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Automated Fuel Station Using Biometrics

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Abstract: As the technology is advancing, automobile usage is increasing leading to increased fuel consumption and crowd at the fuel pump stations. The petrol pumps or fuel filling stations are totally operated by human beings which consumes more time. In rural areas where the population is less, irrespective of the number of customers the number of operators on duty are more. This increases the labour cost and results in loss. On contrary to this, in urban areas the number of customers are more and the manually operated systems results in queuing up the vehicles to be filled by fuel, as fuel is to be supplied and payment is to be made by manual operators resulting in a delayed system. Thus, the paper proposes a solution to this problem, wherein an automated fuel station is proposed using biometrics to fill the fuel tanks of vehicles with an online digital payment system. With this approach, initially, the consumer has to register for the online digital payment system. To use the service, he has to place his finger on the finger plate module and enter the amount through the keypad which in turn will be converted into the quantity of fuel to be pumped into the vehicle. Thus, the consumer could also monitor the pump and can avoid any card transactions or password theft for payment.

1. Introduction

Headings 99% of the petrol stations today are operated manually. Thus, today's petrol pumps[1] require more man power and are time consuming as well. Installing a new petrol station in a particular area not only levies huge initial installation charges but also needs more man power to operate it. The more remote the place is the more difficult and complicated is the situation is as it is difficult to get employees during the night shifts in isolated places either due to insecurities caused by human beings and/or wild animals or due to poor facilities provided. But petrol stations are very important and should be available at certain distances to serve the customers irrespective of urban/rural area or highways and also irrespective of the time of the day.

One solution to this problem is to use Biometric system[10] where customer can get the fuel from a petrol pump and the payment is done by electronic biometric system which requires no man power at the petrol pump.

In this paper, a biometric payment system is introduced which avoids any manual operator. It uses biometric payment system in digital transactions and eliminates cards and passwords.

The rest of the paper is organized as follows:

Section II gives the block diagram and the description of each module in brief. Section III discusses the working principle of the proposed system. Section IV gives the results and Section V concludes the paper.

2. Proposed Work

Biometrics is an identification system which is used in computer science for identification and access control. It is a method used to verify the authenticity of an individual. It is one of the method which describes the individual based on biological details like finger print, palm veins, face recognition, palm print, hand geometry, iris recognition, retina etc.

The conventional methods of access control or security codes include password or personal identification number (PIN) and these can be inter changed between people and or not reliable. Where as biometrics are highly secured and cannot be stolen as these are unique to each individual.

Figure.1 below shows the block diagram of the proposed system. It consists of PIC Microcontroller 16F877A[12], Fingerprint Module[13], a Matrix Keypad, Pumping System, LCD display, LED indicator and a Regulated Power Supply.

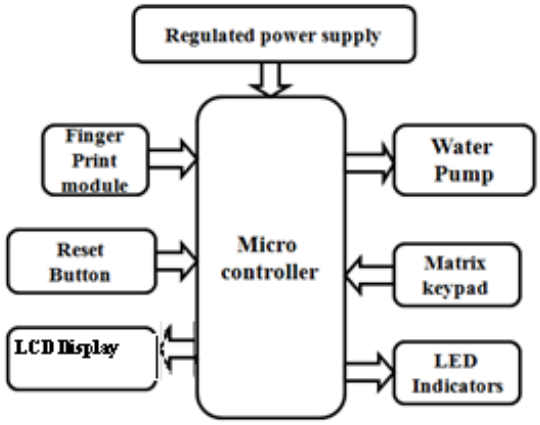

Figure 1. Block Diagram of the Proposed System

Figure 2. Flowchart of Fingerprint Module

2.1. Fingerprint Module

Figure.2 below gives the flowchart of the fingerprint module. It captures the digital image of the print using visible light. ie. it takes the image of an individual's finger. This process consists of Image preprocessing, feature extraction and template registration. The template contains ridges and valleys of the scanned images and then determines whether the pattern of ridges and valleys in the image matches with the pattern of ridges and valleys in the pre-scanned images i.e., the stored template.

2.2. Matrix Keypad

4x4 matrix keypads are commonly used keypads in embedded system applications. A matrix keypad is interfaced to a PIC Microcontroller. There are four rows and four columns connected to 16 push button switches. 8 port points of the Microcontroller are interfaced with the keypad using row and column matrix connection technique.

2.3. Liquid Crystal Display

Liquid Crystal Display: It is a flat panel display which uses the light modulating properties of liquid crystals. It uses a back light or reflector to produce images. In the proposed work, an LCD screen is used to display the information regarding the online payment.

2.4. LED Indicators

This indicator indicates the status and the LCD screen displays the amount of fuel filled into the vehicle. Based on the data entered through the keypad, the Microcontroller actually actuates the valve control circuitry to open and close the valve corresponding to the timer.

2.5. Pumping System

The proposed work is a combination of Biometrics and embedded system[11,13]. Initially, the finger print recognition is required to create a new virtual account of an individual with some minimum amount of rupees to be deposited in the account. Then the individual can access the account using finger print module from any fuel station. Biometric scanner is connected to Microcontroller which in turn triggers the pumping module to fill the fuel accordingly. The system aims to provide accurate quantity of fuel to be filled in terms of liters into the vehicle fuel tank.

3. Working Principle

Figure.3 gives the flowchart of the working principle of the proposed system.

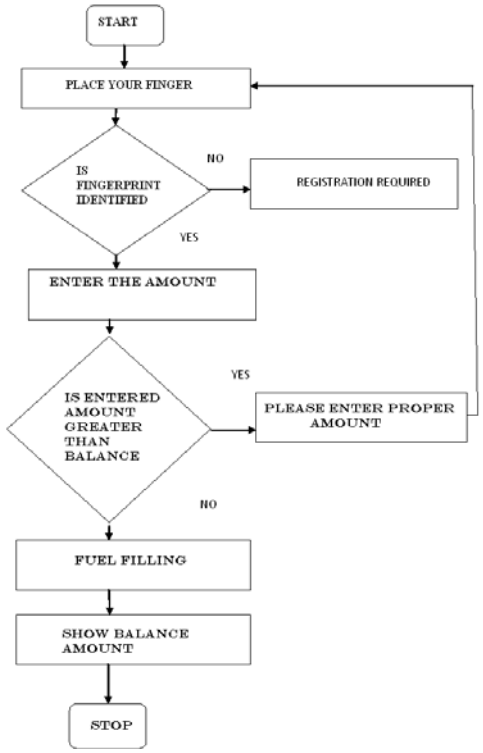

Figure 3. Flowchart of the Proposed System

Initially each of the customers must be registered with banking system for online transactions. The system comprises of a database i.e., storing the information of the customer like name, address and so on along with their finger print image data[13]. When the customer want to use the service of this automated petrol system, he has to first place finger on the fingerprint scanner device as shown in figure 1. The scanned details are processed by the PIC Microcontroller and this in turn is sent to the centralized banking system. The information is then compared with the stored data and if the results match then an acknowledgment is sent to the Microcontroller which in turn is displayed on LCD screen. The system then asks to enter the amount in rupees for the equivalent fuel transfer. Once the amount is entered, the equivalent fuel transfer takes place, which is controlled by the microcontroller and at the same time the amount is also deducted from the account. The system is programmed in such a way that the amount in rupees is converted into seconds so that the pumping system will be 'ON' only for that specified time. If the amount available in the account is less than the amount entered then the same information is displayed on LCD screen. The user has to reenter the amount so that it does not exceed the one available in the account. Once the operation is over system will reset to allow new entry.

4. Results

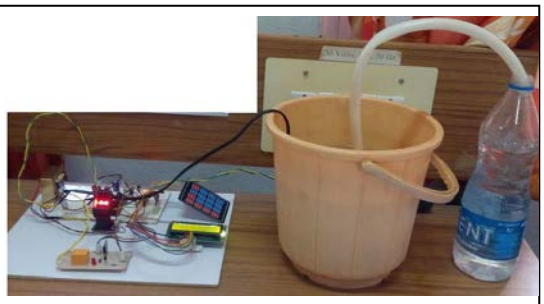

Figure 4. Experimental Setup

Figure. 4 show the setup for the automobile fuel station using biometrics. Instead of fuel tank at petrol pump a bucket is shown with water and pumped into the bottle which can be assumed as the vehicles fuel tank. As shown in the figure.4 if a valid customer places his finger on the finger print module and enters the amount of fuel to be pumped, the microcontroller triggers the pumping station and the quantity of fuel equivalent to the amount entered will be pumped based on the timer. The amount in rupees is converted into seconds and the pumping system is switched on for the corresponding duration. In this set-up the fuel tank is placed at a constant height and the pressure level is also maintained to a particular level which is synchronized with the timer. Thus, the proposed work eliminates the man power at the petrol pumps and avoids any card transactions or password thefts by using fingerprint biometrics.

5. Conclusions

The proposed work automatic fuel station eliminates the involvement of any human operator at the petrol pumps for payment transactions and avoids any manual operation at the pumping system settings. Only requirement is each of the customers has to initially get registered with the online payment system and save his identity in the form of finger print. The system can be efficiently implemented in both urban areas by reducing the time consumption as well as in rural areas by decreasing the cost of the system.

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