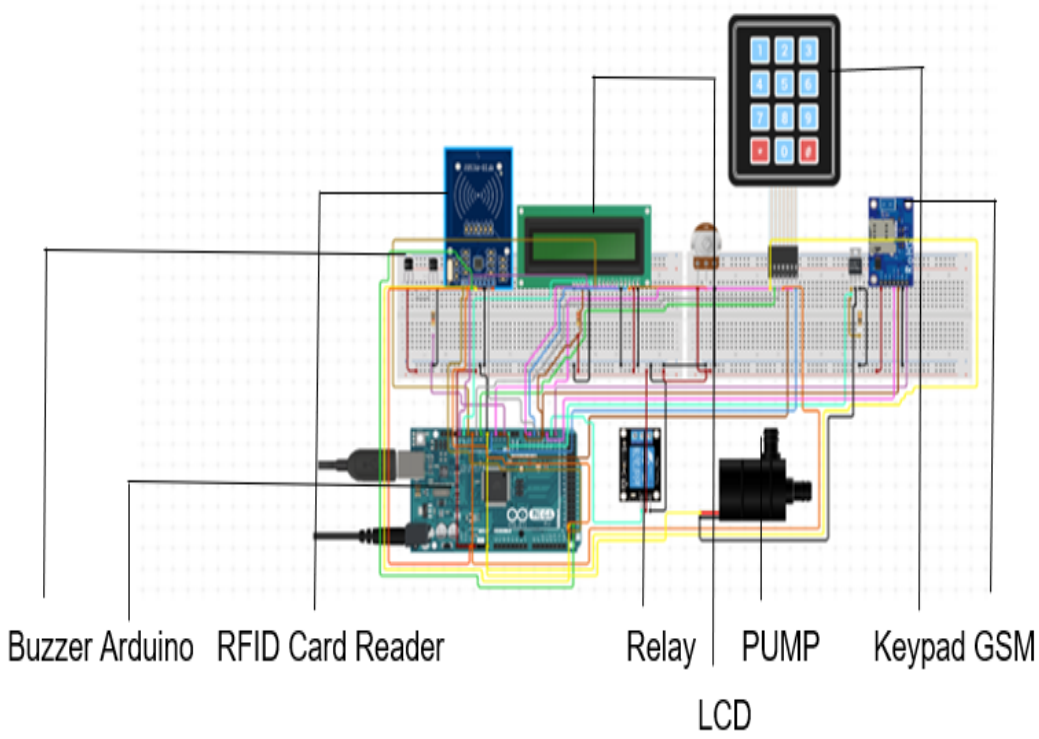

Figure 3.2: Schematic Representation of Proposed System

All RFID cards are encoded with the proper magnetic rates.When a customer swipes his or her RFID card over the RFID reader, a magnetic indication is created, which is utilized to confirm the contents of the container. Now, the scanning antenna is capable of scanning both box statistics and today's data at the same time 3.2. A closer look at these figures and comparisons with the appropriate level of assistance is provided If the datasets are the same, the microcontroller gets the data for the display that matches the dataset. To perform transactions in stages, this microcontroller may be modified and programmed using embedded C code. When it comes to system control, the microcontroller is at the heart of it all. Using the GSM module we picked, we will be able to get the necessary information by sending transaction data to the registered client phones through Short Message Service Short Message Service (SMS) GSM modules serve as a link between the system and the client. The RFID system is made up of three components: a transponder (tag), an interrogator (reader), and a computer that holds the database. The data from the tag is read by the interrogator and transferred to the computer for authentication. Access is granted after the information has been processed and validated. The system operates over a wide range of frequency bands, ranging from low to microwave frequencies.

3.1 Fuel Dispensing System Of Methodology

When a Customer wants to dispatch gasoline. The Customer must provide the RFID card at that moment. If the RFID card is recognised, the customer selects "Fuel Mode." The LCD Display prompts you to enter the required gasoline quantity. The confirm option appears on the LCD display if the balance is sufficient. After that, an SMS is delivered to the customer's mobile phone and the pump motor is turned on. Fuel eventually saves data to the computer fig.3.3.

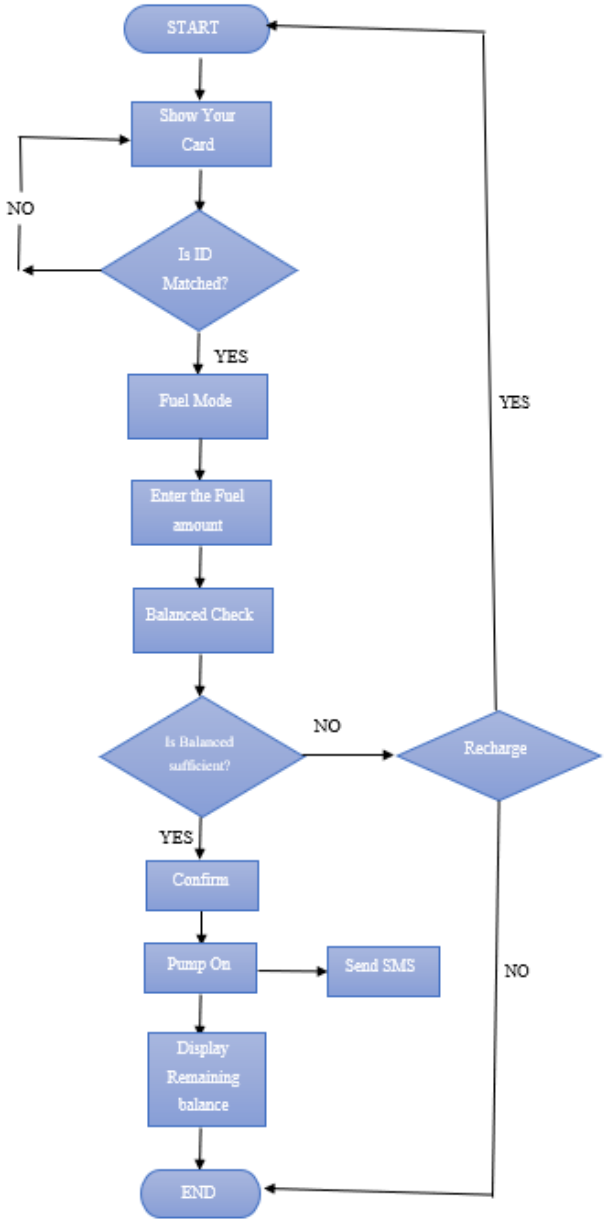

Figure 3.3: Flow chart of Fuel dispensing system

CHAPTER 4

PROJECT REQUIREMENTS

There are several choices for implementing the suggested system, including various technologies that might be employed to achieve the desired outcome. In this study, we choose the most stable and straight forward technique for our system, which includes the following apparatus:

4.1 Hardware Requirements

Figure 4.1: RFID Reader Module

4.1.1 RFID Reader Module, EM-18:

The EM-18 RFID reader module makes use of an RFID reader with a scanning frequency of 125 kHz, which is capable of reading 125 kHz tags. As a result, it is referred to as a low-frequency radio frequency identification reader. It has an operating range of around 8-12 cm and produces a serial signal. There is an antenna built-in, which can be connected to the PC via the RS232 port fig4.1. For your RFID application, the EM-18 RFID Reader module, which runs at a frequency of 125kHz, is an affordable solution.

The Reader module operates with a built-in antenna and requires a 5V power supply to function properly. The transmission pin of the component must be connected to the receiving pin on the microcontroller for it to be powered. If you set your card within the reading range, you will see the card details-pushed towards the output fig4.2. It is possible to add a Wiegand output to the module as an option.

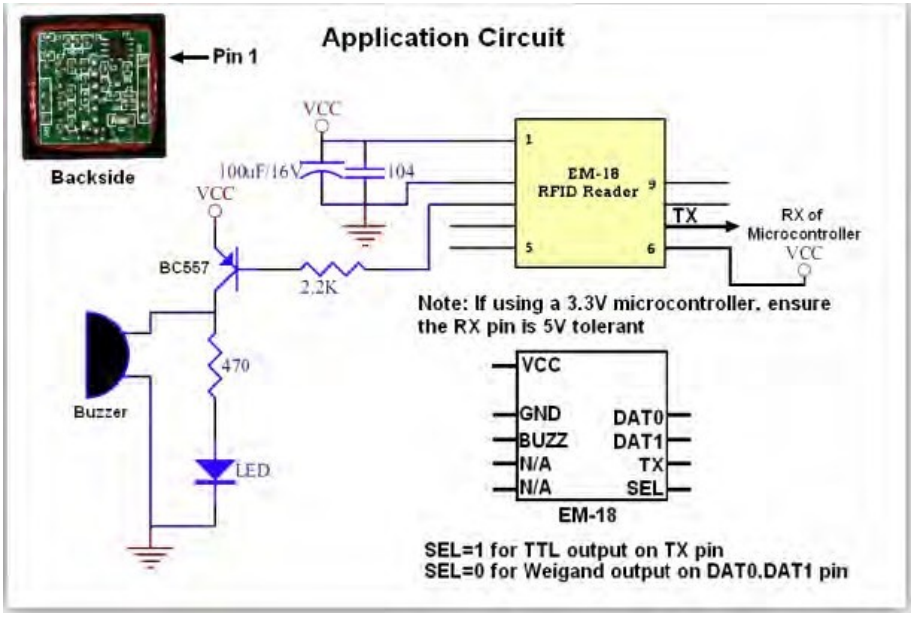

Figure 4.2: EM-18 application Circuit

4.1.2 RFID Tag:

RFID tags are a type a tracking device that uses smart barcodes to identify and track the movement of products. RFID is an abbreviation of radio frequency identification, and RFID tags are small tags that transmit radio waves. employ that technology. These radio frequency waves carry matter from the id to a scanner, subsequently sends the data to a computer software that recognises the tag. When it comes to monitoring products, RFID tags are most commonly employed, but they may also be used to track autos, pets, and patients. RFID tags, also known as RFID chips, are a sort of passive RFID tag fig4.3.

In order to broadcast and receive information from an RFID tag, an antenna and a microchip (also know as an integrated circuit or IC) must be used in conjunction. The user may write any information they want to an RFID reader's microchip. There battery-

Figure 4.3: RFID Tag

operated and passive RFID tags are the two most common varieties.According to the name, lithium ion Radio Frequency ids have an inbuilt batteries that serves as a current source, while passive RFID ids not have an internal battery and instead depend on the electromagnetic energy provided by an RFID reader to generate power. An active tag is an RFID tag that is powered by batteries, as seen in fig4.4.

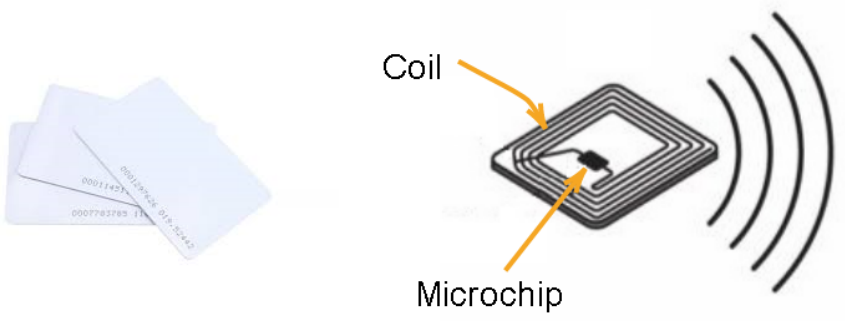

Figure 4.4: RFID Tag structure

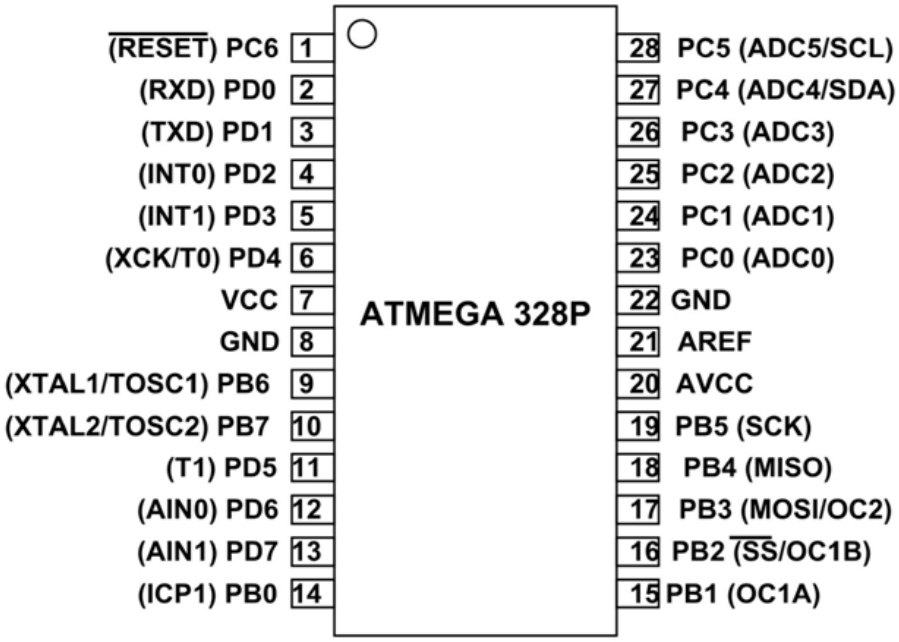

Figure 4.5: Atmega328p Pinout

4.1.3 Atmega328p Microcontroller:

An ATmega328 is a single-chip microcontroller from Atmel that is part of the mega AVR series.The Atmel 8-bit AVR RISC-based microcontroller has 32 kB of ISP flash memory with read-while-write capabilities, 1 kB of Erasable Programmable Read-Only Memory Erasable Programmable Read-Only Memory (EPROM), 2 kB of SRAM, 23 general-purpose I/O lines, 32 general-purpose working registers, three flexible timer to comparisons modes, internal and external interrupts, serial programmable read-only memory SRAM, and a serial Universal Synchronous Asynchronous Receiver Transmitter (USART), a byte-oriented 2-wire serial interface, SPI serial port, 6-channel 10-bit A/D The gadget works with a voltage range of 1.8 to 5.5 volts fig 4.5. In terms of throughput, the device achieves near to 1 Million Instructions Per Second Million Instructions Per Second (MIPS) per megahertz (MHz). At the time of this writing, the ATmega328 is widely used in a wide range of applications and autonomous systems that demand a simple, low-power microcontroller. The ATmega328P is a low-power 8-bit CMOS microcontroller that is based on the AVR enhanced RISC architecture and is designed for embedded applications. With its ability to execute powerful instructions in a single clock cycle, the ATmega328P achieves throughputs approaching 1MIPS per

MHz, allowing the system designer to strike a compromise between power consumption and processing performance fig4.6.

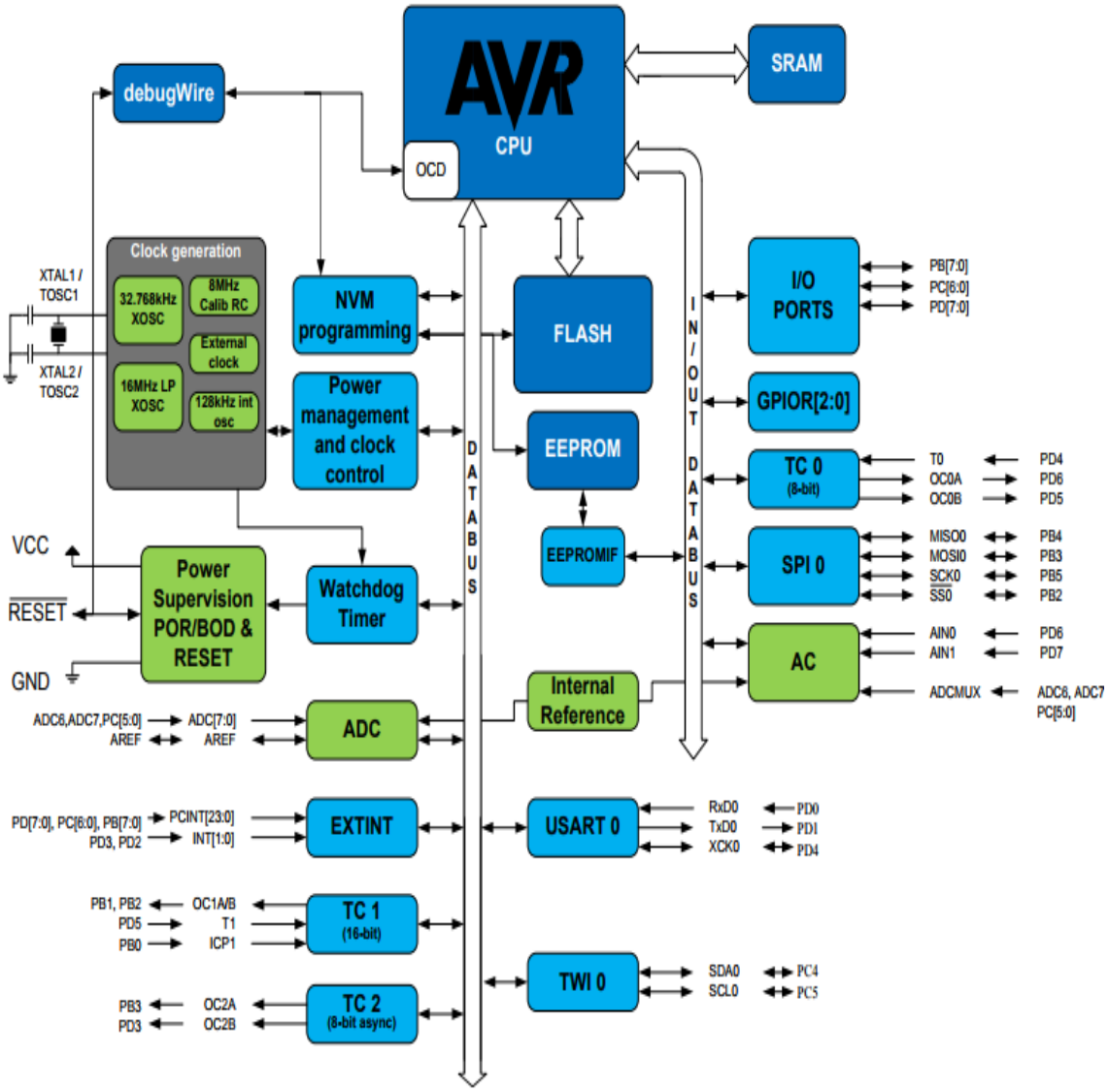

Figure 4.6: Atmega328p Block Diagram

The AVR core includes 32 general-purpose working registers and a large instruction set. The arithmetic logic unit ALU is directly coupled to all 32 registers, allowing two independent registers to be accessed in one clock cycle with a single instruction. The resulting design is more code efficient than traditional CISC microcontrollers while attaining throughputs up to ten times quicker.

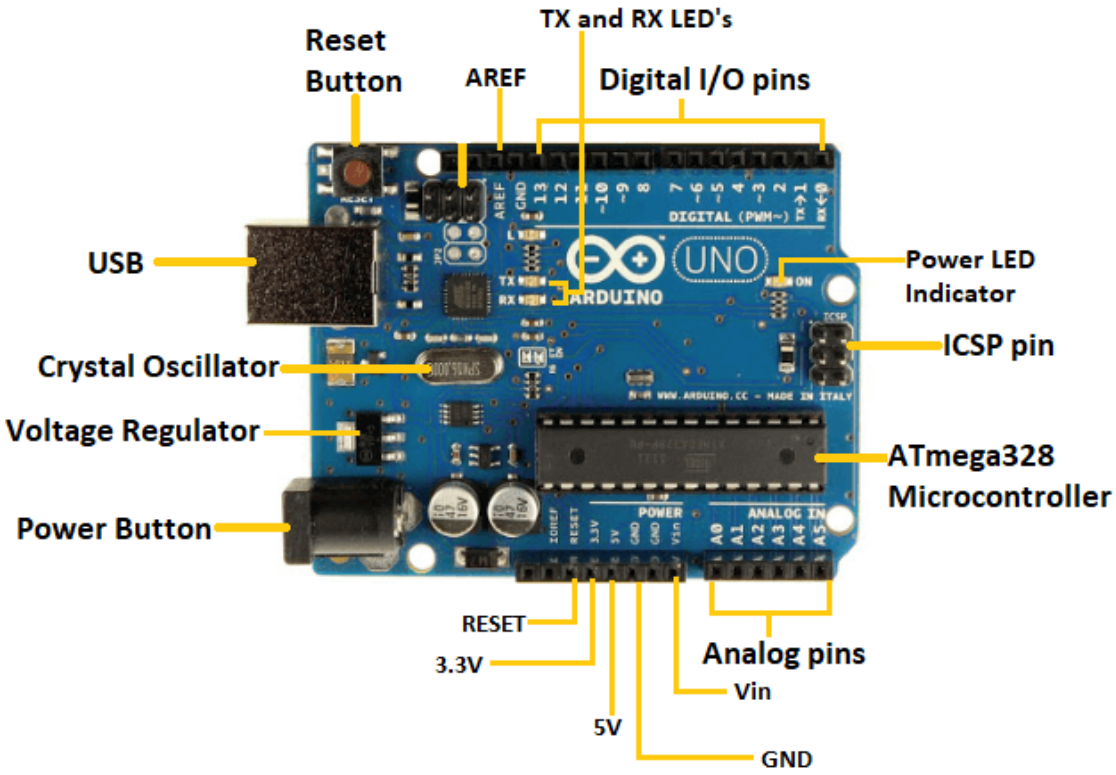

Figure 4.7: Arduino UNO Board

4.1.4 Arduino:

A corporation, initiative, and user community devoted to open source computer hardware and software, Arduino manufactures and distributes single-board microcontrollers and microcontroller kits for building digital devices and interactive things that can sense and control both physical and digital items. The Arduino project's products are open-source hardware and software licenced under the GNU Lesser General Public License (LGPL) or the GNU General Public License (GPL), allowing anybody to create Arduino boards and distribute software under the same licence. Figure 4.7 shows that preassembled Arduino boards and DIY kits are also available for purchase. The Arduino UNO has a number of features, including an AVR microcontroller (AVR328), six analogue input pins, and fourteen digital I/O pins, six of which are used as Pulse Width Modulation (PWM) output. Variations in the input voltage range from 7 to 12 volts are seen. 20 milliamps of direct current flow through each I/O pin, and a 16 megahertz clock frequency are used throughout the system. Additional to this, the working voltage is 5V.

4.1.5 GSM Module:

It is based on SIMCOM's Dual Band GSM SIM900A modem, which we have used in this project. On the 900MHz frequency band, it is active. Changes in frequency bands can also be accomplished with AT commands fig4.8. It is possible to set the baud rate with the AT command to any value between 1200-115200. In terms of size, the SIM900A is extremely small and wireless. It is possible to link your PC to a microcontroller equipped with an RS232 chip via a modem, which is an interface (MAX232). SMS, voice, and data transmission applications are excellent for use with the Machine-to-Machine (M2M) interface. To the onboard Regulated Power Supply, you can connect an unregulated power source with a wide operating range.SIM900A is only functional in India. It also has Quad-Band Global System for Mobile communication (GSM) with frequencies of 850/900/1800/1900MHz. Arduino UNO is supported. 12 volts, 1 amp to 2 amps maximum power supply. The SIM900A Cellular Module features a top right

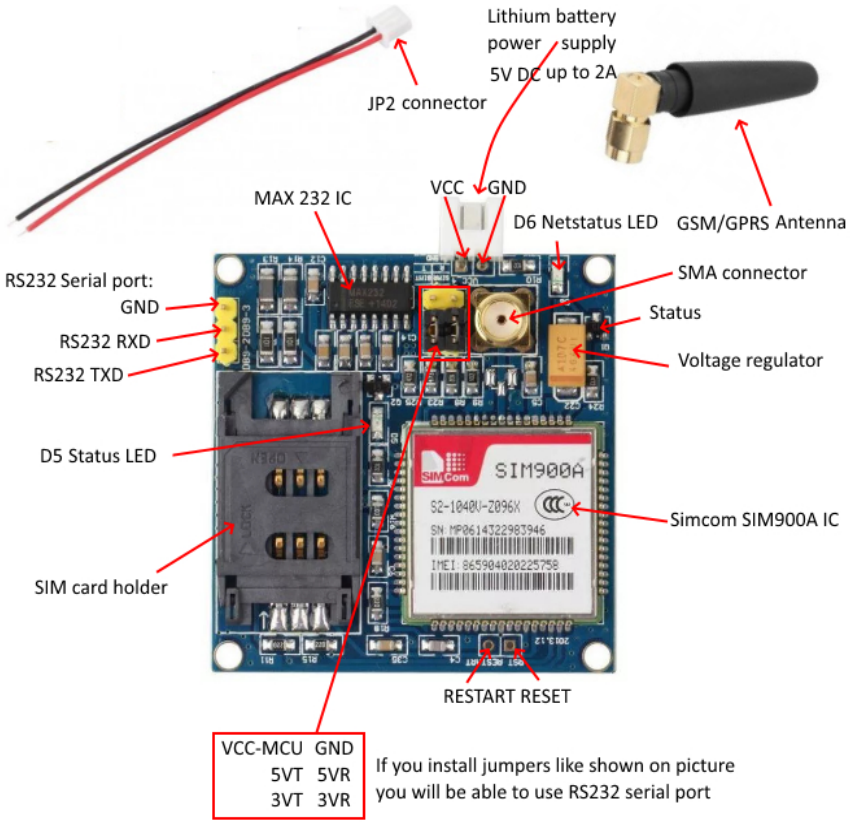

Figure 4.8: GSM Module

side for this LED Indicator. It shows the status of the LED cellular network. It will blink on different sides to indicate the LED status indication. For every Blink 1: This module is in the Running Phase, but there is no cellular network connection. Every Blink 2 indicates that the General Packet Radio Services (GPRS) connection is active. For every Blink 3: This Module is connected to cellular networks and can receive, send, and receive SMS information from contacts. It may appear as though the SIM900A Module is a single chip, but it contains a number of characteristics that can be used to assist in the creation of a variety of commercial applications. Despite the fact that the SIM900A has a total of 68 pins, these pins are used in the development of applications. However, if we utilize a module to interface with Arduino, we will just need a few pins fig 4.9.

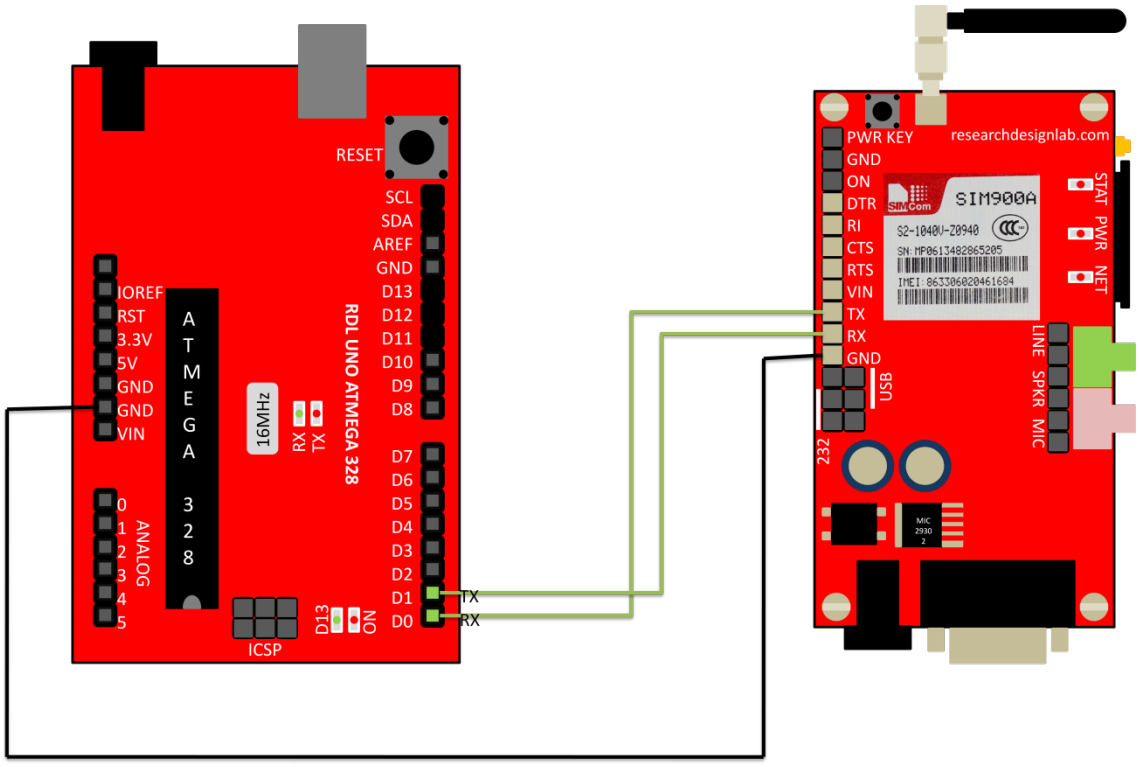

Figure 4.9: Interfacing UNO and GSM Shield

4.1.6 Power Relay:

We use a relay as an electromechanical switch to open and close circuits fig4.10. A plane relay is similar to a single-channel relay module in that its components facilitate connection and switching. They also serve as indicators, indicating that the module is active and that power is flowing through it, as well as indicating that the relay is in

the off/on state.The coil in the relay attracts and contacts them, allowing them to be activated; when the coil is not electrified, the spring separates them. It has a supply voltage of 3.75 to 6 volts. It has a Quiescent current of roughly 2mA.

Figure 4.10: Power Relay

Once the relay is activated, it consumes around 70 milliamps of electricity fig**??**.A relay is a device that turns on and off a circuit or electrical flow. The coil in the relay attracts and contacts them, allowing them to be activated; when the coil is not electrified, the spring separates them. It has two advantages: first, it activates the relay, requiring less current to switch to the appropriate energy source.The second is that the contacts and coils are both galvanised and insulated from one another, resulting in no electrical contact between them.In order for the electromagnetic relay to function as an electromagnetic switch for the Pump and motors, relay drivers must be used. A low-voltage circuit, for example, may be used to switch on and off a light source that is linked to a 230v power supply, which is advantageous. A relay is a component that is electronically separated from the controlling circuit. Switches are used to turn on and off a relatively high current or control signals that would otherwise be difficult to turn on and off using a small circuit.

4.1.7 Mobile Phone:

It communicates with the controlled device's universal transmitter and is used to deliver SMS messages to the customer mobile phone. An electronic prepaid card will be used in this project by the user. With the exception of a magnetic member, the card is devoid of any further components.As soon as a consumer inserts this id into the reader, the scanner scans the card's unique id and sends a signal to a microprocessor, which then processes the information.

4.1.8 UART:

In communicating with external devices and systems, the Universal Asynchronous Receiver-Transmitter (UART), or simply UART, is a popular peripheral found on microcontrollers Microcontroller Unit (MCU) that is used to transmit and receive data. The UART interface allows the microcontroller to communicate with a wide range of devices, including modules, ASICs, and personal computers. It is integrated into microcontrollers that support this peripheral, and it can be accessed. The UART circuitry is built into microcontrollers that support this peripheral. With this configuration, it is possible to build up a complete duplex system fig4.11. However, in other applications, such as display modules, where the MCU's main responsibility is to transfer visual data to the display, only the transmit pin may be required to function. GPS navigation system on board As an alternative, because the MCU only needs to wait for GPS data and does not need to transmit information to the module, the UART's receive pin may be sufficient. In any case, the UART can be used to receive and transmit data to and from a device that is capable of doing so. Providing that both the logic levels on the MCU and the external device are the same, connecting the MCU's UART to the external device is an easy direct connection. Of course, the ground connection for each device should be the same as the other. A GSM Module is shown in the picture below, as are the pin connections between the Microcontroller and the access point. In order to communicate, the RX and TX pins must be "crossed" one against another. Due to the fact that it is an output pin by definition, it must be connected to a pin 2 and likewise. Making the mistake of connecting both the Rx and Tx connectors at the same time is common.

However, you must exercise caution when naming the pins on both the MCU and the external device, as this can cause confusion. For the input pin of the UART in relation to itself, the words "RX," "Receive," and "Receiver" are frequently used to refer to the pin.

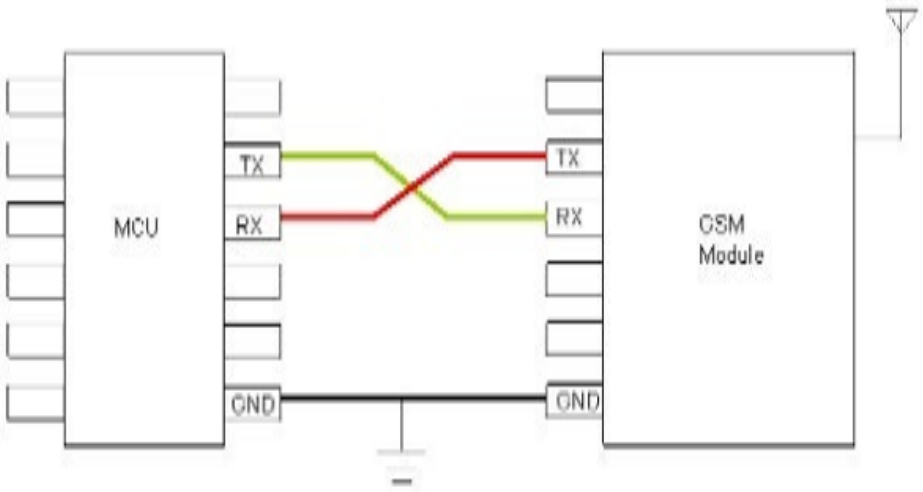

Figure 4.11: Functioning of UART with MCU

4.1.9 Submersible Mini Pump :

An extremely small fuel pump is being used to get fuel out of the vehicle. As soon as the system is activated, the motor will begin to run and remove the quantity of money that we have placed in the system to serve as fuel. A Submersible Pump of tiny size and inexpensive cost is available. An electric motor that operates on a voltage range of 3 to 6 volts. This device can process up to 120 litres per hour while requiring only 220 milliamps of electricity fig4.12. Simply connect a tube pipe to the motor outlet, fill it with gasoline, and switch the engine on to get started. In order to ensure that the fuel level always exceeds the motor's capacity, Because of the overheating that occurs, dry running can cause damage to the engine and create noise. In this case, the flow rate is between 80 and 120 litres per minute. Small and lightweight, the motor is a good choice. The DC motor drives are powered by a 5V power source and are controlled by a microcontroller/Arduino to run the pump. The pipe must be dipped in gasoline and connected to a fuel pipe on the output side in order to pump fuel while also supplying

electricity to the pump. In addition to having a maximum lift of 40 to 110 millimetres, it has a continuous working life of 500 hours and operates in a DC, magnetic drive mode.

Figure 4.12: Submersible Mini Pump

4.1.10 16x2 LCD Display :

We're utilising a 16x2 LCD with 16 columns and 2 rows. It's based on the technology of a plane panel display. It will feature a total of 32 characters, each of which is composed of 588 Pixel Dots. The following image depicts a single character with all of its pixels. So the lcd's total pixels are 1280. The basic operation of an LCD is to transfer light from one layer to the next through modules fig4.13.

These modules vibrate and align themselves at a 90o angle, allowing light to travel through the polarised sheet. This display's working voltage is between 4.7 and 5.3 volts. In addition, the operating current is 1 milliampere (mA). HD44780 was installed in the IC. This IC's purpose is to obtain the MCU commands and data and process them in order to show useful information on our LCD screen. Different colour combinations may be achieved by varying the brightness of each light fig 4.14. This page provides an overview of the LCD 16X2 and how it interacts with apps.These molecules are in charge

Figure 4.13: LCD

of inspecting each pixel's info. To illustrate the digit, each pixel uses the absorbing light approach. The location of molecules must be adjusted to the angle of light in order to display the value.

Figure 4.14: LCD hardware

4.1.11 Prepaid Card:

In mobile phones that use the Global System for Mobile Communications (GSM) network, a Subscriber Identity Module (SIM) is a small memory chip that is widely encountered. Figure4.15 shows how SIMs are used. Personal information about the account holder, such as his or her phone number, address book, text messages, and other information, is stored on these cards. Smart cards, chip cards, and integrated circuit(s)

cards are all terms used to describe any pocket-sized card that contains embedded integrated circuits (ICC). ICCs are classified into two categories, despite the fact that they have a wide range of applications. Memory cards are fully comprised of non-volatile memory storage components, with the exception of any security logic that may be present. Microprocessor cards contain memory and microprocessor components, among other things. Smart cards are typically thought of as credit card-sized microprocessor cards or smaller, as in the case of the MasterCard.It is a compact SIM card that includes interfere capabilities (for example, a safe symmetric encryption, a secure file system, that may deliver security services (for example, data privacy in memory). Given that all smart cards (for example, memory cards) have a microprocessor, all chip cards are treated in the same manner when it comes to smart card classification. On the other hand, there is a considerable degree of variety in language use among the general public.

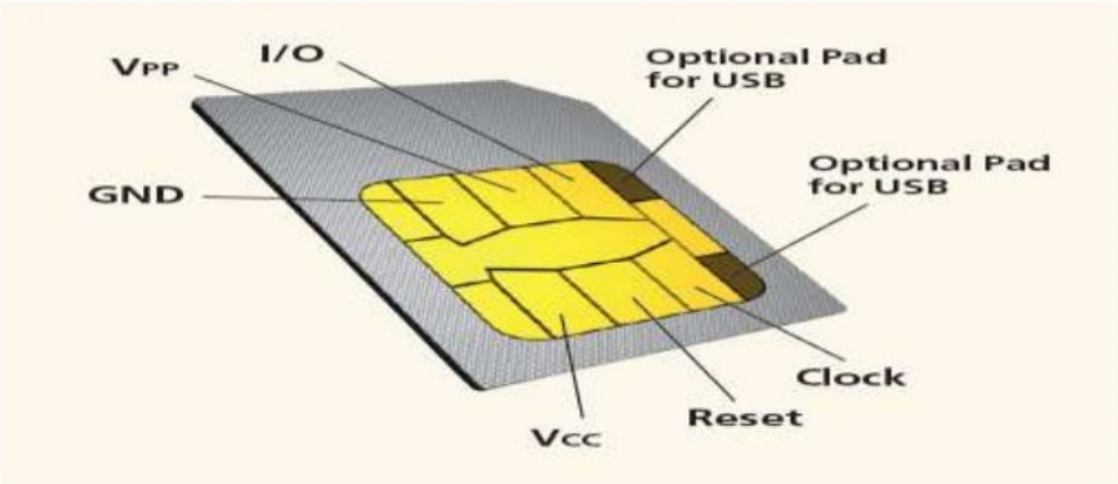

Figure 4.15: Prepaid Card

4.1.12 Buzzer:

When we input a bad password or display the erroneous card to the EM-18 reader, the buzzer begins to blow. This is mostly used to convert audio to sound. In most cases, DC voltage is used to power it. 3.300 Hz is the frequency range fig 4.16. The operating temperature varies from –20 to +60 degrees Celsius. 3V to 24V DC is the operating voltage range. 85dBA (10cm) is the sound pressure level. The current drawn from the power source is less than 15 milliamperes.

Figure 4.16: Buzzer

4.2 Software Requirements

4.2.1 Arduino IDE:

An Integrated Development Environment Integrated Development Environment (IDE) is a software platform that gives computer programmers with a comprehensive set of software development tools fig4.18 for more information. An integrated development environment (IDE) frequently includes a source code editor, build automation tools, and a debugging.

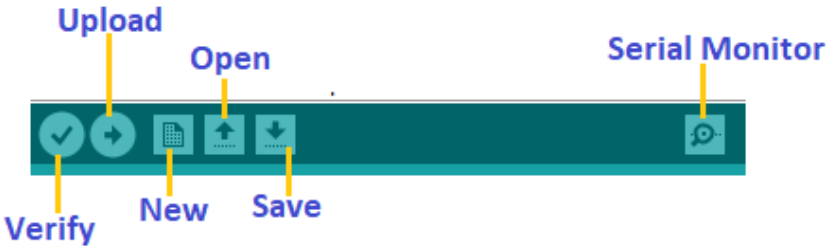

Figure 4.17: Arduino Tool Bar

The Upload button compiles and runs our on-screen code. It then sends the code to the board with which it is linked. We must first ensure that the correct board and ports are selected before uploading the schematic.

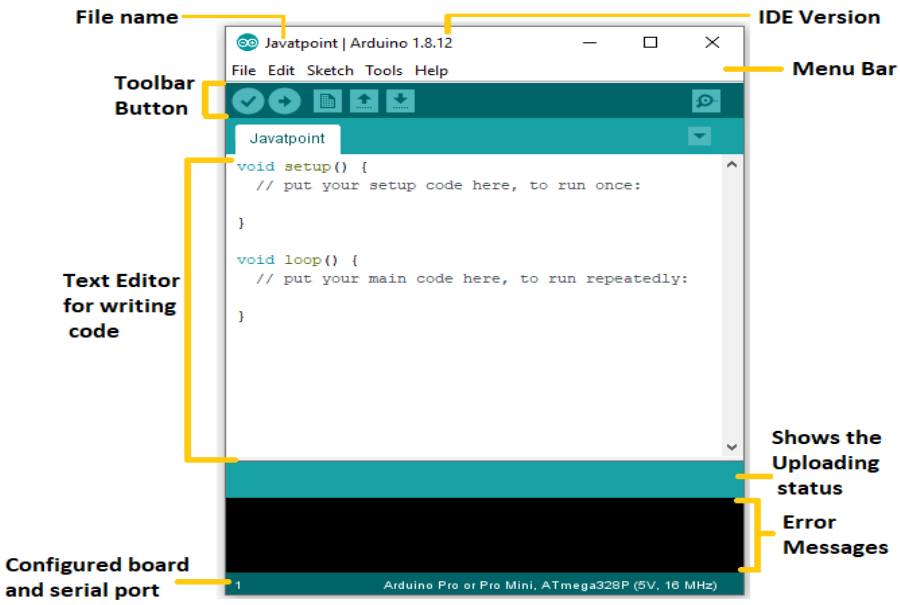

Figure 4.18: Arduino IDE

To link the board with the computer, we'll also need a USB port. After you've completed all of the steps above, go to the toolbar and click the Upload button. Before starting Upload, the most recent Arduino boards can be automatically reset fig4.17. We must use the Reset button on the earlier boards. The Tx and Rx LEDs will begin to blink as soon as the uploading is completed successfully. If the uploading fails, the message in the error box will be displayed window.Using the Arduino Bootloader, we don't need any additional hardware to upload our sketch. A bootloader is a short programme that is loaded into the board's microcontroller. On PIN 13, the LED will blink.

4.2.2 C Programming Language:

C is a general-purpose programming language that is widely used because it is simple, straightforward, and versatile. It is a structured programming language that is machine-independent and is commonly used to construct apps, operating systems such as Windows, and many more difficult programmes such as the Oracle database, Git, the Python interpreter, the Arduino, and many others. The UNIX operating system and the C programming language are inextricably intertwined. C is the programming language that is used to create the majority of the UNIX operating system. 'C' programming was originally exclusive to the UNIX operating system, but as it gained widespread acceptance around the world.

CHAPTER 5

IMPLEMENTATION

5.1 Hardware Implementation

Below,we have included the hardware model of the RFID Based Smart Fuel Dispensing System fig 5.1.

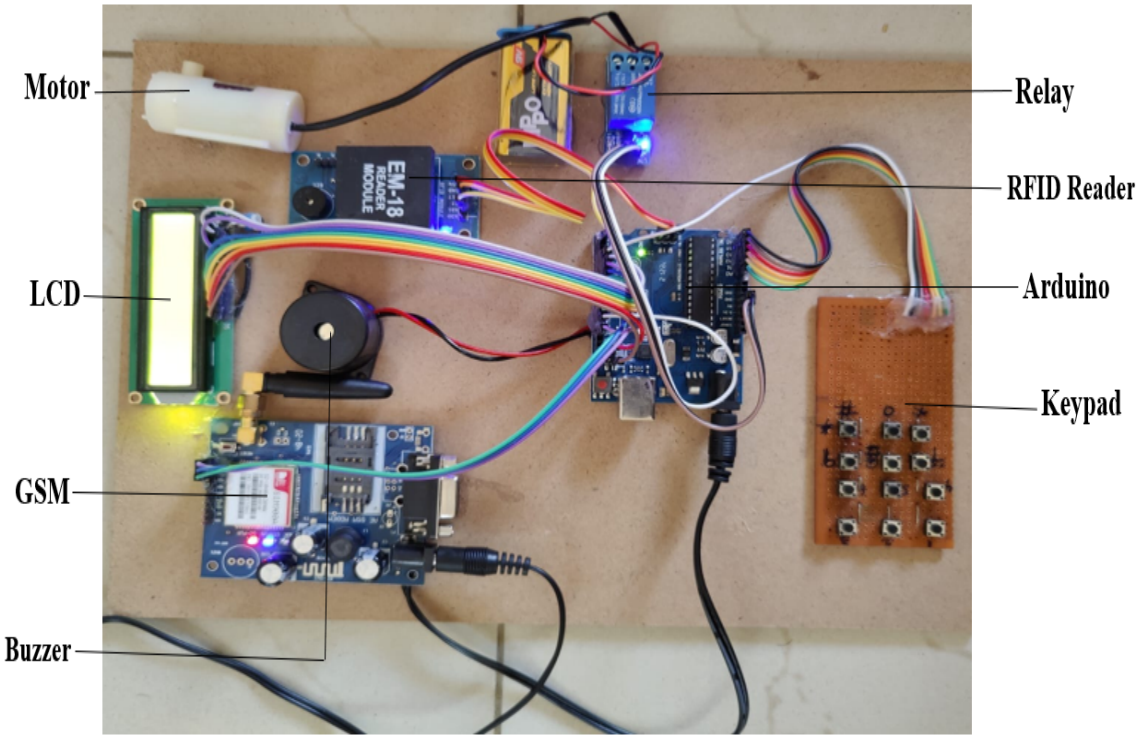

Figure 5.1: Hardware Model of RFID Based Automated Petrol Pump System

5.2 Software Implementation

Below, we have attached code for keypad setup in Arduino ide software for the processing of pressing the button of the user fig5.2.

File Edit Sketch Tools Help

sketch_mar06a

```
#include <string.h>

#include<LiquidCrystal.h>
LiquidCrystal lcd(4,5,6,7,8,9);

#include <Keypad.h>
char Pass[4];
byte data_count = 0;

char customKey;

const byte ROWS = 4;
const byte COLS = 3;

char hexaKeys[ROWS][COLS] = {
  {'1', '2', '3'},
  {'4', '5', '6'},
  {'7', '8', '9'},
  {'*', '0', '#'}
```

Figure 5.2: KeyPad Setup

Below is code for RFID Tag setup in Arduino IDE programme for the procedure of assigning to the user with their information and tag number registration fig5.3.

```
#include <SoftwareSerial.h>
SoftwareSerial gsm(10, 11); // RX, TX
//SoftwareSerial RFID(2, 20); // RX, TX
char tag1[12] ="590081BC4024"; // Replace with your Tag ID
char tag2[12] ="59001C1BE3BD";
char tag3[12] ="59001C89905C";

unsigned int tag=0,ucCardId=0;
int uiChargeAmount=0;

unsigned char key;
//int Amount=0;
unsigned char ucKeys[4];
char input[13];
int count = 0,k1;
int amt1=0,amt2=0;
unsigned char status1;
```

Figure 5.3: RFID Tag Registration

The code for setting up the message alert for the RFID GSM module in the Arduino IDE software has been attached. When the card is debited or accessed, the message will be sent to the registered mobile number fig5.4

```
void SendSMS()
{
    lcd.clear();
    lcd.setCursor(0, 0);
    lcd.print("MODEM INIT....");

  gsm.println("AT");    //To send SMS in Text Mode
  delay(1000);
  gsm.println("AT+CMGF=1");    //To send SMS in Text Mode
  delay(1000);
  gsm.println("AT+CNMI=2,2,0,0,0");    //To send SMS in Text Mode
  delay(1000);
  gsm.println("AT+CMGS=\"6303588858\"\r");
  delay(1000);
  gsm.println("GSM Modem! INIT...");//the content of the message
  delay(200);
  gsm.println((char)26); //the stopping character Ctrl+Z
  gsm.write(0x1A);
  delay(5000);
```

Figure 5.4: Mobile Number Registratiin

5.3 Performance Analysis:

1)Entry Process: First and foremost, authorized individuals should always have their RFID cards on hand. The LCD then displays the message "Show Your Card," which is depicted in fig 5.5.

Figure 5.5: RFID Card using Entry Process

2)Password Protection: When the system is first started, the user is needed to

provide his or her password, as shown in Fig5.6.

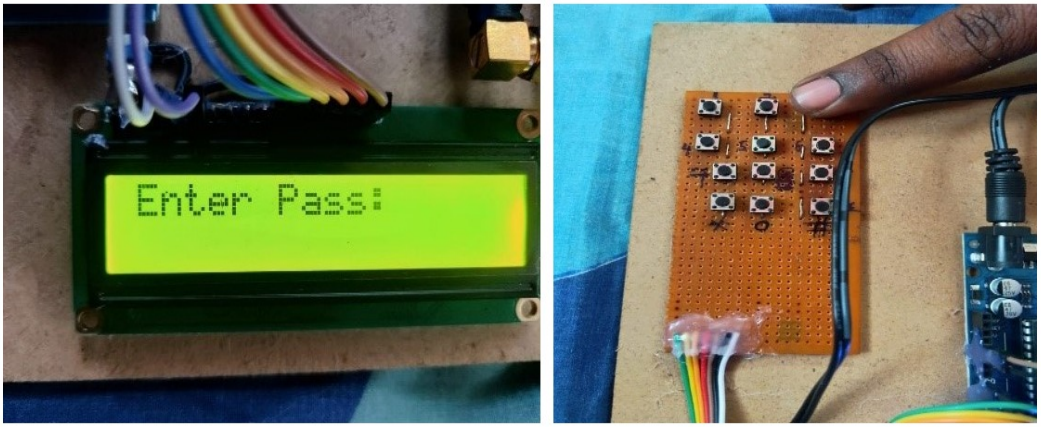

Figure 5.6: User Password input via Keypad

3)Recharge Mode: The following figure5.7 depicts the options available after the correct password has been input. There are two alternatives displayed. If the user chooses option '1, the system will prompt him or her to input the amount to be charged to the card. Immediately after the amount has been recharged, the system will require the person to show their id and enter the key a second time. Following this, the LCD will shows the sum of money still left in the user's or her card's remaining balance. Following that, the selection of one of two possibilities begins the next step in the process.

Figure 5.7: Recharge Money Process

4) Fuel Mode: So if the person chooses the gasoline method, as shown in Fig5.8, the machine will request the person to enter the quantity of fuel that requires to be delivered. Alternatively, if the person does not supply a value, the machine request the

person to input a value. Besides that, the user will get a message detailing the quantity of gasoline he has selected to buy for dispensing..

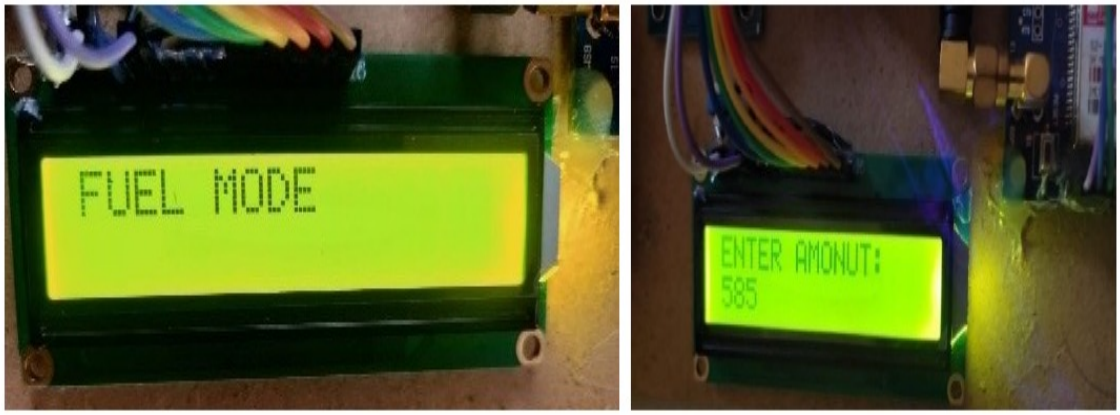

Figure 5.8: Processing of fuel refill

Fig5.9 shows the amount of fuel that is present in the card after the fuel has been dispersed. This operation is repeated one after another user after another, with the same procedure being followed each time.

Figure 5.9: Final Available Balance

5) Message: In addition, the user will receive a message on his phone fig5.10 informing him of the situation. Accessing Card will also receive a user message alert, and it will also send a message of balances RFID card to the cardholder's phone number.

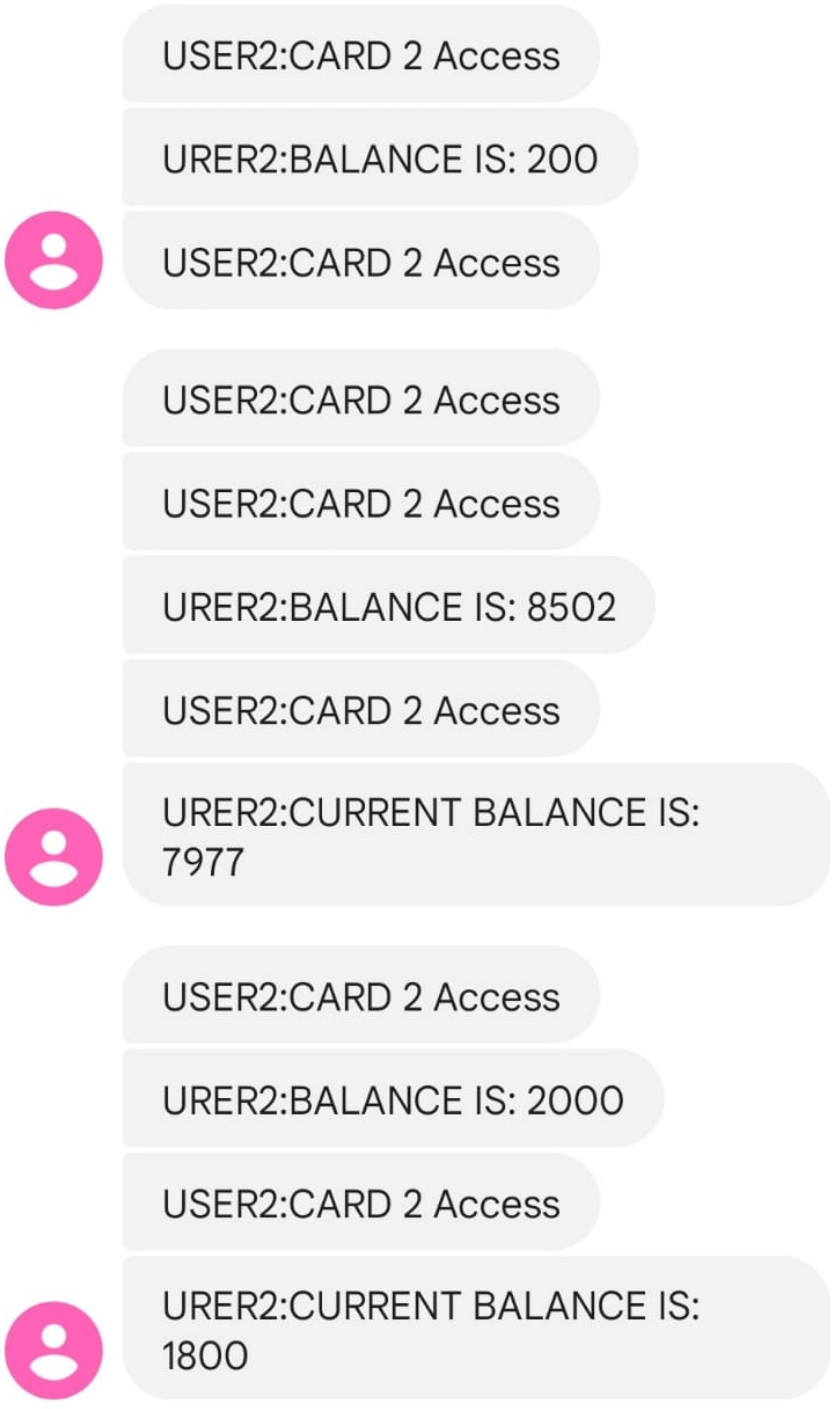

Figure 5.10: Message Alerts Received by GSM

CHAPTER 6

CONCLUSION AND FUTURE SCOPE

Conclusion: The RFID and GSM systems are used to control the smart fuel station control system that has been proposed. The use of RFID in this system ensures that the correct amount of fuel is dispensed, decreasing the possibility of fuel being misused. It also reduces the number of staff. If a customer attempts to swipe with an unauthorized card, the RFID system rejects the card and informs the customer of this. As a result, the system is extremely secure.

Future Scope: The proposed solution is incredibly advantageous since it provides a safe and cashless digital system that prevents fuel thefts in the new digital India idea. The proposed RFID-based fuel station automation model utilizing Arduino Uno can be improved even further by encrypting it with a password. It can be equipped with biometric security, allowing only the person to whom the RFID card belongs to use it for gasoline station entry. Each user will have their unique pin or biometric for their RFID card in this case. If the user inputs the right credentials, he will be prompted to enter the amount, after which the rest of the procedure will begin. If, on the other hand, the credential entered is incorrect, If he does not get it right the second time, he will be given two more opportunities, after which entry will be banned and a security alarm will be triggered notifying the same. This will assist in both authenticating and securing the user. Any access to the system is denied to the unauthorized user .

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