International Journal of Recent Technology and Engineering (IJRTE)
ISSN: 2277-3878, Volume-8 Issue-4, November 2019

Design of an Automated Smart Vehicle Fueling System

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Abstract: ***Today most fuel filling stations have a microcontroller to deal with the electrical pumps, drive the show, live the number and thus shut down the electrical pump. Yet at the same time an individual is expected to accumulate the cash. These fuel pumps are time overpowering and need a great deal of labor. To place fuel stations in far off space is remarkably expensive to create brilliant office to the consumers. Due to the less availability of the workers, 24*7 operation of the petrol stations is not possible. These problems can be sorted out by means of this work which requires less time to work and is powerful which can be introduced anyplace. Our work provides the way to eliminate the cost associated with manpower working at fuel filling stations. The principle point of this work is to create a framework which is able to do routinely deducting the money of oil administered from consumer's card dependent on RFID equipment. This work mainly aims to come up with a postpaid card for fuel bunk system and fuel dispensing system with RFID technology. This will be helpful for common man in his busy scheduled life and avoids fuel theft in fuel filling stations.***

Keywords – RFID, Robotic arm, Centrifugal pump, Fuel dispensing system

I. INTRODUCTION

The twenty first century is with competence called webpage attributable to the increasing use of internet within the day to day activities. As far as electronic petrol station is concerned, a more number of researches has previously done in this area. Every data is being inserted with the assistance of the computers. But as much as safety of Fuel pump is concerned, we are still behind from global level. Leakage of gasoline or any oil ends up in a blast and stealing of gasoline could cause disaster. Smart Vehicle Fueling System is an advanced work which controls the entire set of components associated in the proposed system. The key attractiveness of this work which eradicates human contact and avoids black business matters when man is not present. Here microcontroller perform as a master gadget and smart card (RFID card) as slave gadget.When the transaction is completed, the money is deducted from the card and the latest balance is displayed once again. If there is a low balance, the transaction cannot be completed and the respective message will be shown. It provides an automatic opening or closing of the tank valve according to the amount demanded. The person need not even get out of vehicle to open fuel tank value. This work is done with the help of robotic arm which identifies the fuel tank valve and insert the fuel dispensing nozzle into it.

II. OBJECTIVE

The main objective of the proposed system is to introduce the automation in fuel filling process, to provide cost effectiveness when compared with existing system, to eliminate man power and cost associated with the same, to reduce the time consumption in filling process, to provide 24*7 operation of filling stations and to prevent fuel theft.

III. EXISTING SYSTEM

Today the system which is in wide use involves the practice followed from many years. When a person wants to fuel his vehicle he goes to the fuel filling stations where another person who is working there will fuel his vehicle according to the fuel demanded. The conventional process is a time consuming one and there is a possibility of fuel theft 24*7 operation of fuel stations is not possible. The labour cost associated with the persons working in the fuel filling stations keeps on increasing now a days. All these problems can be overcome by the proposed project.

IV. LITERATURE REVIEW

1. M. Z. A Rashid, H. N. M. Shah in their paper entitled "Study of Automatic Vehicle Fueling System using Robotic Arm Controlled Via PLC" operated Programmable Logic Controller to control the entire process. At first, payment machine will initiate when the system identifies a vehicle on the filling zone. This device can be reached out into the vehicle through window. In any case, it can accept credit card payment only and it will proceed to the next process when positively reading the card and getting the right pin number from the user. Then, as soon as the filler door opens, the fuel cap opener unlocks the fuel cap. This fuel cap opener is made of soft flammable material.

Manuscript published on November 30, 2019.
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Once the fuel cap is disassembled from the car, the fuel pump starts operating. The robot arm extends the nozzle and inserts it into the car. This scheme will guarantee that the nozzle gets completely embedded into the vehicle and the fuel will pump merely after that. At that point the Then the driving scheme will start to actuate once the drive becomes completely injected with no error. When the petrol is completely full into the car fuel tank, the fuel drive will be spontaneously halted to prevent spilling over of fuel and so the nozzle gets remove back to its preliminary place.

2. Wavekar Asrar.A, Patel Tosif.N in their paper entitled "RFID Based Automated Petrol Pump" used simple microcontroller to control the fuel filling operations. According to their work, at the point, when the consumer comes to refuel at the station, initially he will swipe the card. On the off chance that the card is approved, the person who reads the card will acknowledge the card. At that point it will request the pin number. On the off chance that the pin number entered by the client is right, at that point it will request the sum for which the petroleum is to be apportioned. When the sum is entered the comparing measure of fuel gets filled in the petrol tank after relay operation. The main disadvantage of this system is that it eliminates the man power in filling stations but the user himself has to fill the fuel which is a time consuming process and not an effective way to overcome problems in existing system.

V. PROPOSED WORK

The proposed work consists of ultrasonic sensor which is used to detect the vehicle. The information stored in RFID tag is read by the RFID reader .The push button is used to input the quantity of fuel required in terms of its amount, LCD displays the initial cost available in the card, quantity of fuel required and the amount after the fuel is dispensed. Arduino is used to process and control the operations. Robotic arm and pump dispenses the fuel demanded. Buzzer sounds only if there is no amount in the card. The proposed block diagram is shown in figure.1

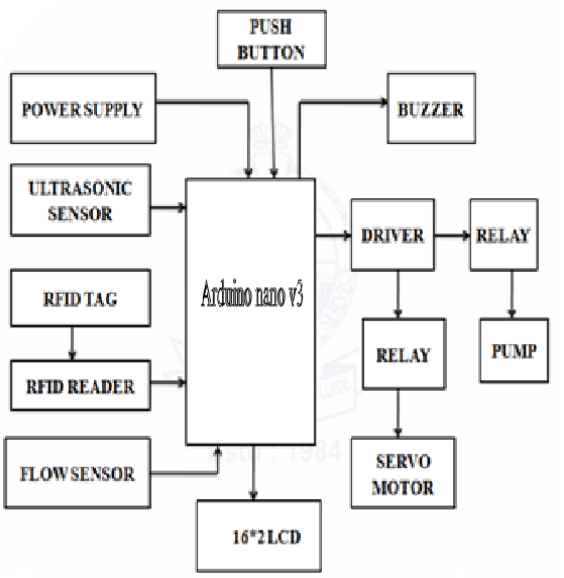


Fig.1 Proposed Block Diagram

VI. SYSTEM DESIGN

The system that we proposed consists of two sections namely, payment section and petrol dispensing section.

A . Payment Section

The payment section consists of RFID tag, RFID reader, pushbutton and buzzer. When the user shows the RFID card to the RFID reader, the control is passed to the arduino controller and the LCD display will show the amount present in that card. The push button is used to enter the quantity of fuel required in terms of its corresponding amount. When the cost of fuel demanded exceeds that of the amount present in the card or when there is no amount available in the card, the buzzer sounds.

B . Fuel Dispensing Section

This section consists of Relay driver circuit, relay, pump and servomotor (robotic arm).Once the amount payment gets over the control passes to the arduino controller to drive the relay via relay driver circuit and the robotic arm gets inserted into the fuel valve. Now the other relay operates and the pump fuels the quantity of petrol required.

VII. HARDWARE DESCRIPTION

A. Arduino Nano V3

The Arduino Nano V3 is a small and breadboard-friendly board based on the ATmega328 .The dimension of Arduino Nano board is only 43mm x 18mm which comes with a 16 MHz ceramic resonator, and a power jack. The board consists of 14 digital Pins and 8 Analog pins. The computerized pins are utilized to interface sensors by utilizing them as input pins or drive loads by utilizing them as yield pins. The capacities like pinMode() and digitalWrite() can be utilized to control the activity of electronic pins. The working voltage for the advanced pins is somewhere in the range of 0V and 5V. The simple pins can quantify simple voltage from 0V to 5V utilizing the 8 Analog pins utilizing a capacity called analogRead()

B. Radio Frequency

Radio-Frequency Identification (RFID) utilizes the radio waves to peruse and catch data put away on a label joined to an item. A tag can be perused from up to a few feet away and need not to be inside direct observable pathway of the per user to be followed like standardized identifications. RFID labels can work inside a lot more noteworthy separations; data can be perused from a tag up to 300 ft. RFID per user sends electromagnetic waves. The label reception apparatus is tuned to get these electromagnetic waves. Label draws control from field made by per user and utilizes it to control microchip. The Micro Chip tweaks the waves that the tag sends back to per user and per user changes over these waves to advanced information and sends it to controller where the information is contrasted and the information in microcontroller for further procedure.

C. Ultrasonic Sensor

The working rule of ultrasonic sensor resembles radar or sonar which finds the characteristics of an objective by deciphering echoes from radio or sound waves individually. Ultrasonic sensors produce high frequency sound waves and assess the echo which is returned back by the sensor.

In our work HC SR-04 ultrasonic sensor is used. The sensor computes the time interim between the signal sent and the echo signal which is gotten to decide the distance to an object. The separation can be determined with the equation:

Distance L = 1/2 × T × C

where L is the distance, T is the time among the emission and reception, and C is the speed.

D. Robotic Arm

A robotic arm is similar to a mechanical arm, which is a programmable one, which functions in a similar way like a human hand, the hand may be the entire sum of the mechanism or a part of a complex robot. The Robotic Arm has a 180° angle of rotation and it provides 6 degrees of freedom allowing it to move in six different ways. There are six servo motors which are used in the arm. First in a swivel base, second in a shoulder, third in a elbow, two servo motors in the "doll", one to move up and down and one for left and right rotation.

and a sixth servo motor is located at the handling clamp. It requires an external voltage of 4.5V to 6V for the servomotors.

E. Push Button

A push-button is simply a switching apparatus for adjusting certain feature of the mechanism or a process. In our project instead of using keypad we have used three push buttons to input the quantity of fuel required in terms of its amount.

F. Centrifugal Pump

Centrifugal pump is a roto dynamic pump in which revolving impeller is used to rise the rate of a fluid. These pumps are beneficial in working liquids over a piping scheme. The fluid pass through the impeller of the pump beside the revolving axis and is accelerated by the impeller, flowing radially external into a diffuser or volute chamber, from somewhere it drifts into the downstream piping system. Centrifugal pumps are suitable for bulk discharge over lesser heads.

G. Liquid crystal display

In this work 16*2 LCD is utilized. Which can show 16 characters for every line in addition here will be 2 such lines. In this LCD every one of the character is shown in 5x7 pixel matrix. This LCD comprises of two registers, specifically, Command register and Data register. The command register stores the command guidelines given to the LCD to do a predefined duty like preparing it, clearing its display, setting the pointer location of arrow, adjusting display etc. The data register stores the data which is to be exposed on the LCD. The data is the ASCII value of the character which is to be exposed on the LCD.

VIII. FLOW RATE CALCULATION

Continuity equation, Q = Area of pump shaft x Velocity

Diameter of pump shaft (D) =15mm

Diameter of outlet of the pump (d) =3mm

Speed of the pump shaft =3000rpm

Area = π x d2/4

= π x (0 .003)2/4

= 7.06 x 10-6 m2 (1)

Velocity = π x D x n / 60

= π x 0.015 x 3000/60

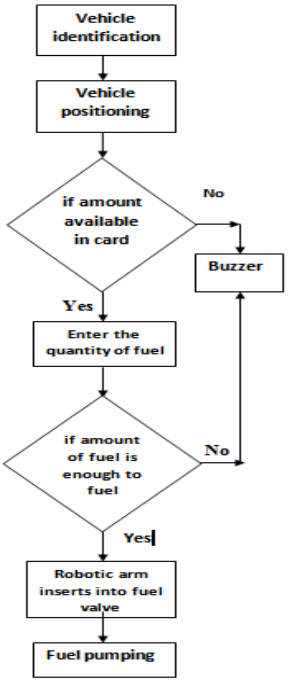
= 2.35 m/s (2)

Therefore, Q = 7.06 x 10-6 m2 x 2.35 m/s

= 0.0014 m3 /min

Q = 0.0014 m3/min (3)

IX. SYSTEM FLOW



X. HARDWARE IMPLEMENTATION

The main aim of this work is to develop with Arduino UNO R3, RFID card, RFID reader, Relay driver circuit with relay, push button, LCD, pump and servomotor (robotic arm). In this work the consumer possess the RFID card. The card is nothing but a magnetic member is embedded inside the card. The scan circuit produces majestic signal to read the majestic number. Once customer shows this card on the reader, the reader reads that majestic number and given the equivalent signal to microcontroller. The microcontroller is previously programmed. So it checks whether the card is approved. On checking whether the card is authorized, the LCD displays the amount present in that card. The setup without robotic arm is shown in figure 2.

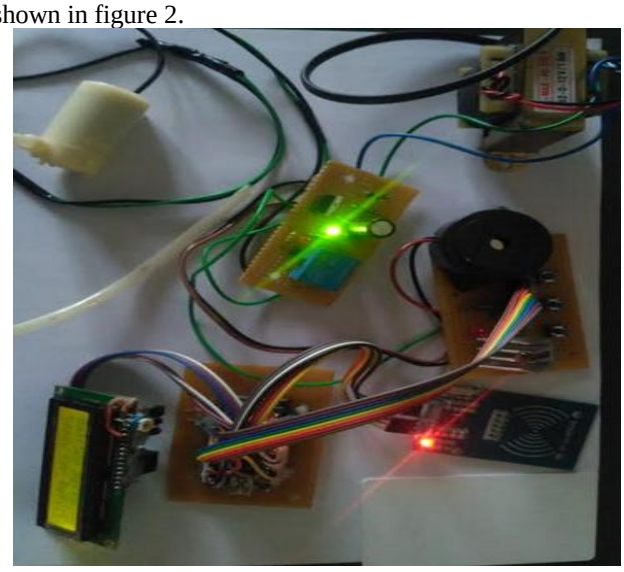


Fig.2 Set up without robotic arm

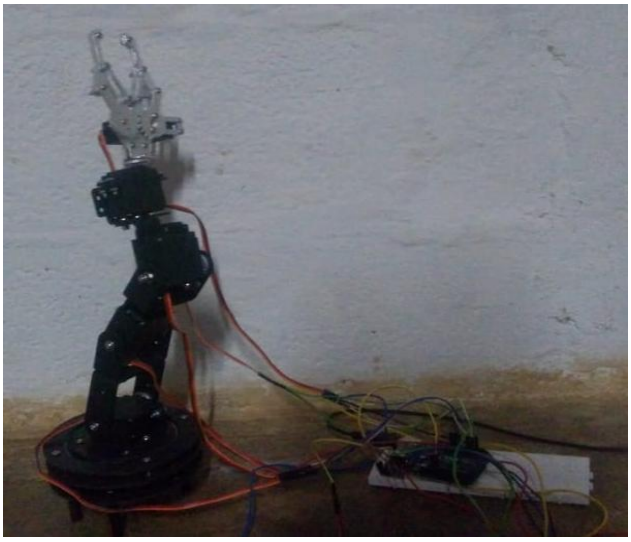


Fig.3 Set up with Robotic arm

The entire setup is shown in the above figure.3.With the help of ultrasonic sensor the fuel valve is detected and the robotic arm inserts the fuel dispensing nozzle into it properly. The push button is used to enter the quantity of petrol required. When the quantity of fuel is come into microcontroller activates the relay driver for that specified time period. The driver circuit is employed to show ON, turn OFF the relays. Relay output is directly joined to petrol pump. So it pumps the petrol as per the number entered in the press button. When the essential measure of fuel is delivered the relay driver which drives the relay is de activated and the pumping process stops and the robotic arm brings back the fuel dispensing nozzle out of the fuel valve. The remaining cost after pumping process is displayed in the LCD.

XI. ADVANTAGES

The advantage of this work which will eliminates the labour charge as it reduces man power and the customer need not wait for the fuel filling process. The project allows 24*7 operation of fuel stations

XII. CONCLUSION

Consumers wish a lot of selections, more speed and more convenience. They're less forgiving of slow pumps and obsolete options and looking for service station everywhere the place. To upgrade market we'd like a dispenser that's reliable, easy and prepared to extend our profitableness. Our project provides an effective solution to these problems. In our application, by using RFID method, the exact amount of fuel is allotted which decreases the mismanagement of the fuel and it also cuts the man power. If a person attempts to swipe through the illegal card, the RFID system refuse the card. In this approach the system is safeguarded. The project is fully automatic which saves the time of the common people in today's busy world and is more accurate which prevents fuel theft. The proposed project can be further developed in future by using IOT Technology where every user can have an application in his/her mobile phone via which he/she can pay amount for the fuel demanded and the other fuel filling processes remain the same

REFERENCES

1. M. Z. A Rashid, H. N. M. Shah, M. F. Abdollah, Marizan Sulaiman, Rosli Omar and M. A. Azhari - Study of the Automatic Vehicle Fueling System using Robotic Arm Controlled via PLC(International Journal of Advanced Science and Technology) Vol.89 (2016), pp.27-36
2. Wavekar Asrar A, Patel Tosif N, Pathan saddam I, Pawar H P—RFID Based Automated Petrol Pump (IJSRD)Volume 4, Issue 01, 2016 | ISSN: 2321-0613.
3. Priyanka A.Gaikwad, Shubhangi S.Wanare, Pallavi S.Sonone, Pratibha K. Bahekar, I.Y.Sheik—Automation in Petrol Bunk using RFID and GSM(IJRAT)Special Issue National Conference "CONVERGENCE 2017", 9th April 2017 | E-ISSN: 2321-9637.
4. E. B. Richard, H. Dearborn, B. Bradford and A. Ann, "Automotive Vehicle Fueling System", United States Patent, 6032703, (2000).
5. G. Irwin, G. Morton, R. Eugene and H. Chicago, "Automatic Fueling System For Automobiles", United States Patent, 3642036, (1972).

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