AN-NAJAH NATIONAL UNIVERSITY

Faculty of Engineering & Information Technology Computer Engineering Department

Hardware Graduation Project

Books Vending machine with Snacks

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1-Acknowledgment

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Finally, we would like to thank our university for cultivating a supportive environment that promotes learning and personal development. The achievement we make today would have remained elusive without the unwavering support of our dear friends and loyal family. Our sincere thanks go to all of you for your continued encouragement.

2-Disclaimer:

Reem Daraghmeh and Haneen Barham of the Computer Engineering Department, Faculty of Engineering, An-Najah National University are the authors of this report. It has not been altered or revised save for editorial changes brought about by the evaluation; as a result, it might include grammatical and/or content errors. The opinions expressed in it, along with any conclusions and advice, are all purely the students'. An-Najah National University disclaims all liability and responsibility for the results of using this study for purposes other than those for which it was commissioned.

3-Abstract

The book vending machine with snacks project is an exciting business idea that brings together the world of reading and snacks. This machine is like a small mobile bookstore that provides instant service to users who want to buy a new book.
The vending machine allows users to place orders through a keypad, specifying the desired items and quantities. The ordered items are displayed on a large LCD screen along with their respective prices.

The machine offers snacks in various sizes to cater to different preferences. Payment can be made using card or mobile phone.

If there are any empty stock, the machine can send a notification message to the owner. In addition, the machine features a locking system to ensure security and prevent unauthorized access.

We used these component in our project : Arduino Mega The Arduino Mega board is used as the main controller of the machine We used these component because the number of bins more than Arduino Uno and its Not enough for our project, and DC Motor: A DC motor can be used to drive the vending mechanisms in the machine. It can be used to drive products, and the Arduino controls the start and stop of the motor by controlling its power signal and RFID , and Magnetic: can be used to lock and unlock the door in the machine.

This project aims to promote a culture of reading and facilitate access to books in a fun and convenient way. And we focused on the elements being of multiple sizes and also it is possible for a person to request more than one request at the same time

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5-Introduction

1.1: Statement of the problem

Convenience and accessibility continue to impact consumer requirements and expectations in today's fast-paced environment. One of the fields that has seen the most radical shift as a result of the convergence of technology and innovation is vending machines. In public spaces, traditional vending machines have long been utilized to provide food and beverages. The absence of vending machines that can accommodate the preferences and demands of many people and mix the practicality of snacks with the intellectual richness of books, however, leaves a significant vacuum in the market.

The project's main objective was to create and put into practice a novel idea: a vending machine for books and snacks. There are many snacks vending machines in public spaces, but there are noticeably few interesting and accessible platforms for people to read literature and further their education. This discrepancy poses a unique challenge: how to easily combine the distribution of both snacks and books into a single, user-friendly, automated system, thereby increasing the accessibility of reading materials to a larger audience.

The absence of such groundbreaking vending machines not only limits people's access to reading materials but also fails to recognize the potential for nurturing a reading culture and encouraging continuous learning. Our project is dedicated to bridging this gap by designing and deploying a vending machine that offers a variety of popular snacks alongside a diverse range of reading materials. In doing so, we aim to promote literacy and provide a distinctive and convenient experience for users.

1.2: Objectives and Scope

Our main objective is to revolutionize the vending machine experience by creating a unique platform that seamlessly combines literature and snacks, promoting reading culture while catering to users snacks preferences. Within this section, we outline our project's key objectives, such as enhancing accessibility to reading materials, providing a convenient and enjoyable user experience.

6-Constraints/ Standards / Codes and Earlier course work:

- ## Constraints:
- We, two computer engineering students, faced considerable difficulties in grappling with the mechanical aspects of our project. Challenges such as strikes, political circumstances, and occupation hindered the continuity of our work within the university.

  As we ventured into the initial phases of our project, we were confronted with an array of obstacles and complexities in the development of the book and snack vending machine. These challenges encompassed various domains, ranging from the meticulous selection of appropriate products and the design of the machine to the meticulous adherence to industry standards and codes.

  Foremost among these challenges was the critical task of product selection, requiring meticulous consideration of product dimensions and seamless integration within the mechanical framework. Another prominent hurdle emerged while designing the mechanism for product dispensation through a spiral system, necessitating adjustments to cater to the unique attributes of different products. The mechanical intricacies demanded dedicated efforts to achieve a mechanism that was both stable and precise.

  Transitioning to the electrical and electronic realm, fresh challenges presented themselves, primarily concerning the establishment of component connections and the optimization of actuation force. The process of choosing appropriate wiring connections for various components proved to be particularly demanding.
  Another challenge that we faced was power . In our project, we tried using (12v) for all components, but an error occurred in the process, so we solved this issue by putting 5v, So we use (12volt) for DC motors and (5volt) for rest components.

And The Arduino Mega has a technical issue where it occasionally isn't detected on our devices.

In summation, our journey as computer engineering students was marked by persistent dedication to overcoming obstacles, be they mechanical intricacies or electrical conundrums. The amalgamation of our efforts and innovative solutions exemplified our commitment to crafting a functional and efficient book and snack vending machine.

Standards/ Codes:

The programming language we used for the project was Arduino. Popular open-source electronics platform Arduino is known for its straightforward hardware and software elements. It was essential to the success of our project. The Arduino development environment, which is easily downloaded and incorporated into our system, is used to construct the project's code. To put our concept into function, we build and validate the code before uploading it to the Arduino board. We were able to produce a dependable and strong design by adhering to the fundamentals of this tested platform.

Furthermore, the knowledge we acquired in our "Networks 2" course proved to be quite useful. This course equipped us with the skills and knowledge necessary to configure a PHP server and provide efficient HTTP requests-based communication between the server and our project, and We were able to construct this system with the use of digital design, microprocessors, electrical circuits, electronic circuits, and microcontrollers. Additionally, in order to complete the work, we took some online classes where we learnt the fundamentals of Arduino programming.

7-Literature Review

Vending machines have long had a presence in consumer culture as automated points of sale .Yet, in recent times, technology's stride has ushered in a new era, transforming these once-simple product dispensers into dynamic and interactive systems. This literature review delves into the realm of vending machine evolution, with a focus on the integration of advanced features that enhance user engagement, diversify payment methods.

The idea of book vending machines has emerged in recent decades and has been located in different regions around the world. The aim of this portal is to provide an easy way for readers to access books as soon as they need them.

Book vending machines have been in use in some places since the mid-2000s. Since then, this idea has become more. This is why people buy books easily and quickly in places where there may not be offices nearby.

Over the years, touch screen and electronic payment technologies have been incorporated into the industry resulting in a more intuitive and interactive buying experience, We reviewed several previous vending machines to utilize in building our graduation project.

A standout enhancement in contemporary vending machines is the multi-order functionality. Through interaction with a keypad, users can place multiple orders within a single transaction. This innovation streamlines the purchasing process, aligning with the contemporary consumer's preference for efficiency and convenience.

A noteworthy addition to our vending machine is the integration of large LCD screens. These screens elegantly display selected items alongside their respective prices, delivering both visual appeal and vital information to users. This interactive display ensures an engaging and informed user experience.

Further augmenting the vending experience, we've introduced an assortment of snack sizes to cater to diverse consumer appetites. Additionally, the inclusion of

various book types expands the array of choices available to customers, catering to a wider range of preferences.

our vending machine accommodates transactions through cards and mobile phones, aligning seamlessly with the increasing trend towards cashless transactions. This integration enhances transaction security and convenience, reflecting the evolving financial landscape.

In conclusion, vending machines have transcended their conventional roles to become hubs of interactivity, enriched with advanced features that prioritize user ease, and efficient management. The amalgamation of multi-order functionality, diversified product selections, and modern payment mechanisms has reshaped vending machines into sophisticated entities. This evolution speaks to the fusion of technology and convenience, fostering a more engaging and seamless consumer experience.

8-Methodology

- Overview: Our project required us to do two phases.

  The first stage is: involves the creation and implementation of the mechanical system. This encompasses tasks such as identification, sketching, design, and the installation of mechanical components.
  The second stage is: pertains to the intelligent component containing the integrated circuits. This aspect is instrumental in defining the machine's functionality, its operational methods, objectives, and other functions it carries out.
  In this section, we will provide details of components.

- Hardware Components:

  a) IR Sensors:

  IR sensors work by detecting the infrared radiation emitted or reflected by objects. They typically consist of an IR transmitter ,and an IR receiver The IR emitter emits infrared light, and the receiver detects changes in the intensity of this light

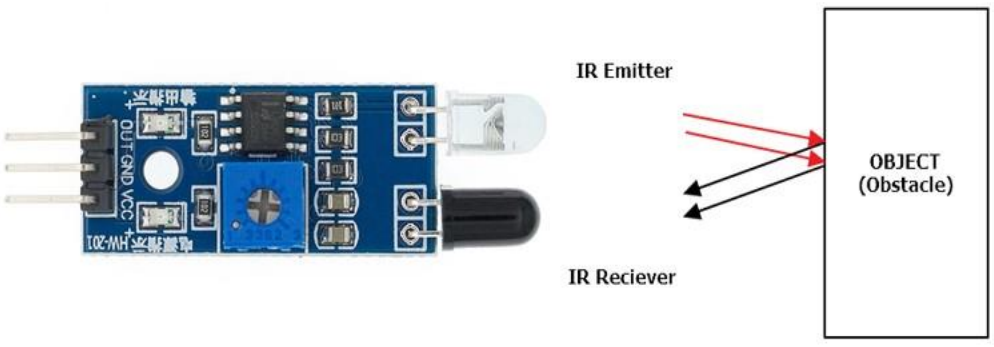


Figure 1: IR Sensors

b) Power Supply:

We used in our project 12 V Power Supply For DC motor

Figure 2:Power Supply 12v

And 5 V for rest component

Figure 3:Power Supply 5v

c) H-Bridge:

An H-bridge motor driver is an electronic circuit that provides control over the direction and speed of a DC motor. It is called an "H-bridge" because its configuration typically resembles the letter "H.", and They are a crucial part of many electromechanical systems, allowing for versatile and efficient motor control in various applications.

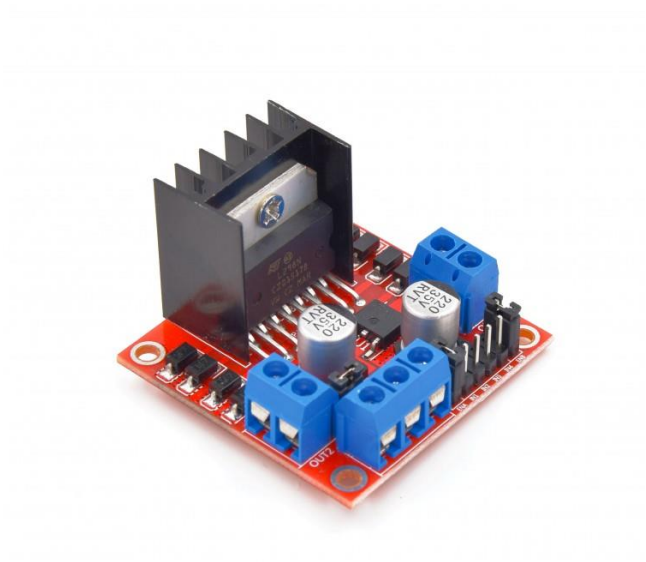


Figure 4: H-Bridge

d) Magnetic:

A magnetic lock contain two main components: an electromagnetic coil and its mounted on the frame of the vending machine, and an armature plate (mounted on the door). When power is applied to the electromagnetic coil, it generates a magnetic field that attracts the armature plate, effectively locking the door in place. This holding force is typically strong enough to secure the door and prevent unauthorized access.

Figure 5: Magnetic

e) DC Motor:

The DC motor rotates the spiral mechanism, which pushes the product forward.

Figure 6:DC Motor

f) Rolls:

We used different sizes according to the sizes of the products:

Figure 7 :roll1

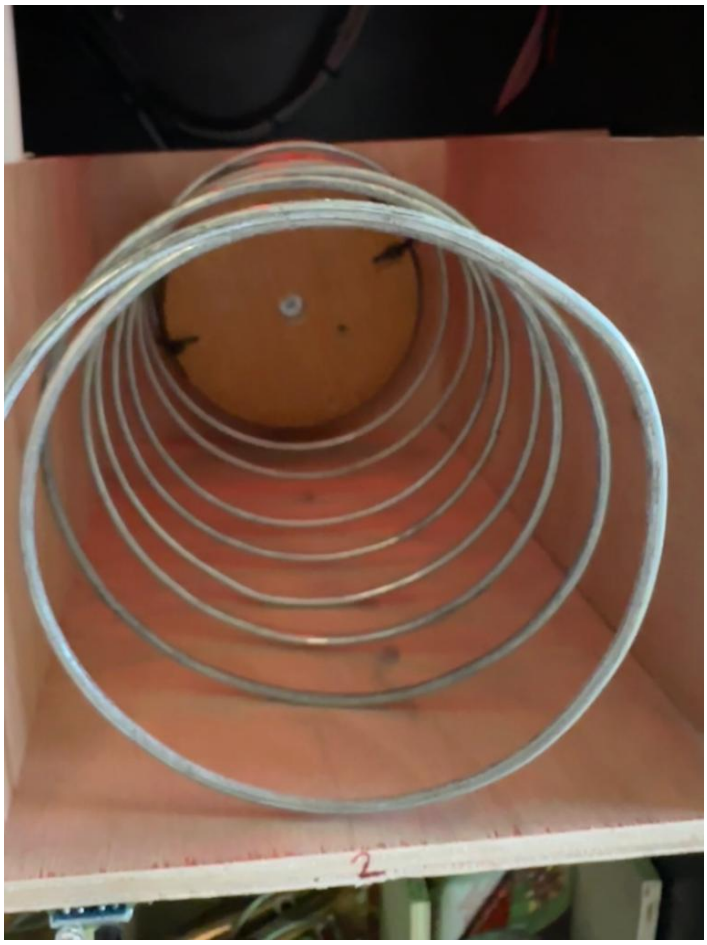


Figure 8:roll 2

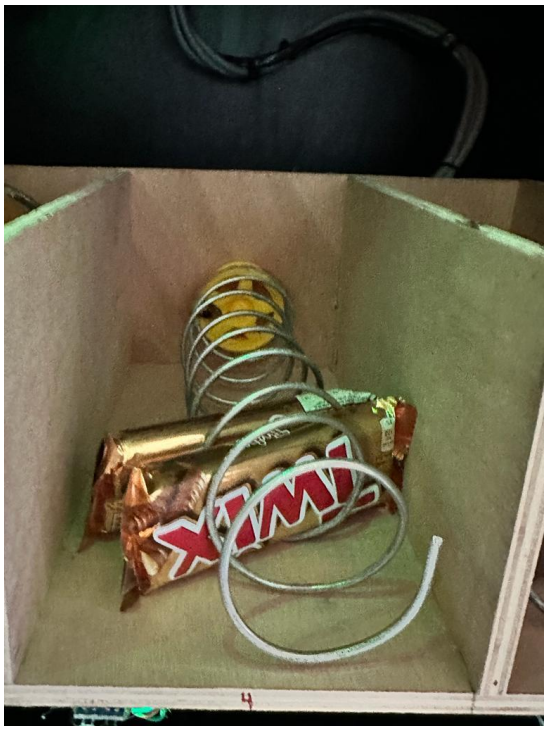


Figure 9:roll 3

g) Arduino mega:

the Arduino Mega 2560 can play a vital role by managing various tasks involving serial communication, digital input, and output, We use Arduino mega on our project because we have many connections which can’t by fit in Arduino uno.

Figure 10:Arduino mega

h) LCD 32X2:

A "2x32 LCD" typically refers to a liquid crystal display (LCD) module with a 2-row by 32-character configuration. This means the LCD screen can display up to 32 characters in each of its two rows, making it a relatively wide display format.

Figure 11:LCD 32X2

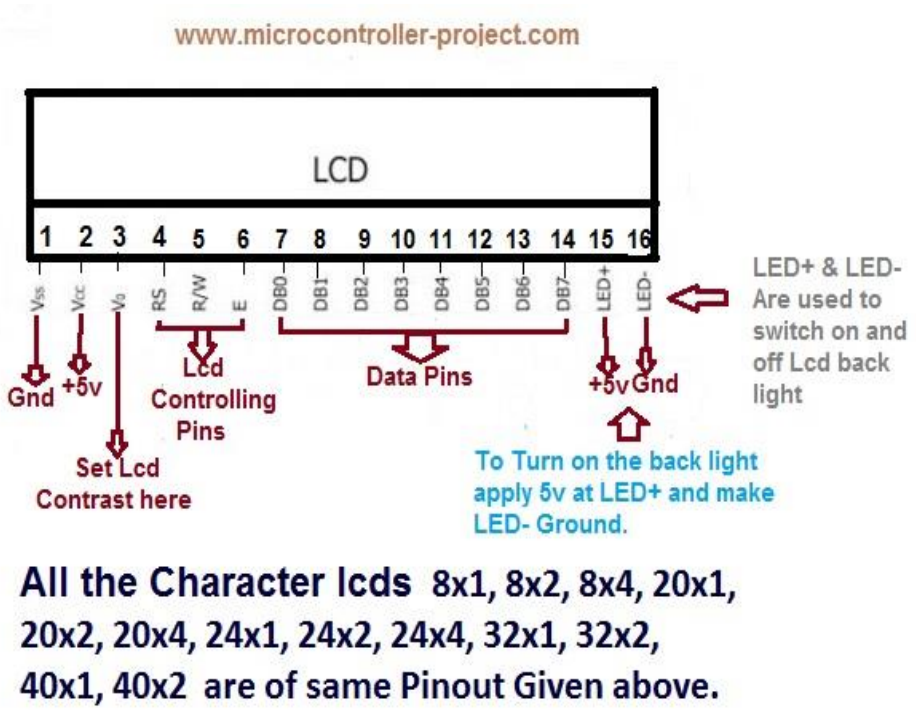


Figure 12:lcd 2

i) potentiometer:

We use it to Controls the brightness of the letters.

Figure 13:potentiometer

j) Keypad:

A small group of keys that are part of a larger keyboard or other device, used to allow users to Interact with the machine. We use it to get the user to order the products they want.

Figure 14:Keypad

k) RFID:

We use it to control a magnetic lock and enable card-based payment is a smart and secure way(method one for payment).

Figure 15:RFID

l) Bluetooth HC-05:

It establishes a communication protocol between the vending machine and the mobile application, providing users with an additional payment option. Upon successful payment, the vending machine verifies and confirms the transaction.

Figure 16:Bluetooth HC-05

m) GSM:

Developing a communication protocol using short messages , and the coordination of SMS messages that the vending machine will send to the phone if the product is empty . It is connected to the Arduino Mega via serial communications .

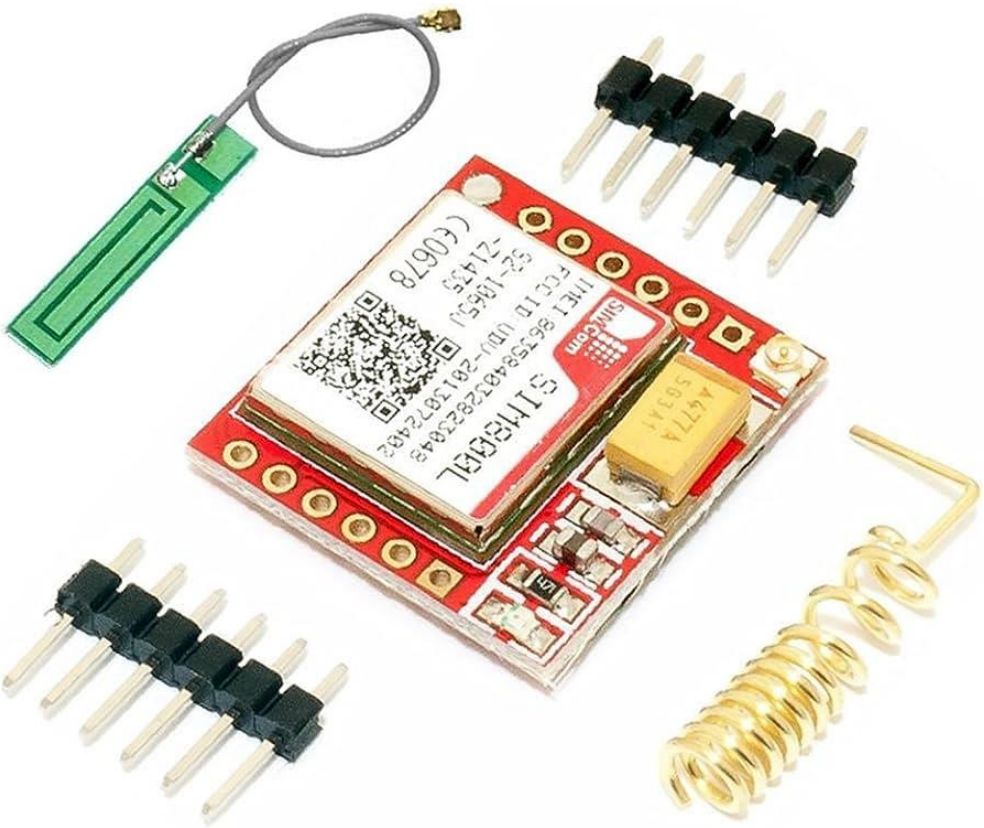


Figure 17:GSM

❖ Send a message to the administrator when the product is sold out:

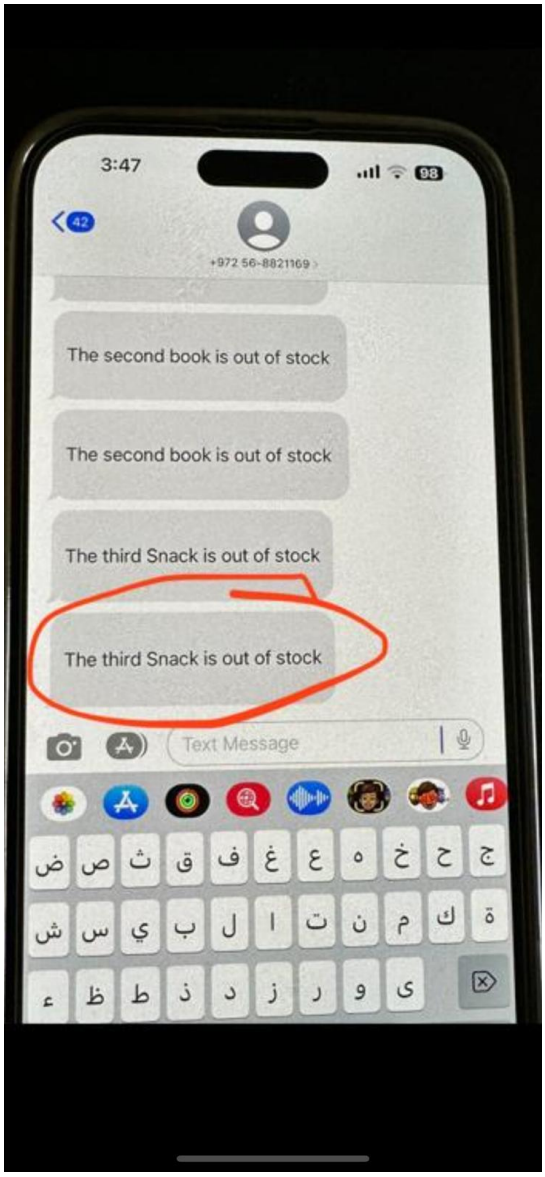


Figure 18:SMS

n) Esp. 8266:

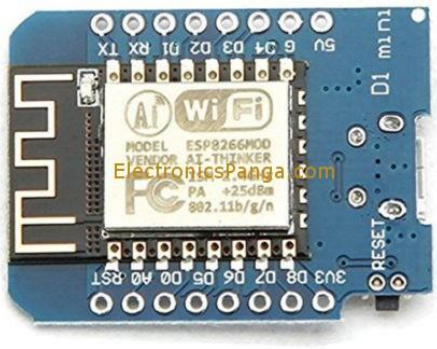
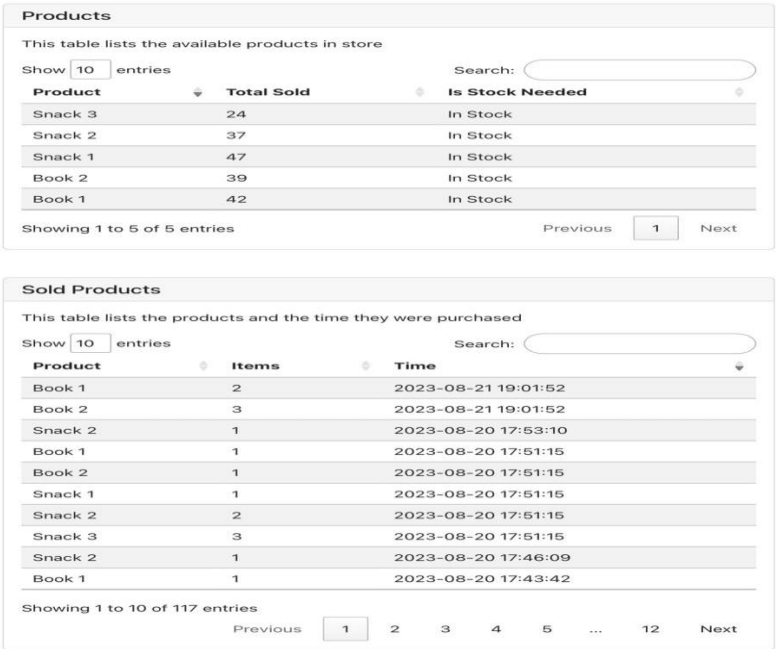


Figure 17:ESP

❖ As we mentioned earlier, we used the ESP so that the responsible person has a source for the machine so that he knows how many products he has sold and if the quantity has run out or not.



Products

This table lists the available products in store

Show 10 entries Search:

Product	Total Sold	Is Stock Needed
Snack 3	24	In Stock
Snack 2	37	In Stock
Snack 1	47	In Stock
Book 2	39	In Stock
Book 1	42	In Stock

Showing 1 to 5 of 5 entries Previous 1 Next

Sold Products

This table lists the products and the time they were purchased

Show 10 entries Search:

Product	Items	Time
Book 1	2	2023-08-21 19:01:52
Book 2	3	2023-08-21 19:01:52
Snack 2	1	2023-08-20 17:53:10
Book 1	1	2023-08-20 17:51:15
Book 2	1	2023-08-20 17:51:15
Snack 1	1	2023-08-20 17:51:15
Snack 2	2	2023-08-20 17:51:15
Snack 3	3	2023-08-20 17:51:15
Snack 2	1	2023-08-20 17:46:09
Book 1	1	2023-08-20 17:43:42

Showing 1 to 10 of 117 entries

Previous 1 2 3 4 5 ... 12 Next

Figure 18:THE SITE

❖ This is the exterior design of the machine:

Figure 19:exterior design

❖ This is the circuit design of the machine:

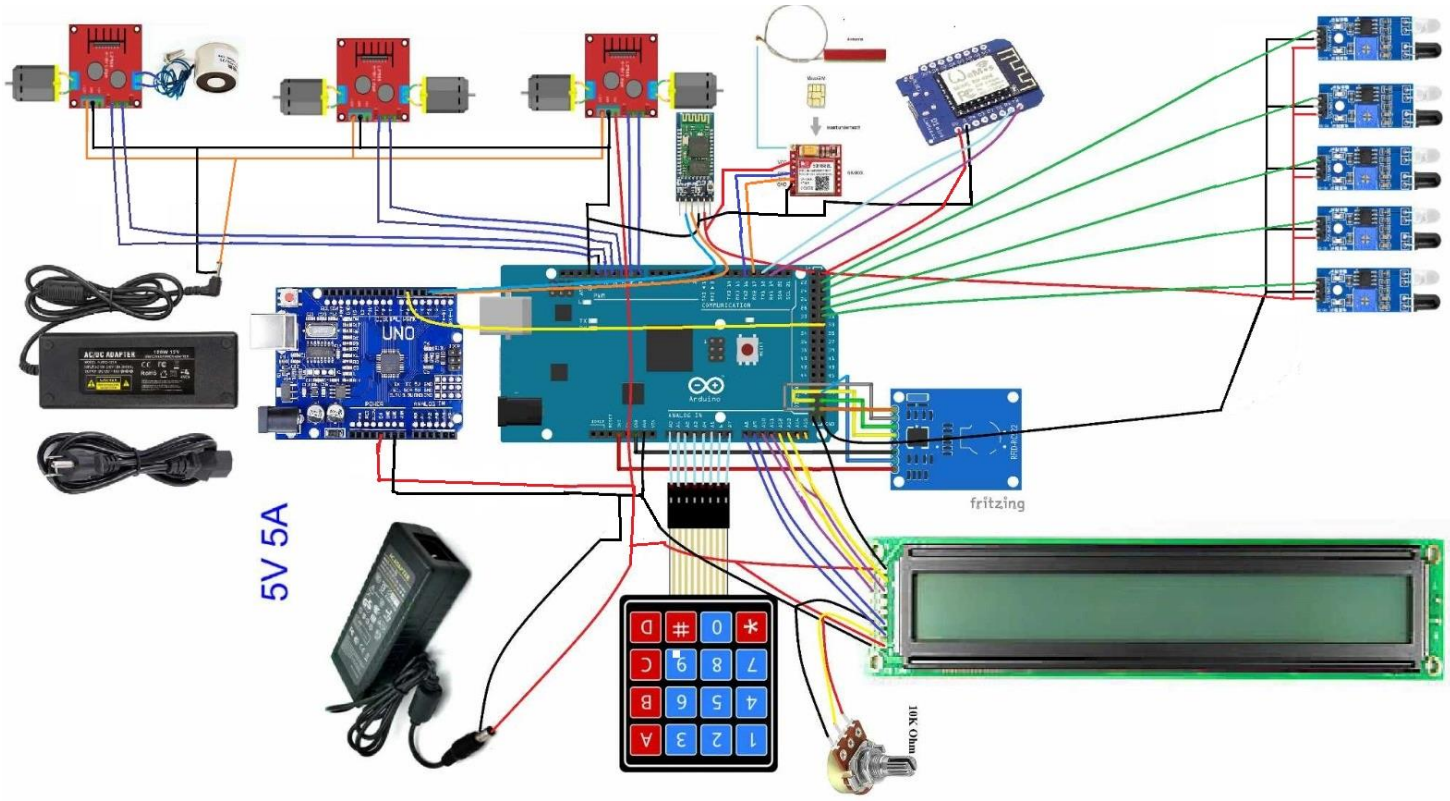


Figure 20:circuit design

9-Results And Discussion

Building a vending machine was initially challenging, as we needed to conceptualize its design based on the features we aimed to incorporate. Our previous background in the PIC course and Networks 2 course played a pivotal role in swiftly grasping new concepts about Arduino, even those we were unfamiliar with.

A vending machine is a mechanized apparatus that dispenses snacks and books to customers following payment, both through RFID card and phone transactions. Moreover, an associated website enables administrators to remotely monitor real-time product updates. Our machine also offers various product sizes to cater to diverse consumer preferences.

Additionally, we have used GSM technology to notify the owner when the product has been sold. A unique lock mechanism operated by an RFID card grants access to the device. This access control is further facilitated by a magnet mechanism.

With these features in place, our vending machine seamlessly accommodates user convenience, technological innovation, and enhanced security. This project exemplifies the successful convergence of our technical skills and creative problem-solving.

10-Conclusion

In conclusion, our project has achieved its intended goals, enhancing the overall performance of the vending machine by implementing modern non-cash payment methods, increasing its attractiveness, and ensuring reliability. The successful integration of an Arduino Mega as the main controller has been a pivotal step in realizing these objectives. This project not only improves user convenience but also aligns with the evolving needs of a tech-savvy and convenience-driven society.

11-Future work

1. Expanding Product Range: Our future goal is to diversify the vending machine's product offerings, providing users with a wider selection of items.

2. Enhanced User Experience: We plan to incorporate intuitive touch screen interfaces, voice recognition, or augmented reality features to enhance the vending machine's appeal and user-friendliness. This may encompass interactive product displays, immersive virtual shopping experiences, and personalized product recommendations.

3. High level error detection system.

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