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Next Generation Automated Petrol Pump

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ABSTRACT

Today, everything has been digitized, and the entire gasoline pump has a design that can display the task of controlling the pump, driving the display, quantifying the flow rate, and turning off the pump. To collect the cash, still someone is mandatory and there is a chance of many human errors. So, the main aim is to propose a system is to avoid human errors. My proposed system is petrol pump automation, which can deduct gasoline from the user card based on RFID technology without human intervention. Liquid dispensing systems are normally found in our day-by-day life in better places like workplaces, Bus stands, Railway stations, Petrol syphons. Here we are going to display the modern era petrol dispensing system which is intended to be working with a prepaid card utilizing RFID innovation technology. The undertaking primarily points in structuring a prepaid card for petrol bunk framework and furthermore petrol dispensing system utilizing RFID innovation. Today, fluid supply systems are common in different places in our daily lives. Here, we will introduce the modern gasoline distribution system. To place petrol stations in remote areas is extremely precious to supply outstanding capacity to the clients. All these troubles can be solved by using this gasoline pump automation technology, which requires shorter operating time, higher efficiency and can be installed anywhere. This self-service gasoline pump device also provides customers with the protection of fuelling at the gas station without any involvement of the service provider, so the risk of carrying money every time is minimized.

Keywords: Automated, RFID, Petrol pump, Microcontroller.

I. INTRODUCTION

Today practically all petrol pumps have a controlling unit to play out the undertakings like dealing with the electrical pump, drive the presentation, measure the stream and respectively turning off the electrical pump. Yet at the same time, an individual is required to gather the cash and have a perception over the accumulation and dissemination of petroleum at every petrol bunk. This venture goes for structuring a system to wipe out this human collaboration as that there is no requirement for laborers to fill the petroleum and watch every oil bunk independently [4]. The dispensing of the fuel to huge number of vehicles at the fuel stations has caused many complications in India. The vehicle driver has to pay for fuel with cash money

and may have to pay more than the amount of dispensed fuel due to the lack of small money change available with station operator. RFID Based Automated Petrol Pump is to reduce human work and develop an auto-guided mechanism and to implement the task sequentially by using RFID technology. These systems are highly reliable and less time-consuming devices. Petroleum products are one of the valuable and rare creations of the nature. The proper use and distribution are an important task to survive these products. A fuel station is a facility which sells fuel and lubricants via fuel dispensers which themselves are used to pump gasoline, Diesel, kerosene, etc. into vehicles and to calculate the financial cost of the product thus dispensed the emergency of radio frequency technology has changed the traditional methods of data collection. Compared to the traditional bar code, magnetic card and IC cards, RFID tags [3]. In this system, all drivers have a smart card and all the data are exchanged to a single proprietor through IoT. There are different highlights of our project. This will be consisting of prepaid card, RF modems, microcontroller, keypad, display and solenoid valve. This framework will decrease labour and will spare time. IOT is used to monitor each activity in the petrol pump and also maintain it from a far distance.

II. EXISTING SYSTEM

In recent days the petrol bunks are managed physically. Normally in petrol bunks there is a person-to-person communication. Approximately all petrol pump has a microcontroller to handle the electrical supply, trip the screen and also execute all tasks. But still a person is necessary to collect the cash. These fuel stations are requiring more time and require more manpower. This system is designed to reduce this human relations and errors. Therefore, there is no need for workers to refuel. In this system, all drivers have an RFID card, which can be recharged by us or some places. The gasoline pump is equipped with an RFID reader, which will read our fingerprint and enter the amount, the motor will start, and gasoline will be injected into the gasoline tank from the fuel dispenser. [2]

III. PROPOSED SYSTEM

Liquid distribution systems are usually set up in many other places in our daily life, such as offices and gasoline pumps. Here, we will introduce a new era, that is, a gasoline dispensing arrangement, which is operated by a prepaid card using RFID technology.[2] In this proposed petrol pump automation system, we are using RFID card to access petrol at different petrol pump. Whenever we want to fill the tank from the fuel dispenser, we just have to place the RFID card near the RFID reader. Then the microcontroller reads the data from the RFID reader and performs the action according to the customer requirements. We propose a system where client will simply enter the price from the keypad and the vehicle will be loaded up with petrol. It automatically detects the petrol level and makes the whole system automated. RFID based automated petrol pump is to lessen human work and build up an auto-guided system and to actualize the undertaking successively by utilizing RFID innovation. These systems are exceptionally reliable and less tedious gadgets. IOT is utilized to monitor every movement in the petrol bunk and furthermore maintain it from a far separation (like requesting for petroleum from the industry and so on). Petroleum products are one of the valuable and rare creations of the nature hence our system greatly reduces stealing of petrol and wastage of the same. This digital petrol pump system also provides the security for the customers for filling petrol at the Petrol pump by avoiding the involvement of human beings, hence reduces the risk of carrying money every time.

Block Diagram:

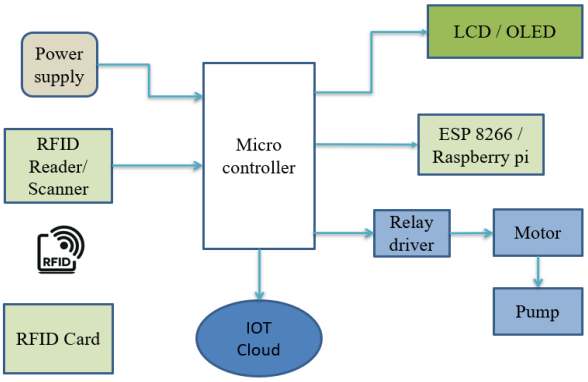

Fig 1 Block Diagram of Automated Petrol Pump

When the customer comes to fill the fuel at the station, firstly he will swipe the card. If the card is authorized, RFID card reader will accept the card. then it will ask for the amount for the petrol to be dispensed. The amount will be given by the user with use of IOT cloud, then the microcontroller will have the amount it processes the amount and then give it to the LCD/OLED the display. Then after displaying amount the microcontroller will command relay driver to run and relay driver will run motor and then it will dispense the petrol from the pump, in such a way system works.

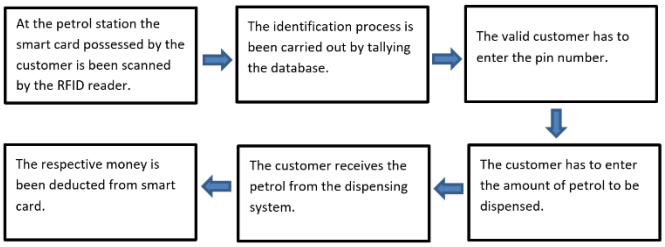

Fig 2: Flow Chart of the similar type of RFID Based Automated Petrol Pump System [2]

Components Required:

1. **Microcontroller**

- A microcontroller is a compact integrated circuit designed to govern a specific operation in an embedded system. A typical microcontroller includes a processor, memory and input/output (I/O) peripherals on a single chip.
- Sometimes referred to as an embedded controller or microcontroller unit (MCU), microcontrollers are found in vehicles, robots, office machines, medical devices, mobile radio transceivers, vending machines and home appliances, among other devices. They are essentially simple miniature personal computers (PCs) designed to control small features of a larger component, without a complex front-end operating system (OS).

Types of microcontrollers:

- Common MCUs include the Intel MCS-51, often referred to as an 8051 microcontroller, which was first developed in 1985; the AVR microcontroller developed by Atmel in 1996; the programmable interface controller (PIC) from Microchip Technology; and various licensed Advanced RISC Machines (ARM) microcontrollers.
- A number of companies manufacture and sell microcontrollers, including NXP Semiconductors, Renesas Electronics, Silicon Labs and Texas Instruments.
- **STM32**

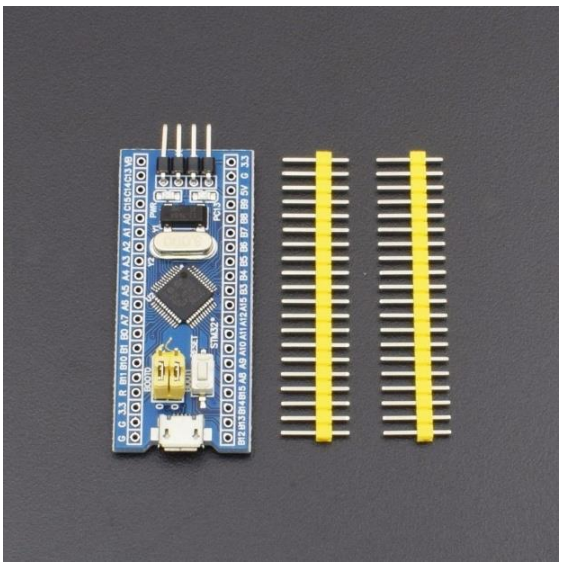

Fig 3 STM32

- The STM32 series of microcontrollers from ST Microelectronics is a popular, and very large, family of ARM-based 32-bit microcontrollers.
- Being ARM-based means that the core of the microcontroller is one of the various ARM cores licensed from Advanced RISC Machines. In the case of the STM32, these can be Cortex M0/M0+, M3, M33, M4 or M7, either in single, or multiple, core configurations.
- Within each one of these main microcontroller branches, there are many variants. In total, there are a few hundred microcontrollers in the STM32 family. So, choosing one can be quite an undertaking in itself.
- Having chosen a suitable microcontroller, the next step is to actually understand its internal architecture so as to be able to successfully set it up for the intended application. While the STM32 microcontrollers are quite versatile and highly configurable, it is this very fact that makes them hard to initialize.
- **Atmega 328**

Atmega328 IC

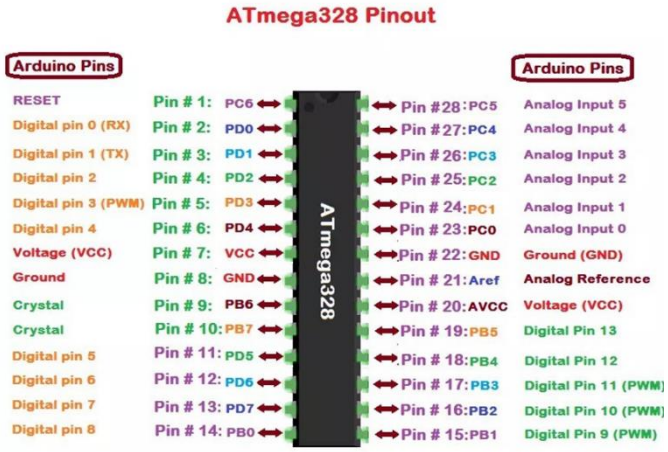

Fig 4 ATMEGA 328

- ATmega328 is commonly used in many projects and autonomous systems where a simple, low-powered, low-cost micro-controller is needed. Perhaps the most common implementation of this chip is on the popular Arduino development platform, namely the Arduino Uno, Arduino Pro Mini and Arduino Nano models.
- ATmega328 is an Advanced Virtual RISC (AVR) microcontroller. It supports 8-bit data processing. ATmega-328 has 32KB internal flash memory.
- ATmega328 has 1KB Electrically Erasable Programmable Read-Only Memory (EEPROM). It has 2KB Static Random Access Memory (SRAM). It has 8 Pins for ADC operations, which all combine to form PortA (PA0 - PA7).
- It also has 3 built-in Timers, two of them are 8 Bit timers while the third one is 16-Bit Timer.
- It operates ranging from 3.3V to 5.5V but normally we use 5V as a standard.
- Its excellent features include cost-efficiency, low power dissipation, programming lock for security purposes, real timer counter with separate oscillator.

1. Comparison of ATMEGA32 with STM32

FEATURES	ATMEGA 328	STM 32
Clock frequency (MHz)	20 max	48 max
Flash size (KB)	32	32
SRAM SIZE (bytes)	2048	4096
EEPROM SIZE (bytes)	1024	None
USART	1	1
SPI	2	1
I2C	1	1

Table 1 Comparison of ATMEGA328 with STM32

- In comparison of stm32 and atmega328, we have found atmega328 suitable for our application and as well as it is easy to interface with other sensors that is why we have gone for atmega328.

2. Keypad

Fig 5 4*4 Keypad

- Keypad is used as an input device to read the key pressed by the user and to process it.
- 4x4 keypad consists of 4 rows and 4 columns. Switches are placed between the rows and columns.
- A key press establishes a connection between the corresponding row and column, between which the switch is placed.
- When we want to interface one key to the microcontroller then it needs one GPIO pin. But when we want to interface many keys like 9, 12 or 16 etc., then it may acquire all GPIO pins of microcontroller.
- To save some GPIO pins of microcontroller, we can use matrix keypad. Matrix keypad is nothing but keys arrange in row and column.
- E.g., if we want to interface 16 keys to the microcontroller then we require 16 GPIO pins but if we use matrix 4x4 keypad then we require only 8 GPIO pins of microcontroller.
- Keyboards are organized in a matrix of rows and columns. When a key is pressed, a row and a column make a contact Otherwise; there is no connection between rows and columns.
- Starting from the top row, the microcontroller will ground it by providing a low to row R1 only.
- Now read the columns, if the data read is all 1s, no key in that row is pressed and the process continues for the next row.
- So, now ground the next row, R2. Read the columns, check for any zero and this process continues until the row is identified.
- E.g., In above case we will get row 2 in which column is not equal to 1111.
- So, after identification of the row in which the key has been pressed we can easily find out the key by row and column value.

3. RFID Cards & Reader Module

Fig 6 RFID Module

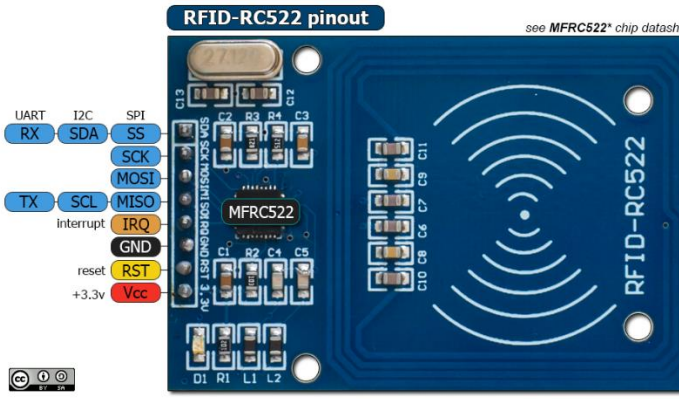

Fig 7 RC 522 Circuit Diagram

- RFID tags are a type of tracking system that uses radio frequency to search, identify, track, and communicate with items and people. Essentially, RFID tags are smart labels that can store a range of information from serial numbers, to a short description, and even pages of data. Some RFID tags include cryptographic security features for a high level of verification and authentication. RFID tags are usually identified by their radio frequencies: low frequency (LF), high frequency (HF), and ultra-high frequency (UHF).

i. LF systems have a range between 30 and 300 KHz and a read range up to 10 cm. These systems are more frequently used in applications like access control and livestock monitoring.

ii. HF systems have a range between 3 and 30 MHz and a read range from 10 cm to 1 m (3 ft). These systems are commonly used for electronic tickets, payments, or user experience applications.

iii. UHF systems have a range between 300 MHz and 3 GHz and a read range up to 12 m (39 ft). These are the systems most commonly used in retail inventory tracking, parking garages, door access, and asset management.

- A radio frequency identification reader (RFID reader) is a device used to gather information from an RFID tag, which is used to track individual objects. Radio waves are used to transfer data from the tag to a reader.
- RFID is a technology similar in theory to bar codes. However, the RFID tag does not have to be scanned directly, nor does it require line-of-sight to a reader. The RFID tag it must be within the range of an RFID reader, which ranges from 3 to 300 feet, in order to be read. RFID technology allows several items to be quickly scanned and enables fast identification of a particular product, even when it is surrounded by several other items.
- RFID tags have not replaced bar codes because of their cost and the need to individually identify every item.
- RFID is an acronym for “radio-frequency identification” and refers to a technology whereby digital data encoded in RFID tags or smart labels (defined below) are captured by a reader via radio waves. RFID is similar to barcoding in that data from a tag or label are captured by a device that stores the data in a database. RFID, however, has several advantages over systems that use barcode asset tracking software. The most notable is that RFID tag data can be read outside the line-of-sight, whereas barcodes must be aligned with an optical scanner.

- RFID belongs to a group of technologies referred to as Automatic Identification and Data Capture (AIDC). AIDC methods automatically identify objects, collect data about them, and enter those data directly into computer systems with little or no human intervention. RFID methods utilize radio waves to accomplish this. At a simple level, RFID systems consist of three components: an RFID tag or smart label, an RFID reader, and an antenna. RFID tags contain an integrated circuit and an antenna, which are used to transmit data to the RFID reader (also called an interrogator). The reader then converts the radio waves to a more usable form of data. Information collected from the tags is then transferred through a communications interface to a host computer system, where the data can be stored in a database and analyzed at a later time.

2. OLED

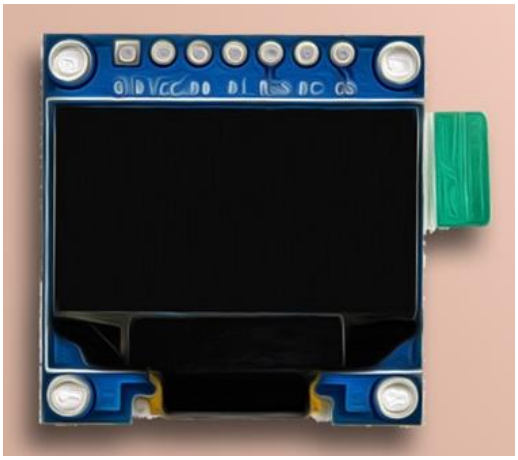

Fig 8 OLED

- An organic light-emitting diode (OLED or organic LED) is a light-emitting diode (LED) in which the emissive electroluminescent layer is a film of organic compound that emits light in response to an electric current. This organic layer is situated between two electrodes; typically, at least one of these electrodes is transparent. OLEDs are used to create digital displays in devices such as television screens, computer monitors, and portable systems such as smartphones and handheld game consoles.
- OLED stands for Organic Light Emitting Diode. The OLED displays are very small and have high resolution. These displays have no back light and they make their own light. That's why these are very low power devices.
- The OLED that we are going to use has individual 128X64 white OLED pixels. It is 0.96" (25mm X 14mm) in size. The OLEDs of other sizes are also available. The OLED used in this tutorial is monochrome (Only one color) but you can also get the OLED's having several colors.
- This OLED uses the SPI communication to communicate with Arduino. The SPI communication is faster than the I2C communication so this will make our display faster.

3. Relay driver

Fig 9 Relay Driver

- In a low power circuit or an output from a Microprocessor is very low. It is sufficient for a LED to glow but to drive a high load you will need a Relay (Electromagnet Switch), and to give proper voltage or current to a relay you will need a relay driver. Many times, one transistor with a resistance is enough to make a Relay Driver. In this type of circuit Transistor is use as current amplifier and Relay does two things (a) they isolate current (flow of electron) this is important because high load appliances run at different voltage (potential difference) thus Relay protects your sensitive

electronics parts. (b) Relay is a electromagnetic switch. It is a type of mechanical Switch which is pulled by a electro-magnet so its resistance is very low and thus it can control large power appliances.

- Now days in market **Relay Driver Module** is available which is generally combination of relay and a transistor. In many modules LED's is also placed to indicate status of a Relay Switch. In Market Relay module can purchased by telling how many Channels Relay is Required and operating voltage.

4. Motor Pump

Fig 10 Motor Pump

- DC powered pumps **use direct current from motor, battery, or solar power to move fluid in a variety of ways**. Motorized pumps typically operate on 6, 12, 24, or 32 volts of DC power. Solar-powered DC pumps use photovoltaic (PV) panels with solar cells that produce direct current when exposed to sunlight.

Circuit Diagram

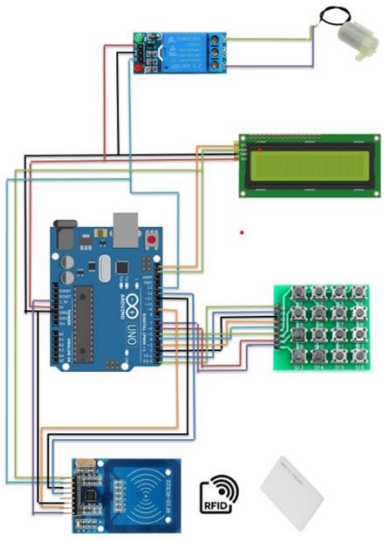

Fig 11 Circuit Diagram of Automated Petrol Pump

In circuit diagram we have placed arduino in place of microcontroller Atmega328 we can observe that rfid tag scanner is connected to arduino as an input whenever a card is scanned at the input the rfid scanner indicate microcontroller that card is scanned, then microcontroller processes it and indicate the card is valid and then it will allow user to enter the amount via use of IOT or Keypad interfaced then the entered amount will be displays on OLED. After amount given it will enables Relay driver to turn on the motor pump and that's how the automated petrol pump will perform.

Schematic diagram:

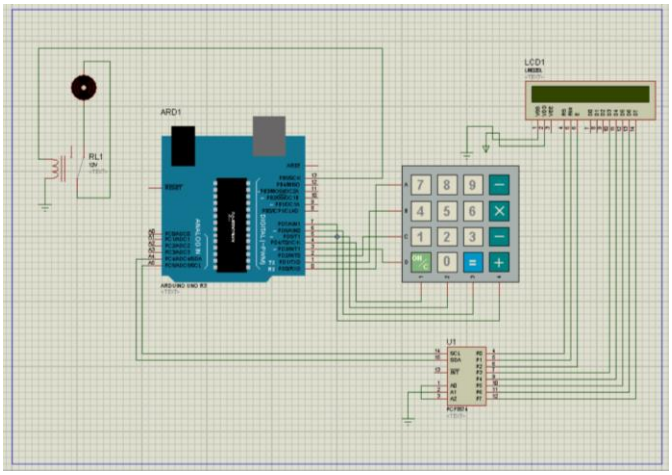

Fig 12 Schematic Diagram of Automated Petrol Pump

For this schematic diagram we have used proteus 8 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.

From use of proteus we have created a schematic diagram of automated petrol pump, in this we have done use of arduino library for proteus, keypad library for proteus and lcd library for proteus. And in the output, we have connected motor pump library for proteus. That's how schematic of automated petrol pump is made.

Also, system configurations for Proteus are, High performance x64 processor with at least 4 cores. Dedicated ATI or NVIDIA graphics card supporting OpenGL and Direct3D. 16GB or more of RAM. Microsoft supported 64-bit Windows operating system.

IV. CONCLUSION

The RFID system dispenses the exact measure of fuel as entered by the client which lessens the wastage of fuel and furthermore diminishes the labour. If the customer tries to swipe with the unapproved card, the RFID framework rejects the card. Along these lines, the system is so verified. To acquire the best execution the RFID readers and tags must be in great quality and for IOT interface there must be an amazing internet association.

V. Future Scope

If the government or some higher companies take interest in implementing such a project, entire chain of petrol bunks can be interconnected and these systems would be successful in providing 24 hours service. With the interconnection of these system user may track which petrol bunk would be near to him or which would have sufficient petrol reserve. In future the biometric scanner and password can be added where the vehicles number will be compared with number stack which will be containing all the theft. If the number in both stacks matches then a photo of the vehicle and the location will be sent to the nearest available police station.

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