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IOT Based Petrol Bunk Management for Self-Operation using RFID and Raspberry PI

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***Abstract*: This paper emphasis on designing a system which can spontaneously dispense the fuel and deduct the amount from prepaid RFID card. Here, all users will have their own RFID cards which are recharged by prepaid amounts. The dispenser in the fuel station is installed with RFID reader which reads the RFID card and displays the available balance on LCD display unit. The user will enter the desired amount of fuel using the keypad, the system will calculate the time of operation for the electrical fuel pump and initiates the operation of fuel dispensing. The system will automatically shuts down the pump after reaching the user's desired value. It is combined with raspberry pi module which sends notification to the user through mobile application. Added to that, this system has fire sensor to detect fire accidents and purity sensor to check the purity of the fuel. Hence this work will make the petrol bunk management system with no boundaries and reduced manpower.**

Index Terms: Raspberry Pi controller, RFID reader, keypad, relays, purity sensor, LCD display, power supply, WIFI modem, fire sensor, web app.

I. INTRODUCTION

Based on RFID technology and system automation technology we aim to electronically upgrade the traditional. The LCD display unit will show the values that are entered through keypad which will help the user to confirm electrical pump operation display unit and the keypad unit. The microcontroller unit controls the measuring by operating the pump for precise amount fuel stations. Petrol pumps nowadays generally have a microcontroller unit which controls the operation of time but still we need worker to enter the amount and collect money. Our proposed system is fully automated so that there is no manpower required to maintain the pump. Ease of transaction, transparency and safety is assured to the users too. Our aim is to reduce the working manpower and to upgrade the current fuel stations to a whole new level using technologies. The RFID cards will be given to the customers, now the whole process of fuel dispensing is done by the user itself with the help of automated system for refueling.

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The system is automated and System-user interaction is kept simple for the ease of his inputs. The system is well programmed that it automatically calculate the precise amount of fuel for entered amount and runs the pump for the accurate calculated time interval, hence it reduces the cheating in fuel stations. Next generation petrol bunk management for self-operation uses raspberry pi module as the central controller unit, which co-ordinate with RFID card, electric motor, LCD display and Wi-Fi modem. It can offer number of advantages to users. Our work has some most countable features like automatic transmission petrol can be filled into the tank without human interference. This system also offers us facility to recharge our RFID card onsite. One of the major fascinating thing about this work is that it reduces human intervention and prevents illegal trade of petrol. Raspberry pi module acts as the central controller device and other peripherals co-ordinates with the Raspberry pi module. After a transaction is completed, amount is deducted from RFID card and the remaining balance is displayed on screen. If the balance is low the transaction is terminated and the same message is displayed on the screen. The confidentiality and security of data is maintained very well by the system. Power management is very easy. Power disconnection-reconnection won't affect the operation. In this work we will be connecting USB, mouse, keyboard and HDMI cable. This cable comes from the monitor side one end is connected to converter and another end is connected to monitor, we will be connecting HDMI cable to raspberry pi and keyboard and mouse to raspberry pi.Power supply is given for hardware and raspberry pi. Then raspberry pi is turning on and we have to set the IP address using the application name FING. Now Wi-Fi is automatically connected through our hotspot then we should go to the file manager to see the code. To run the code we should go to the command window it will update the values of fire and turbidity. It will ask for selection of petrol or diesel option 1 is for petrol and the left button is for diesel then it will ask for the amount, so relay will turn on according to the amount entered using keypad.

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II. BLOCK DIAGRAM

Figure 1 shows the block diagram of next generation petrol pump. It mainly consists of LCD, keypad, relays, purity sensor, power supplyLM317, Raspberry pi, RFID card reader, WI-FI modem, fire sensor, server with database and webapp.

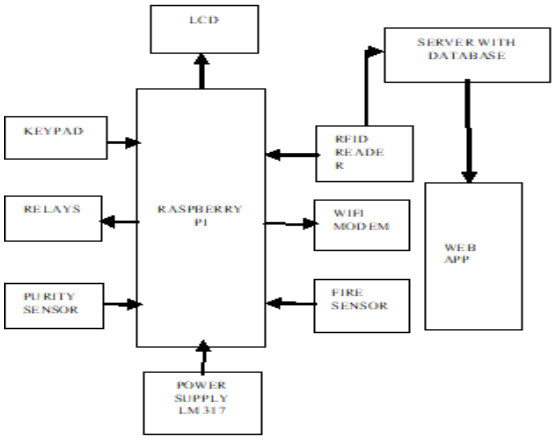

Figure 1: block diagram of next generation petrol pump

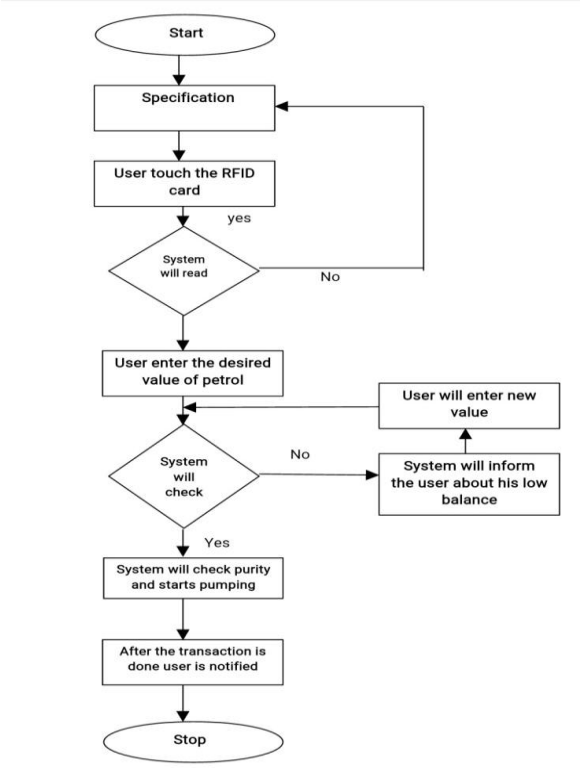

Figure 2: flow chat of next generation petrol pump

The customer will his own RFID card with all his details installed in it, The RFID reader will read the data present in the card and authenticate the user. The user authentication is done by Raspberry pi module by using the data in RFID card. If valid user is confirmed the corresponding details is displayed on the LCD display. The amount of fuel required is entered in through the keypad. Raspberry Pi is efficiently programmed for precise motor operation. When the user enters the amount of fuel, the Raspberry Pi activates the relay drive. Relay's output is connected directly to the raspberry pi module which process the data for further operations. Further operation involves operation of pump, bill generation, purity check, safety and updating the details of transaction on mobile app. Raspberry Pi*:* It is the main part of the system where other components will be controlled by it.The raspberry pi hardware has evolved through several versions that feature variation in memory capacity and peripheral-device support.

The processor of the raspberry pi 3 uses a Broadcom BCM2837B0 SOC with a 1.4GHz 64-bit. The raspberry pi 3 is described as having ten times the performance of a raspberry pi, benchmark showed the raspberry pi 3 to be approximately 80% faster than the raspberry pi 2 in parallelized tasks.

III. METHODOLOGY

Methodology of the work is represented as shown in the below figure 2. Initially, the user will touch the RFID card the system will read the information about the user. If the information is true the user should enter the desired value of fuel needed, if not it will go to specification .Next the system will check the balance in RFID. If there is insufficient amount the system will inform the user that the balance is not enough for transaction, then user enter the new value. The system will check the purity of the fuel and start operating. After the transaction will do the user is notified through web app. The server database stores all the data, the record of all transactions from previous and current month is stored in the server database and can be accessed by the mobile application. Hence to avoid damages to the working components controlled voltage is implemented. Track of all previous transactions are available in the web server which are user accessible through mobile application. The methodology flow is shown above.

IV.IMPLEMENTATION

Figure 3 shows the internal circuit diagram of next generation petrol bunk Raspberry pi module is a single board computer which acts as the central hub for controlling all other components present in our work. The IC-7805 is a voltage regulator which gives controlled voltage to all the components. Pins D4, D5, D6, and D7 are the 8 bit data pins which are connected to the general purpose input/output pins of Raspberry pi module. IC MCP3008 is the analog to digital converter which takes the analog input from purity sensor and gives digitized input to Raspberry pi module. 5V relay circuit is used which helps in turning the petrol pump on/off as per the instruction given by the central hub.

RFID reader is connected to the raspberry pi module through transmission and receiver pin of read and hub respectively. After every successful transaction the user is sent with bill having all the details of transaction through the mobile app. In this manner many ideas have been proposed to improve automation in petrol bunk.

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V. RESULTS

As we shown in the figure 4 this system basically involve secure user authentication before starting the transaction. Password facility enhances the security by stopping unauthorized usage of the card. Transparency of transaction is available in this system. The figure 4 shows the purity analysis of different fuel samples which is based on the data obtained by the purity sensor. The Raspberry-pi module computes the purity of the petrol and informs the user through web app, Fire sensor senses the fire in the vicinity of pump and ensures the safety of the fuel station as well as the customer.

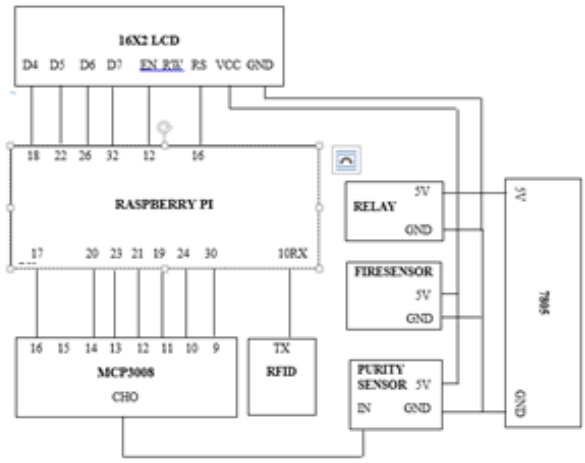

Figure 3: internal circuit diagram of next generation petrol bunk

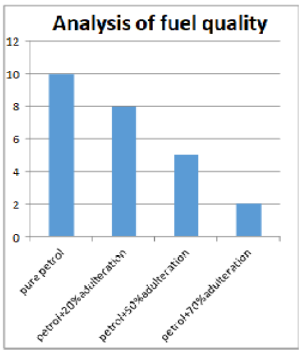

Figure4: analysis of fuel quality for different fuel samples

The complete transaction details are available in the mobile app which is easily accessible to the customer.

VI. CONCLUSION

The application of the work is very much user friendly, access through smartphone will make this work more beneficial. Security is ensured to users as RFID technology gives unique proof of identity to each user. Maintenance of this system is very easy. This implementation reduces the time and efforts that was wasted in conventional fuel stations. The main goal of this to upgrade the conventional petrol pump by reducing man power, labor and enabling smart transaction. The software programming is done in Embedded C which is a user friendly language to fulfill user's need. Due to up gradation to smart transaction cheating in fuel station is minimized. In future enhancement the system can be installed with a bill printer, density checker, and touch screen display can be installed to give the user a smart interface.

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