

Vending Machine with Cash and Cashless Payment Support

Girish Mahajan¹, Vaibhav Phale², Sanket Mane³

Prof. Ajit B. Patil⁴

^{1,2,3}Student, Dept. of Electronics and Telecommunication Engineering, Pimpri Chinchwad College of Engineering, Pune, India

⁴Assistant Professor, Dept. of Electronics and Telecommunication Engineering, Pimpri Chinchwad College of Engineering, Pune, India

Abstract - A Vending machine is a device that is used to disperse a product to user once a certain amount of money is deposited into it. Vending machines were once used just to sell food, drinks and other small items but nowadays they also sell products like cameras, mobiles etc. Vending machines are easily found in tourist spots, airports, railway stations etc and Vending machines are very popular in developed countries like Japan, US, UK. Conventionally people used cash as standard payment mode for vending machines. But nowadays people prefer to use digital payment options instead of cash to avoid the hassles associated with carrying cash. So to mitigate the demand for both conventional and modern payment modes, we implement a 2 way payment system that accepts both coins and digital payments via UPI, online wallets etc. Here we are solving a common issue faced by customers that sometimes don't have the proper change or signal reception.

Key Words: Automation, Vending machine, Digital Payment.

1. INTRODUCTION

During the first 1880s, the primary commercial coin-operated vending machines were introduced in London, England. Invented in 1883 by Percival Everitt, the machines were found at railway stations and post offices, as they were a convenient means to purchase envelopes, postcards, and notepaper. Automatic vending machines are not that common in our country. Hence implementing such a machine in real-time will be of great use for people. The advantages of the machine is that it requires no human supervision, highly efficient, compact, easy to maintain and use and also portable.

Most of the vending machines available only accept cash and it can cause hassle for tourists and people that want to buy products but don't have proper change. There should be a system for vending machines to accept coins as well as digital payment facilities like UPI (Unified Payment Interface) and other digital wallets like Paytm, PayPal, PhonePe, Mobikwik etc. This will allow people to pay for things without having to actually carry cash and go cashless.

1.1 MAIN OBJECTIVES

The main objective of this project is to build an online payment incorporated vending machine that will dispense product. We design and implement a vending machine that will accept a variety of coins and also supports digital payment options to make purchases.

2. LITERATURE SURVEY:

Around 215 B.C, the primary vending machine that sold sacred water is accepted to have been developed in Alexandria, Egypt. The primary candy machine in the U.S. was developed 1888 by the Thomas Adams Gum Company. The candy machine administered a bit of tutti-frutti gum.

In late 1920 and 1930, costlier items were presented. Sample being soda pop and nickel-confection. In 1946, espresso sellers were introduced followed by refrigerated sandwich merchants in 1950.

These days, numerous things are often found in candy machine, for instance, dress, milk, cigarettes, postage

stamps, cologne, baseball cards, books, live draw, comic books, and a few more. Some high tech machines can apportion hot nourishments, for example, pizza, popcorn, French fries and burger.

3. PROPOSED SYSTEM :

In our proposed framework, the vending machine is intended to distribute certain milk additive products of varying costs. The delivery method is rotary spiral wire mechanism that is attached to dc motors. Our vending machine has 3 dc motors that are driven by a motor shield that is mounted on Arduino mega.

There are indicator LEDs above the products that keep the products visible in dark environments and highlight a product when it is paid for until the product is delivered.

For handling the physical (or cash) payment part, we have a coin acceptor module that accepts a maximum of 6 types of denominations and can have multiple coin inputs set for a single denomination (such as 5 Rs coins that includes the older and newer coins).The machine accepts only on the coins it is programmed to accept and rejects others. The accepted coins are deposited in a container.

For the online payment we rely on a GSM module that receives the payment notifications and parses them to extract the amount paid to the machine. This amount is then compared with the product prices and the respective product is delivered. This system allows the machine to function without the need of being connected to internet which is helpful in remote areas where communication is an issue.

We also have a payment mode selection switch which makes the vending machine respond to online payments once it is flipped upwards and to coin payments when it is flipped downwards.

4. SYSTEM REQUIREMENTS

4.1 SOFTWARE REQUIREMENTS

Software components are selected in such a way that the use of that specific software may produce efficient output. Software requirements may be the prerequisite that is needed to be installed on the system for the proposed system to work smoothly. Else it can be the supporting libraries needed for the project to work.

4.1.1 Arduino

Arduino is an open-source hardware and software enterprise, project group which designs and produce single-board microcontroller kits for building digital devices and interactive objects which sense and control instruments both physically and digitally.

Arduino board designs use a spread of microprocessors and controllers. The boards are equipped with sets of digital and analog input/output (I/O) pins which will be interfaced with varied expansion boards or breadboards (shields) and other circuits. The microcontrollers can be programmed using C and C++ programming languages. The Arduino project also provides a developer system supported by language project

4.1.2 Fritzing

Fritzing is an open-source beginner CAD software for designing electronic circuits by designers and artists developing a prototype by putting together a more permanent circuit. It had been developed at the University of Applied Sciences Potsdam.

Fritziing was made to foster the spirit of the programming and so the Arduino microcontroller and allows creators to document their Arduino-based prototype and make a PCB layout for finalizing and creating the device. The associated website helps users share and discuss drafts and experiences also on reduce manufacturing costs.

Fritzing is an electronic design automation (EDA) tool inspired by the design of projects, while the output is focussed on accessible means of production.

4.2 HARDWARE REQUIREMENT

4.2.1 ARDUINO MEGA 2560 REV3

Arduino Mega 2560 is a microcontroller single board powered by ATmega2560. It has 54 digital I/O pins (also 15 support PWM outputs), 16 analog input pins, 4 UART ports, a USB connector, and a reset button. It contains everything needed to support the board; we just plug it into a pc with a USB cable or couple it with a DC adapter or battery. The Mega 2560 board supports many component shields designed for the Uno and the former boards.



Figure 4.1 Arduino MEGA 2560

4.2.2 LCD Display

A 16x2 LCD display is a basic module commonly used in various devices and circuits. A 16*2 LCD display means it can display 16 characters per line and there are 2 such lines. We used this type of display as it is easily programmable, cheap and easily available and can even display custom character and animations.



Figure 4.2 LCD Display

4.2.3 GSM Module (SIM800L)

The following component is a GSM module used with SIM card with some AT commands. A **GSM module** or **GPRS module** can be used to provide mobile communication capability via GSM or GPRS. Many GSM modules are available in the market. For our project we chose SIM00L, a compact module that can be powered by 3.3V supply from the Arduino board. We insert the admin SIM card in the module and once it is powered, the SIM800L generally gets required cell reception in 30 seconds. The module is also preferred due to its low cost and high availability.



Figure 4.3 GSM Module (SIM 800L)

4.2.4 Coin Acceptor (CH-923)

The following component is coin acceptor used as one of the input devices for vending machine. The sensors in this coin acceptor check width, coin diameter and fall time of the coin to identify it and it can be programmed to accept coins of any nation, denomination. Once we set the valid coin profiles, the coin acceptor will check them and report when each type is inserted, while rejecting other coins. We programmed this coin acceptor to accept coins of 3 denominations namely 2Rs, 5Rs, 10Rs.



Figure 4.4 Coin Acceptor (CH-923)

4.2.5 DC Motors, LEDs

We used geared DC motors that rotate at 30 rpm to ensure smooth and accurate delivery of product. We have programmed the DC motors to rotate for a specific amount of time during which one product is dispatched through the spiral mechanism to ensure no extra product dispatch.



Figure 4.5 LED



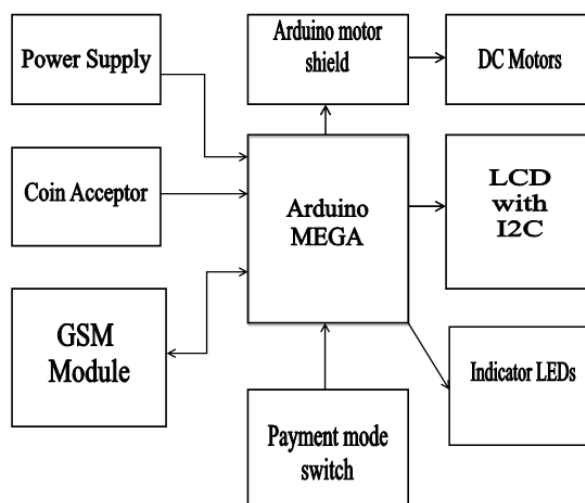
Figure 4.6 DC Motor

The LEDs are used as indicators. The DC motors will rotate the spiral mechanism which in turn will move the product towards user and finally dispatch the product purchased through the hatch.

5. BLOCK DIAGRAM

This is the block diagram for our project vending machine which gives idea about connection of various blocks/components with each other.

Figure 5.1 Block diagram for Vending Machine



1. Power supply: Provides required power to the devices and components to work.
2. GSM module: Starts listening for notifications and once the notification is received, it is parsed to find out the amount paid by the user, this amount is then used to drive the respective DC motors to dispatch the product.
3. Coin acceptor: Takes the coins entered by the user and checks if they are among the ones that are valid and accepts or rejects them. Send the coin value in the form of pulses to the Arduino to work on.
4. Payment mode switch: Used to set the vending machine to respond to particular mode of payment. Switch UP for online payments and DOWN for coins.
5. DC motor: Each motor is connected to a spiral mechanism which houses the products to sell and acts as a delivery mechanism. When payment is made, the raspberry pi will alert the respective motor to rotate in order to deliver product.
6. Indicator LEDs: the indicator LEDs are used only for highlighting the product in a specific price range.
7. Display: LCD is used to display payment and dispatch details.
8. Arduino MEGA: The central processing unit is Arduino which is used to encode and decode various signals as per requirement. It receives inputs from Coin acceptor, GSM module and works on them to derive the amount paid by the user and then provides the DC motors the inputs to dispatch product accordingly.

6. FLOW CHART

In the flowchart given below, we first choose the product and check its price. Then we set the payment mode switch in position that enables our mode of payment. We pay the vending machine by our selected method, the amount that corresponds to product of our choice. The machine checks if amount entered matches the price of a product and if it does match, the product is dispatched otherwise the transaction is denied and rejected.

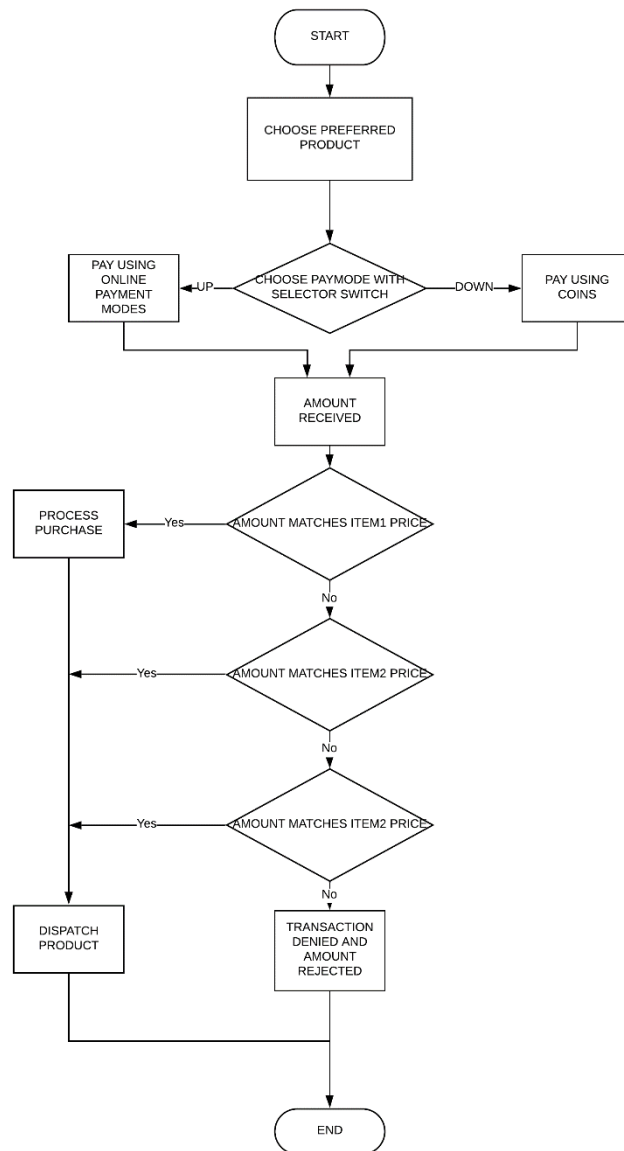


Figure 6.1 Flow chart for Vending Machine Operation

7. CIRCUIT DIAGRAM

In the circuit diagram given below, we have displayed the actual structure and connects of the vending machine components. The diagram is made using Fritzing software.

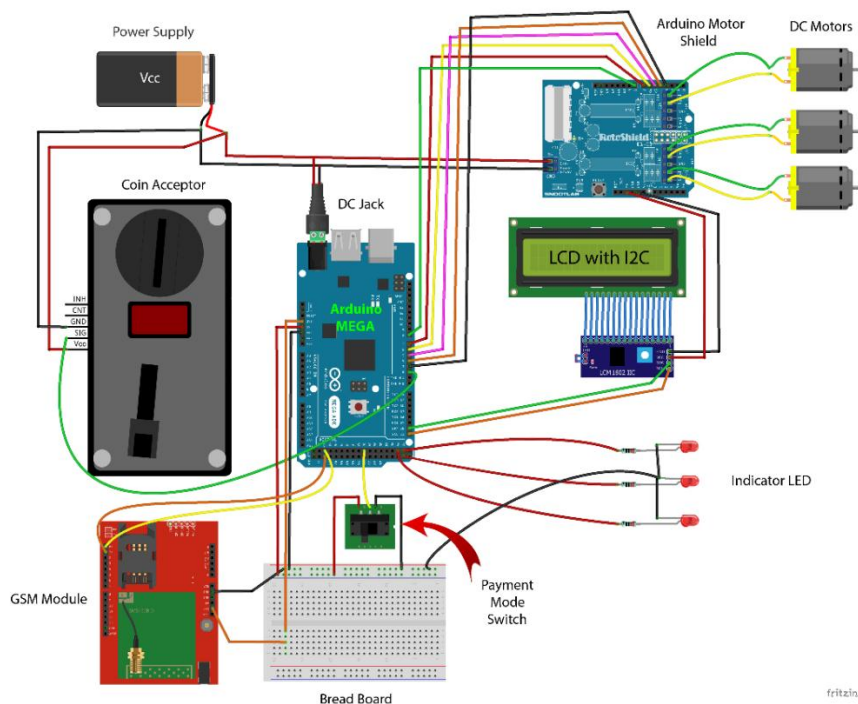


Figure 7.1 Circuit diagram for Vending Machine

8. OUTPUT

The output of the application is dispatching of product by accepting either digital payment or physical payment without need of any human supervision or intervention. The device can also work without internet connectivity and is thus cost efficient as compared to current IoT based vending machines.

9. RESULT

The system is operational as a proof of concept model and can be implemented in real world scenarios in actual vending machines for business. The machine costs a fraction of what the alternatives available today in market cost. A large number of DC motors can be driven by Arduino MEGA by adding a suitable driver shield to enable the machine to have variety of items. The system can also be modified to add keypad for making the machine support choice of products having same price.

The main problem addressed by the proposed system was delay in purchase and dispatching of product. The system design is in such that the cost and resources required are restricted to a minimal level. This was necessary in order to cut the production cost to an extent where the product will be affordable for the offices and buildings.

Implementation of this machine in schools and colleges will help the students to take the items whenever they are in need of it. Coins were inserted and items were vended successfully. This vending machine can also be useful in the current COVID-19 situation to dispense essential products without any human contact, contamination at any place and any time while helping prevent spread of infection.

The photos of the resulting product are given below:

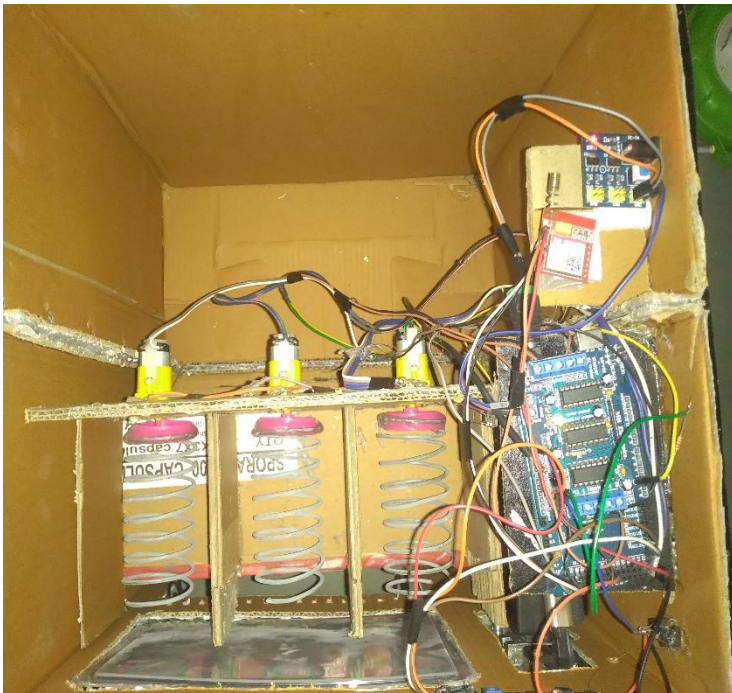


Figure 9.1: Front view



Figure 9.2: Top view



Figure 9.3: Side view

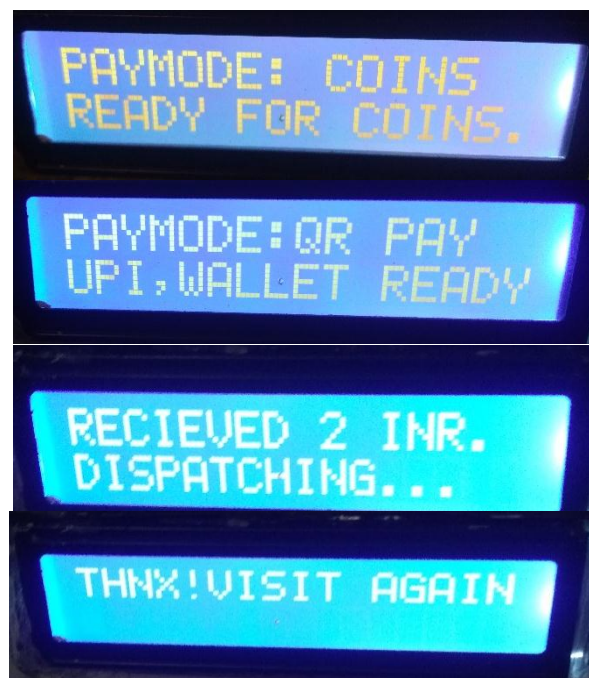


Figure 9.4: LCD status view

10. CONCLUSION

Products have become a necessity, taking into consideration about how our environment evolves. There is an immediate demand in dispatching the products with minimum delay and high efficiency, by considering the above problem statement and justification provided. We believe that the technologies suggested and implemented by us will set a benchmark in the industry thus directing the use of technology as a way to ease the lives of people. The proposed method is a more advanced technique to access the product at offices and other buildings with ease, saving precious time and effort of users, by introducing the concept of digitalization in industry has created a revolution the way in which people can get benefits in a more personalised and effective manner, and also opened doors for other business ventures to invest in this kind of development, thus easing lives of people and creating more job opportunities to the people. The use of web technology for product searching and payment has decreased the use of paper and cash in a tremendous way and also use of online transaction capability for product dispensing and network interfacing has made human delay incurred in dispatching of product almost negligible in addition to that the system is developed at a minimal cost making it affordable to any organization.

11. ACKNOWLEDGEMENTS

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