

Coin Acceptor Based Vending Machine using Microcontroller

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How to cite this paper: Hay Man Oo | Khin Thandar Tun | Su Mon Aung "Coin Acceptor Based Vending Machine using Microcontroller" Published in International Journal of Trend in Scientific Research and Development (ijtsrd), ISSN: 2456-6470, Volume-3 | Issue-5, August 2019, pp.2239-2243, <https://doi.org/10.31142/ijtsrd28003>



IJTSRD28003

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I. INTRODUCTION

Today, automation plays an important role in human life. People always look for convenience even in handling commodities and other basic needs in life such as food and medicine. Automation not only refers to reduce human effort but also energy efficiency and time saving. In places such as shopping malls, wholesale and retail outlets, automation is incorporated for the automatic delivery of the products to the customers. As people continue to seek for convenience, more and more technologies are invented. One of these technologies is the vending machine. Vending machines come in different types as they are made for different purposes. Vending machines are rarely found in the market. They are a coin operated machine for selling merchandise. They have many benefits as well. A vending machine is a machine that dispenses items such as snacks, beverages, alcohol, cigarettes, lottery tickets, cologne, consumer products and even gold and gems to customers automatically after the customer inserts currency or credit into the machine. For instance, the automatic cool drink vending machine, ice-cream vending machine, chocolate vending machine, water, tea, coffee vending machines and etc, increasingly found to encroach the shops nowadays, which reduces the time and also reduce the human effort required to recognize, search, count and deliver the product along with the cash handling. The ticket vending machine is the best example of all for the application of engineering principles to reduce time and human effort.

ABSTRACT

This paper investigates based on coin acceptor vending machine using microcontroller system. Technology has become a part of the different aspects of peoples' lives as it makes most of their work faster and easier. One of the fast-paced technologies is the vending machine. It is a machine that dispenses automatically, products such as beverages, tickets, snacks, etc., by inserting currency or credit to the machine. Vending machines appear in different forms and functions. These are generally used in public and private areas such as malls, markets, business and government offices, schools and along the streets. This paper proposes the design of Arduino based automatic vending machine. The main objective of this paper is to launch new technology application in society. In this proposed system, Arduino Mega board, Liquid Crystal Display (LCD), coin acceptor, servo motor, stepper motor and push button are used. The rectifier circuit is used for power supply and step down DC to DC module is used to reduce the rectifier output voltage 12V to 5V. Mega is mainly used to run the program for the vending machine. LCD is used for showing the information, for inserting coin and making a selection. The user can choose the product by touching the related button. Four push button are used to choose four different types of product. For the servo motor, it is used for the dropping of the product.

KEYWORDS: Arduino Mega, Coin Acceptor, LCD, Servo motor, Stepper motor, Motor driver, DC/DC converter, Push button

II. System Block Diagram

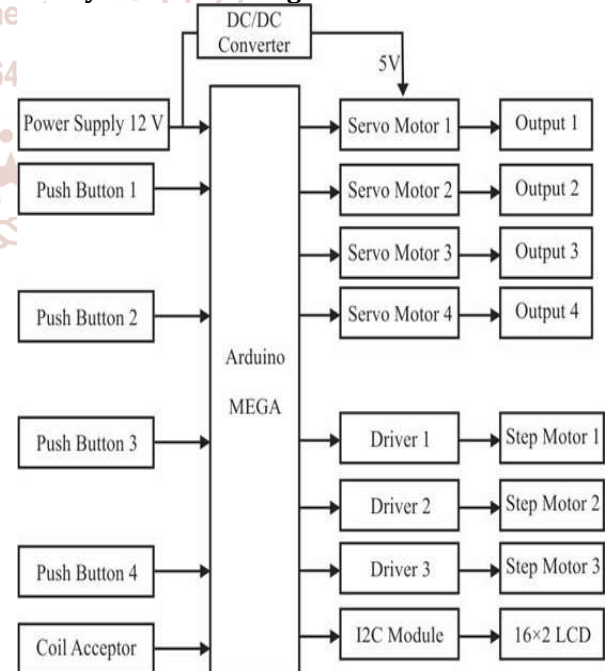


Fig1: Overall Block Diagram of The System

Fig 1: shows overall block diagram of the system. First, the information show on the LCD screen by running the system. So, the user inserts the appropriate coin and pushes the require button to choose the product. After pushing the button, the servo starts rotate to drop the product. Four push button are used to choose four different types of products.

III. Implementation

A. Software Implementation

The software implementation is the Arduino IDE based software environment. A program written with the Arduino IDE is called a sketch. Sketches are saved on the development computer as text files with the file extension .ino. Arduino Software (IDE) saved sketches with the extension .pde. A minimal Arduino C/C++ program consists of only two functions: setup (): This function is called once when a sketch starts after power-up or reset. It is used to initialize variables, input and output pin modes, and other libraries needed in the sketch. Loop (): After setup () function exits (ends), the loop () function is executed repeatedly in the main program. It controls the board until the board is powered off or is reset.

Software Implementation for LCD Working

```
void loop()
{
  lcd.clear();
  lcd.setCursor(0, 0);
  lcd.print(" Insert a coin!");
  while (true) {
    if (digitalRead(coinDetector) == HIGH)
    {
      break;
    }
  }
  delay(10);
  lcd.clear();
  lcd.setCursor(0, 0);
  lcd.print("Select your item");
  Serial.println ("Select your item");
  lcd.setCursor(0, 1);
  lcd.print(" 1, 2, 3 or 4? ");
}
```

In the main program, start by printing on the LCD the message "Insert a coin". Then user get stuck in the while loop. Once the insert a coin and it pass near the proximity sensor the logic state at the coin detector pin will drop to LOW and in that case user get out of the while loop using the break statement. Then print the message "Select your item" and user get stuck in another while loop.

Software Implementation for Push Button

```
while (true)
{
  if (digitalRead(button1) == LOW)
  {
    buttonPressed = 1;
    break;
  }
  if (digitalRead(button2) == LOW)
  {
    buttonPressed = 2;
    break;
  }
  if (digitalRead(button3) == LOW)
  {
    buttonPressed = 3;
    break;
  }
  if (digitalRead(button4) == LOW)
  {
    buttonPressed = 4;
  }
}
```

```
break;
}
}
```

This while loop waits for us to press any of the four buttons and once user get out of it and print the message "Delivering".

Now depending on the pressed button, user execute once of the case in the switch statement. In case user pressed the first button, the carrier start moving up using the custom made "move UP()" function.

Software Implementation for Item 1

```
Item 1:
moveUp(3850);
delay(200);
moveLeft(3000);
delay(300);
for(int i=0; i<50; i++)
{
  digitalWrite(servo1,HIGH);
  delayMicroseconds(clockwise);
  digitalWrite(servo1,LOW);
  delay(18.5);
}
moveRight(3000);
delay(200);
moveDown(3850);
break;
```

When push button 1 is pressed, stepper motor move up with 3.85ms, left with 3ms and servo motor1 work and output 1 is drop. Then stepper motor move right with 3ms and down with 3.85ms.If user take a look at this function user see that it simply sets the stepper motor to move in a particular direction, and makes the amount of steps that user entered as argument.

Software Implementation for Item 2

```
Item 2:
moveUp(3850);
delay(200);
for(int i=0; i<50; i++)
{
  digitalWrite(servo2,HIGH);
  delayMicroseconds(clockwise);
  digitalWrite(servo2,LOW);
  delay(18.5);
}
moveDown(3850);
break;
```

When push button 2 is pressed, stepper motor move up with 3.85ms and servo motor2 work and output 2 is drop. Then stepper motor move down with 3.85ms.

Software Implementation for Item 3

```
Item 3:
moveUp(1900);
delay(200);
moveLeft(3000);
delay(300);
for(int i=0; i<50; i++)
{
}
```

```
digitalWrite(servo3,HIGH);
delayMicroseconds(clockwise);
digitalWrite(servo3,LOW);
delay(18.5);
}
moveRight(3000);
delay(200);
moveDown(1900);
break;
```

When push button 3 is pressed, stepper motor move up with 1.9ms, left with 3ms and servo motor3 work and output 3 is drop. Then stepper motor move right with 3ms and down with 1.9ms.

Software Implementation for Item 4

```
Item 4:
moveUp(1900);
delay(200);
for(int i=0; i<50; i++)
{
digitalWrite(servo4,HIGH);
delayMicroseconds(clockwise);
digitalWrite(servo4,LOW);
delay(18.5);
}
moveDown(1900);
break;
}
```

When push button 4 is pressed, stepper motor move up with 1.9ms and servo motor4 work and output 1 is drop. Then stepper motor move down with 1.9ms.

B. Implementation by Hardware

In this proposed system, Arduino MEGA board, single coin acceptor, LCD, four servo motor and four push button are used. To power the system rectifier circuit is used and step down DC to DC module is used to reduce the rectifier output voltage 12 V to 5 V. Arduino Mega mainly is used to run the program for the vending machine. LCD is used for showing the information such as inserting coil and making a selection. User choose the product by touching the related button. For the servo motor, it is used for the dropping of the product. Firstly, after supplying the power to Arduino board, it is started running with the program installed in it. Then, LCD starts working by showing the information, "Select Your Items". In addition, it asks the user to insert the coin for buying the product. Then, the user must insert appropriate coin to the coin insert hole. As soon as the user inserts the coin, LCD monitor asks the question "Insert a coin". Customer select required product by pressing on the related push button. Four push button are used to choose four different types of product. The costs of four different products are same for this vending machine design. The related servo runs to give the required product if the push button is ON. Stepper motor use to deliver the required product. Then, the chosen product drop out to the bottom of the machine. Arduino based paper, it is convenience and easy to build and no many components are needed. This run automatically as long as it is supplied by the required amount of power. So, no employee is needed to cash and to give service to the customer. It use everywhere that the required power supplied get. Therefore, it put at the public places like garden, train station and others. So, people buy

easily whenever they needed even when they relaxing. The main problem of this paper is the detection of the correct coin.

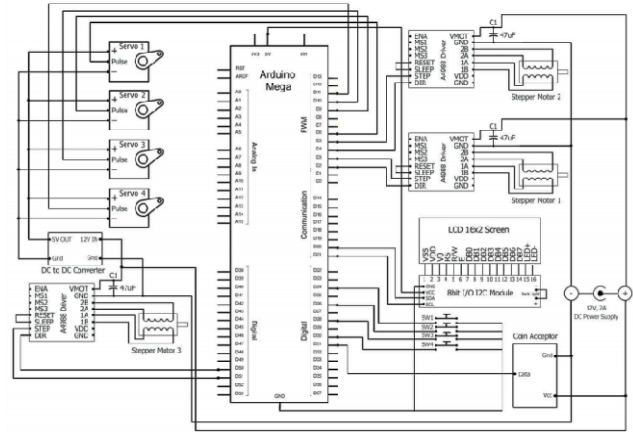


Fig2: Overall Circuit Diagram of The System

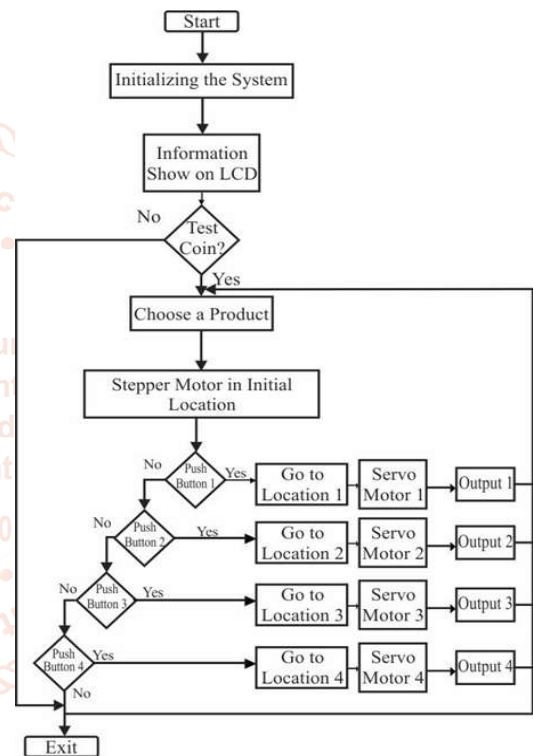


Fig3: Flowchart of The System

IV. Results

Wiring of Arduino Board for the System

For testing the Arduino board, it is connected to the PWM pins (D6, D9, D10, D11) of the servo motors and the digital pins (D24, D26, D28, D30) of the push button.

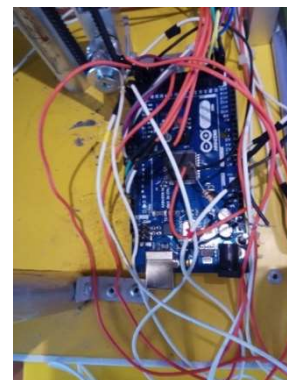


Fig 4: Arduino Board Connected Wires

Wiring of Push Button for the System

For testing the push button, it is connected to the digital pins (D24, D26, D28, D30) of the Arduino Mega board.

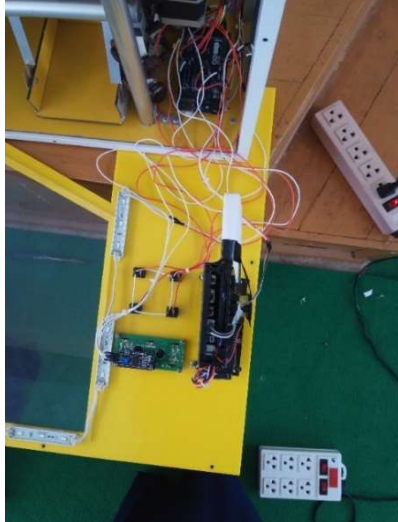


Fig5: Wiring of Push Button for the System

Wiring of Converter Pin for the System

For testing the servo motors, it is connected to the PWM pins (D6, D9, D10, D11) of the Arduino Mega board.

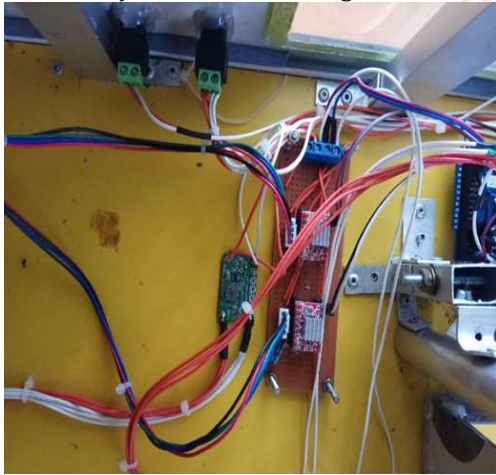


Fig6: Wiring of Converter Pin for the System

Wiring of Power Supply Pin for the System

For testing the power supply 12V, it is connected to the pins of the DC to DC converter.

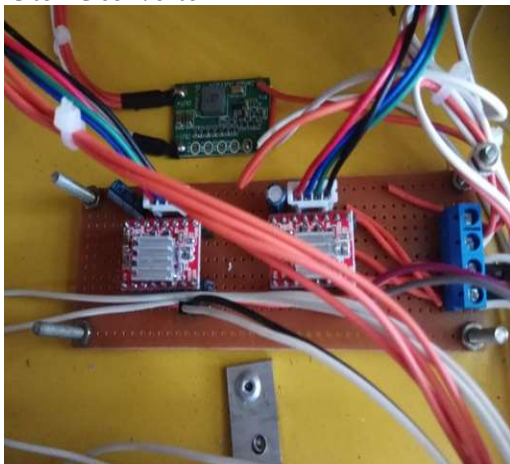


Fig7: Wiring of Power Supply Pin for the System

Wiring of Coin Acceptor for the System

For testing the coin acceptor, it is connected to the only digital pin (D31) of the Arduino Mega board. For V_{cc} pin of the coin acceptor, it must be connected to the power supply.

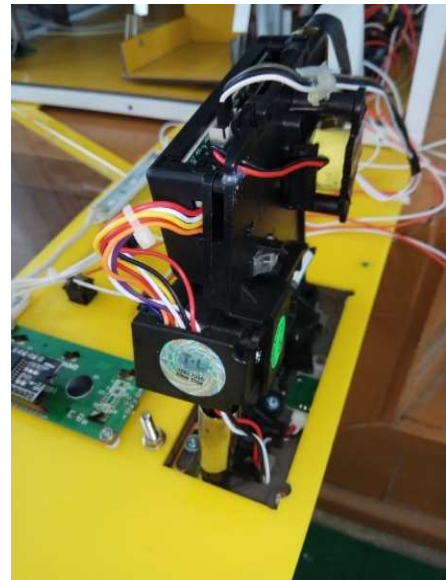


Fig 8: Wiring of Coin Acceptor for the System

Wiring of LCD for the System

For testing the LCD, it is connected to the communication pins (D20, D21) of the Arduino Mega board. LCD shows this status as long as servo is running and servo starts working to drop out the user.



**Fig 9: Wiring of LCD for the System
Result of the System**

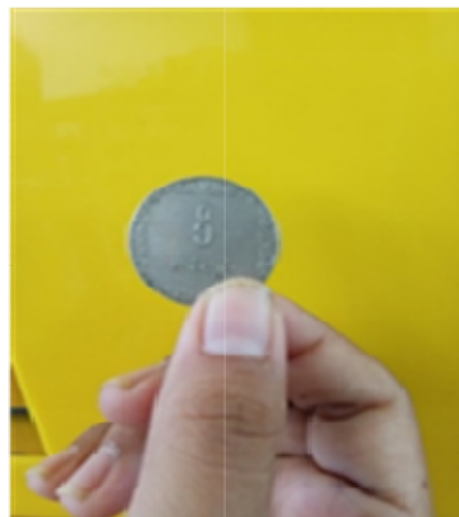


Fig 10: One Kyat Coin



Fig 11: LCD Showing to Insert Coin

Fig 12: shows user to insert the correspond coin. For this paper, one kyat coin is used in coin acceptor.



Fig12: LCD Shows to Make a Selection

After inserting the coin the LCD will show as the figure. It has four choices. So user can choose the product by putting on the appropriate push button.

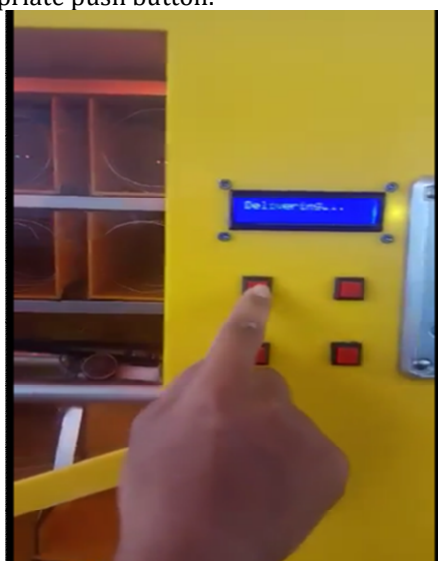


Fig13: LCD Shows the Servo Working

LCD shows this status as long as servo is running and servo starts working to drop out the user.

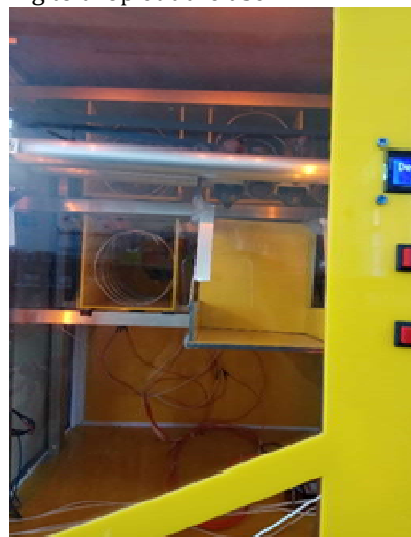


Fig14: Result For Item

V. Conclusion

When the world is running hastily with advancement, time is the undisputedly the most valuable resource of all. It becomes inevitable to save the time by all possible means. This automatic vending machine offers variety of product as well as many different types of payment option. In the recent time use of digital is increasing day by day due to their accuracy and feasibility. Due to time saving feature people use vending machine in busy area like airport, bank, office, etc. This system is portable, affordable, consumes less power and can be made easily available so that the user use this system whenever and whatever. Start thinking about what machines with need to purchase and begin to price them, new and used. This help budgeting so, when the time comes to start buying machines, user well prepared.

VI. REFERENCES

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