

DEPT. OF ELECTRONICS AND TELECOMMUNICATION ENGG.

DKTE SOCIETY'S

TEXTILE AND ENGINEERING INSTITUTE, ICHALKARANJI

(An Autonomous Institute)



Promoting Excellence in
Teaching, Learning & Research

TEA AND COFFEE VENDING MACHINE

**A Project Report Submitted
in Partial Fulfillment of the Requirements
for the Degree of**

**BACHELOR OF TECHNOLOGY
IN
ELECTRONICS AND TELECOMMUNICATION
ENGINEERING**

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PROF. (DR.) S.R. PRASAD**

2023-24

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TEXTILE AND ENGINEERING INSTITUTE, ICHALKARANJI

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Teaching, Learning & Research

CERTIFICATE

This is to certify that the project entitled Tea and Coffee Vending Machine submitted by

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in the partial fulfillment of the requirements for the degree of **Bachelor of Technology in Electronics and Telecommunication Engineering** at the DKTE Society's Textile and Engineering Institute, Ichalkaranji (An Autonomous Institute Affiliated to Shivaji University, Kolhapur) is an authentic work carried out by them under our supervision and guidance.

The students have satisfactorily completed the project work and to the best of our knowledge and belief, the matter embodied in this submission has not been submitted to any other University/ Institute for the award of any degree or diploma.

Place: Ichalkaranji

Date:

Dr. S. R. Prasad
Guide

Prof. (Dr.) S. A. Patil
[HOD]

Prof. (Dr.) L. S. Admuthe
[I/c Director]

DECLARATION

We declare that this written submission represents our ideas in our own words and where others' ideas or words have been included, we have adequately cited and referenced the original sources. We also declare that we have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in our submission. We understand that any violation of the above will be cause for disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

Name of the Students

Signature of the students

1)Aditya Pol

2)Prathamesh Salunkhe

3)Nikhil Yalgar

Place: Ichalkaranji

Date:

ACKNOWLEDGEMENT

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ABSTRACT

In the abstraction of a tea and coffee vending machine project, the primary objective is to create a seamless and user-friendly experience for customers seeking hot beverages. At its core, the vending machine serves as a self-service station where users can interact with a simple and intuitive interface to select their desired drink options. This interface is designed to accommodate various preferences and customization choices, ensuring that users can easily navigate through the available beverage selections.

Behind the scenes, the vending machine houses compartments or canisters for storing essential ingredients such as tea leaves, coffee beans, sugar, powdered milk, and flavourings. These ingredients are meticulously stored to preserve their freshness and quality until they are dispensed into the beverage cup. The vending machine's brewing mechanism is responsible for accurately measuring and dispensing the appropriate quantities of ingredients, mixing them with hot water, and brewing the beverage to perfection.

In essence, the abstraction of the tea and coffee vending machine project outlines the key components and interactions required to deliver a satisfying beverage experience to customers. By focusing on these core aspects, developers can design and implement a robust vending machine system that meets the needs and expectations of users, providing them with a convenient and enjoyable way to access their favourite hot beverages.

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Chapter 1

Introduction

1.1 Introduction

A tea and coffee vending machine are a versatile and convenient solution for providing a wide range of hot beverages in various settings, including offices, schools, hospitals, and public spaces. These machines offer users the convenience of freshly brewed tea and coffee at the touch of a button, eliminating the need for manual preparation or waiting in line at cafes.

Typically equipped with user-friendly interfaces, these vending machines allow customers to customize their beverages according to their preferences, adjusting parameters such as strength, sweetness, and milk content. With a diverse menu of options including different types of tea, coffee, hot chocolate, and specialty drinks, these machines cater to a wide range of tastes and preferences.

Tea and coffee vending machines have come a long way since their inception. Initially simple in design, primarily dispensing standard brews, today's machines are equipped with advanced technology, offering an extensive array of beverage options. From traditional teas and coffees to specialty blends and flavoured concoctions, these machines cater to diverse palates and preferences.

The benefits of tea and coffee vending machines extend beyond mere convenience. For businesses, these machines serve as cost-effective solutions, eliminating the need for dedicated baristas or manual brewing equipment. They enhance workplace productivity by providing employees with instant access to rejuvenating beverages, fostering a conducive environment for collaboration and creativity.

In public spaces such as airports, hospitals, and universities, tea and coffee vending machines offer a respite for weary travel, medical professionals on break, and students burning the midnight oil. Moreover, they generate additional revenue streams for establishments, serving as profitable assets in high-traffic areas.

Future Prospects, the future of tea and coffee vending machines is bright with possibilities. Advancements in artificial intelligence may enable predictive analytics and personalized recommendations, enhancing the user experience further. Moreover, with the rise

of smart cities and interconnected ecosystems, these machines could seamlessly integrate into urban landscapes, offering on-the-go refreshment to residents and commuters alike.

The tea and coffee vending machine represents a paradigm shift in beverage consumption, combining innovation with practicality to deliver a superior user experience. From its humble beginnings to its current state of technological sophistication, this ubiquitous fixture continues to revolutionize the way we save our favourite hot drinks. As we embrace the future, tea and coffee vending machines stand poised to redefine convenience, sustainability, and hospitality in the modern world.

1.2 Motivation/ Relevance of Project

The main motivation behind this project is

Convenience: Automatic tea and coffee vending machines provide a convenient way for people to get their favourite hot beverages without having to wait in line or make them themselves.

Time-saving: These machines can dispense a cup of tea or coffee in a matter of seconds, which saves time for busy individuals who need a quick caffeine fix.

Cost-effective: Automatic tea and coffee vending machines can be a cost-effective solution for businesses and organizations that want to provide hot beverages to their employees or customers without having to hire additional staff.

Customization: Many automatic tea and coffee vending machines offer customization options, allowing users to choose the strength, sweetness, and type of milk they prefer.

Hygiene: Automatic tea and coffee vending machines are designed to be hygienic, with many featuring touchless dispensing and automatic cleaning cycles.

Variety: Automatic tea and coffee vending machines can offer a wide variety of hot beverages, including different types of tea, coffee, and hot chocolate, which can cater to different tastes and preferences.

1.3 Objectives

The motivation behind this project is

- To reduce manpower and automate the system of making tea or coffee.
- To provide the home-made taste of tea or coffee to the customers instantly.
- Implementing a product level project which brings future opportunities in start-ups and Business

Chapter 2

Review of Literature

- "Design and Development of an Automatic Tea and Coffee Vending Machine" by S. S. Rao et al., published in the International Journal of Engineering and Technology in 2015.

This paper presents the design and development of an automatic tea and coffee vending machine using a microcontroller-based system. The authors describe the hardware and software components of the machine, including the microcontroller, sensors, actuators, and user interface. The paper also discusses the machine's operation, including the dispensing of tea and coffee, and the control of water temperature and brewing time. The authors conclude that the use of microcontrollers improved the machine's efficiency, accuracy, and user-friendliness.

- "Quality of Coffee Dispensed by Vending Machines" by S. K. Singh et al., published in the Journal of Food Science and Technology in 2017.

This study investigated the quality of coffee dispensed by vending machines. The authors evaluated the coffee quality based on factors such as water temperature, brewing time, and coffee-to-water ratio. The study found that the quality of coffee was influenced by these factors, and that the use of fresh coffee beans and optimal brewing conditions improved the coffee quality.

- "Artificial Intelligence in Vending Machines: A Literature Review" by M. A. Bhuiyan et al., published in the Journal of Foodservice Technology and Management in 2019.

This literature review examined the use of artificial intelligence (AI) in vending machines. The authors reviewed various studies on AI applications in vending machines, including user experience, customization, and maintenance. The review found that AI can improve the user experience, customize beverage options, and optimize machine maintenance.

- "Internet of Things (IoT) in Vending Machines: A Review" by S. K. Singh et al., published in the Journal of Intelligent Manufacturing in 2020.

This research paper explored the use of IoT (Internet of Things) technology in vending machines. The paper discussed the potential benefits of IoT, such as real-time monitoring, predictive maintenance, and energy savings. The authors also reviewed various IoT applications in vending machines, including inventory management, payment systems, and

customer engagement. The paper concluded that IoT can improve the efficiency, reliability, and sustainability of vending machines.

- "Design and Implementation of a Smart Tea and Coffee Vending Machine" by M. A. Bhuiyan et al., published in the Journal of Intelligent Information Systems in 2019.

This paper presents the design and implementation of a smart tea and coffee vending machine using IoT technology. The authors describe the hardware and software components of the machine, including the microcontroller, sensors, actuators, and user interface. The paper also discusses the machine's operation, including the dispensing of tea and coffee, and the control of water temperature and brewing time. The authors conclude that the use of IoT technology improved the machine's efficiency, accuracy, and user-friendliness.

Chapter 3

Hardware Implementation

3.1 System Block Diagram

The system block diagram is as given in Fig. 3.1.

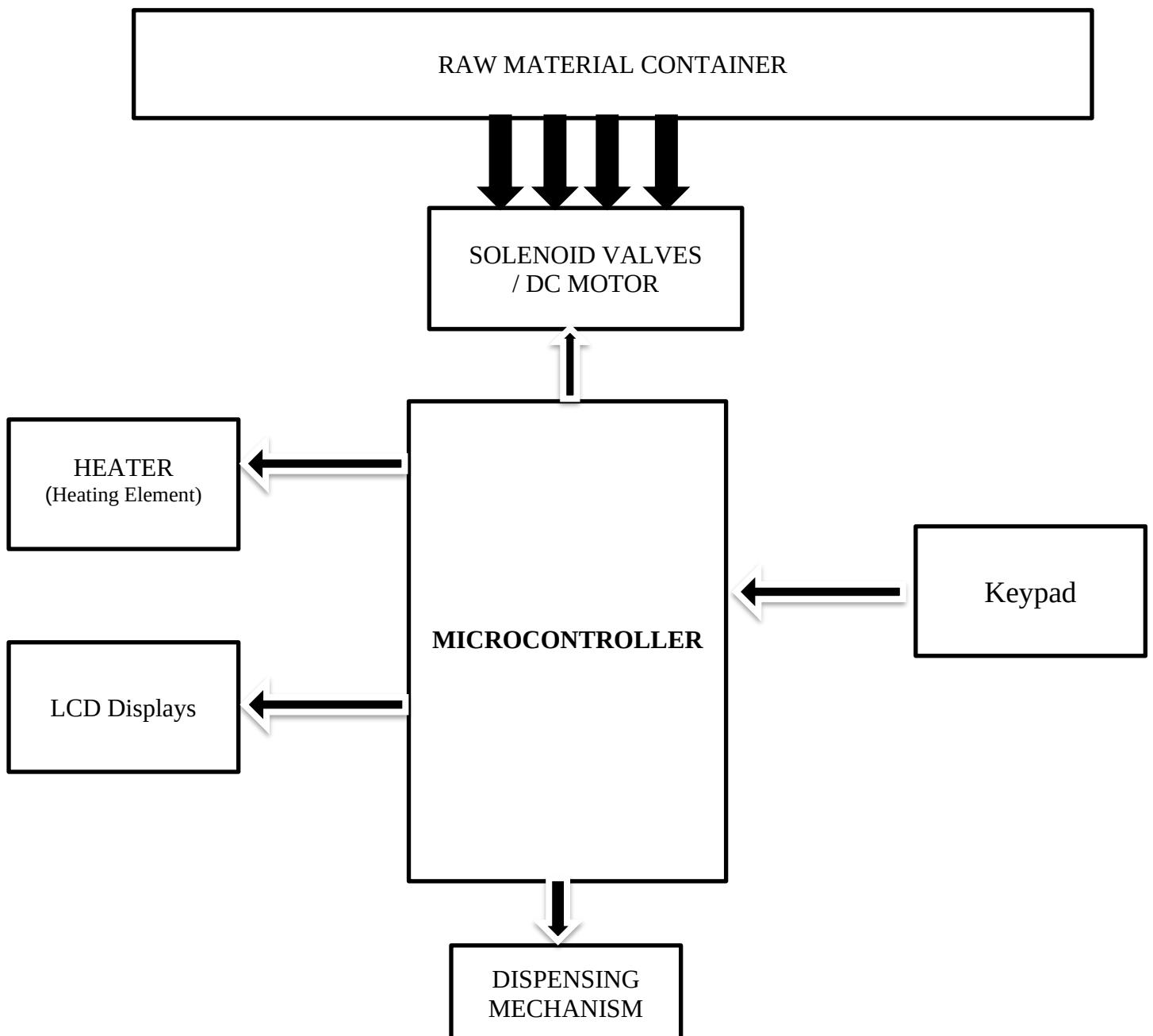


Fig 3.1 Block Diagram

The block diagram illustrates the interconnected components of a tea vending machine powered by Arduino, solenoid valves, relays, and motors. At the core of the system lies the Arduino microcontroller, serving as the central processing unit. The user interface, which typically comprises buttons, a touchscreen, or an LCD display, enables users to select their desired beverage options. Upon input from the user, the Arduino processes the selection and coordinates the operation of various components accordingly.

The ingredient storage section encompasses canisters or compartments designated for storing tea leaves, coffee beans, sugar, powdered milk, and other additives required for beverage preparation. Controlled by the Arduino, solenoid valves regulate the flow of hot water and ingredients from the storage compartments. This precise control ensures accurate dispensing of each ingredient, tailored to the user's beverage preferences.

Finally, the dispensing mechanism, operated by motors or relays, releases the prepared beverage into a cup or container for consumption. Orchestrated by the Arduino, this mechanism ensures the correct proportions of ingredients are dispensed, delivering a customized and satisfying beverage to the user. In summary, the block diagram offers a visual representation of the interconnected components and their coordinated operation within the tea vending machine system.

3.2 Hardware Design

3.2.1 Arduino Microcontroller

Arduino microcontrollers serve as the backbone of innovation in the realm of tea and coffee vending machines, empowering developers to create intelligent and customizable solutions that enhance user experiences and optimize operational efficiency. At the heart of these microcontrollers lies their versatility and ease of use, making them ideal for prototyping, experimentation, and rapid iteration in the development process.

The Arduino UNO is a standard board of Arduino. Here UNO means 'one' in Italian. It was named as UNO to label the first release of Arduino Software. It was also the first USB board released by Arduino. It is considered as the powerful board used in various projects. Arduino.cc developed the Arduino UNO board.

Arduino UNO is based on an ATmega328P microcontroller. It is easy to use compared to other boards, such as the Arduino Mega board, etc. The board consists of digital and analogue Input/Output pins (I/O), shields, and other circuits.

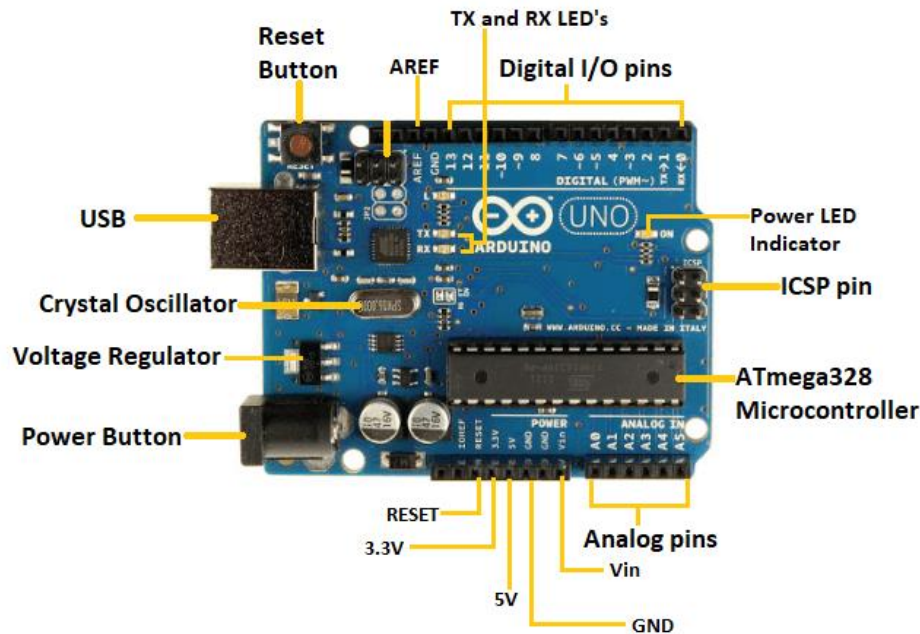


Fig. 3.2 Arduino Microcontroller

3.2.2 Relay Modules

Relay modules are essential components that empower developers to achieve precise control and efficient operation in tea and coffee vending machines. With their ability to isolate control signals, provide versatility, and enhance efficiency, relay modules contribute to the overall functionality, safety, and longevity of vending machines, ensuring a satisfying and reliable beverage experience for users.

Relay modules serve as indispensable components within tea and coffee vending machines, facilitating precise control over various electrical devices and systems. These modules act as switches, allowing the microcontroller to toggle power to specific components such as heating elements, pumps, and solenoid valves, thereby enabling precise and efficient operation of the vending machine.



Fig 3.3 Relay Module

3.2.3 DC Motor

DC motors are electric motors that operate using direct current (DC) power. They convert electrical energy into mechanical energy to produce rotational motion. DC motors are widely used in a variety of applications due to their simplicity, reliability, and ease of control. This is 60RPM 12V Low Noise DC Motor with Metal Gears-Grade A. These motors are simple DC Motors featuring Metal gears for the shaft for obtaining the optimal performance characteristics. They are known as Centre Shaft DC Geared Motors because their shaft extends through the centre of their gear box assembly.

These standard size DC Motors are very easy to use. Also, you don't have to spend a lot of money to control motors with an Arduino or compatible board. The L298N H-bridge module with onboard voltage regulator motor driver can be used with this motor that has a voltage of between 5 and 35V DC. This DC Motor – 60RPM – 12Volts can be used in all-terrain robots and a variety of robotic applications. These motors have a 3 mm threaded drill hole in the middle of the shaft thus making it simple to connect it to the wheels or any other mechanical assembly.



Fig 3.4 DC Motor

3.2.4 LCD Module

A 16×2 LCD display is a liquid crystal display that can show 16 characters in each of its two rows, providing a total of 32 characters of information. It's commonly used to display alphanumeric information in various electronic devices. A 16x2 LCD display is a compact and versatile module commonly used in electronic projects and devices to provide visual feedback

and user interfaces. With its grid of 16 columns and 2 rows, it can display up to 32 characters at once, allowing for the presentation of alphanumeric characters, symbols, and basic graphics. These displays are designed to be easily interfaced with microcontrollers or other electronic devices using parallel or serial communication protocols, making them compatible with a wide range of systems including Arduino and Raspberry Pi. Equipped with LED backlighting, they ensure readability in various lighting conditions, further enhancing their usability in diverse applications.

In the realm of embedded systems, 16x2 LCD displays find applications in devices such as digital clocks, temperature monitors, and home automation systems, where they provide essential visual feedback to users. In industrial settings, they serve on control panels to display status information, sensor readings, and diagnostic messages, contributing to efficient monitoring and management of machinery and equipment. Additionally, these displays are integrated into consumer electronics products like calculators, digital instruments, and home appliances, offering users clear and concise information in a user-friendly format.

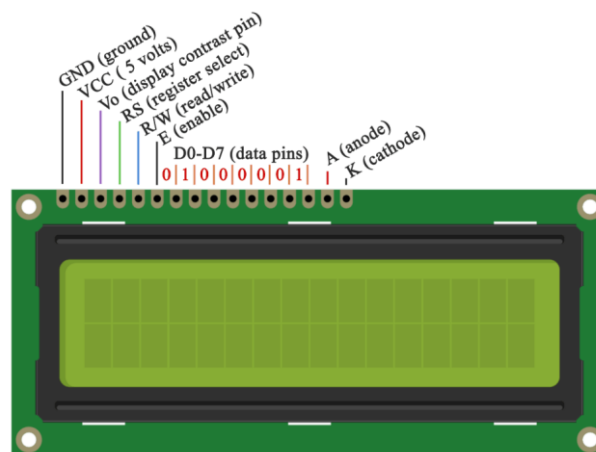


Fig 3.5 LCD Display

3.2.5 LCD I2C Module

An LCD I2C module combines the functionality of a liquid crystal display (LCD) with the convenience of an I2C (Inter-Integrated Circuit) interface. With a standard LCD screen capable of displaying alphanumeric characters and symbols, these modules are commonly available in popular configurations like 16x2 or 20x4 characters. The integration of an I2C interface simplifies connectivity with microcontrollers and other devices, reducing the number of required pins and streamlining the wiring process. This makes LCD I2C modules ideal for projects where space is limited or where ease of integration is essential, such as in embedded systems, robotics, and DIY electronics.

One of the key advantages of LCD I2C modules is their compatibility with a wide range of microcontrollers, including popular platforms like Arduino and Raspberry Pi. This versatility allows hobbyists, students, and professionals to incorporate visual displays into their projects with ease. Additionally, many LCD I2C modules come equipped with LED backlighting, adjustable contrast, and address selection options, further enhancing their usability and flexibility in various applications. Whether used for displaying sensor data, providing user interfaces, or conveying status information, these modules offer a user-friendly solution for adding visual feedback to electronic devices.

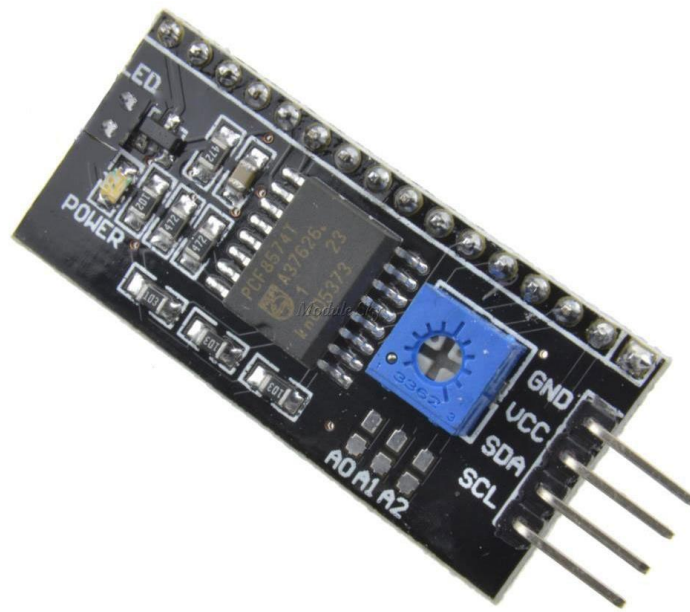


Fig 3.6 I2C Module

3.2.6 DC Chopper

A boost converter, often referred to as a step-up converter, is a vital component in electronics for elevating input voltages to higher output levels. Operating on the principle of energy storage and transfer, it efficiently increases the voltage level to match the requirements of specific components or subsystems. At its core, a boost converter comprises a switching transistor, inductor, diode, capacitor, and control circuitry. During operation, the switching transistor alternates between on and off states, allowing current to flow through the inductor when on and releasing stored energy when off. This process results in a higher output voltage than the input, making it invaluable in scenarios where a stable and elevated power supply is needed.

In practical applications, boost converters are ubiquitous across various industries and technologies. In portable electronics, they enable the efficient utilization of battery power by

stepping up the voltage to meet the demands of power-hungry components like displays and processors.



Fig 3.7 DC Chopper

3.2.7 Vending machine canisters

Vending machine canisters are pivotal components within vending machines, tasked with storing and dispensing a variety of dry ingredients essential for beverage preparation. Constructed from durable materials like stainless steel, plastic, or glass, these canisters ensure the freshness and quality of ingredients over time. Their airtight seals preserve the integrity of perishable items such as coffee beans, powdered milk, and tea leaves, maintaining their flavour and aroma until dispensed.

Capacity is a critical consideration in canister design, with sizes varying to accommodate different ingredient quantities. Larger canisters are reserved for high-demand items like coffee beans or powdered milk, while smaller ones house flavourings or condiments. Equipped with dispensing mechanisms such as augers or spirals, ensuring accurate portioning and consistent quality in each beverage.

Efficient refilling and maintenance are facilitated by features like removable lids or access panels, streamlining operations for vending machine operators. Clear labelling and color-coding further enhance usability, allowing for quick identification of stored ingredients. By securely storing and dispensing ingredients, vending machine canisters uphold the freshness and reliability of beverages and snacks, ultimately contributing to a seamless and satisfying vending experience for users.



Fig 3.8 Vending machine canisters

3.2.8 Solenoid valves

Solenoid valves are electromechanical devices that play a critical role in controlling the flow of liquids or gases within a system. Comprising an electromagnetic coil, a movable plunger or piston, and a valve mechanism, these valves operate by converting electrical energy into mechanical motion. When an electric current is applied to the coil, it generates a magnetic field, which attracts or repels the plunger or piston, thereby opening or closing the valve. This mechanism allows solenoid valves to precisely regulate the flow of fluids or gases, making them indispensable in a wide range of applications across industries.

The versatility of solenoid valves is reflected in their various types and configurations. Two-way solenoid valves, for instance, feature two ports for controlling inlet and outlet flow, providing on/off control of fluid or gas flow. These different types of solenoid valves enable engineers and designers to tailor their choice to specific application requirements, whether it involves simple on/off control or more complex flow diversion and direction control.



Fig 3.9 Solenoid valves

3.2.8 Electric Kettle

Electric kettles are sophisticated appliances designed for the efficient and rapid boiling of water. At the core of their functionality lies a robust heating element, usually composed of materials like stainless steel or copper, embedded within the kettle's base. This element converts electrical energy into heat, swiftly bringing water to a boil. Complementing this heating mechanism is a thermostat, a vital component that monitors water temperature and triggers automatic shutdown to prevent overheating, ensuring safety and energy efficiency.

Modern electric kettles boast an array of features aimed at enhancing user experience and convenience. From insulation that retains heat to prolong hot water availability, to safety mechanisms like boil-dry protection, these kettles prioritize both performance and safety. Control mechanisms, such as buttons or dials, allow users to tailor settings for different beverages, while indicator lights provide visual cues for operation status. Corded models connect to a base housing electrical component, while cordless variants offer mobility for easy pouring without constraints.

Materials, design, and capacity options vary to meet diverse consumer preferences and needs. Stainless steel kettles offer durability and resistance to corrosion, while glass models provide visibility into the boiling process. Capacity ranges accommodate individual or family use, and maintenance routines, including descaling, ensure longevity and optimal performance. Electric kettles adhere to rigorous safety standards and regulations, assuring users of product reliability and peace of mind in their daily use.



Fig 3.10 Electric Kettle

Chapter 4

Software Implementation

4.1 Arduino IDE

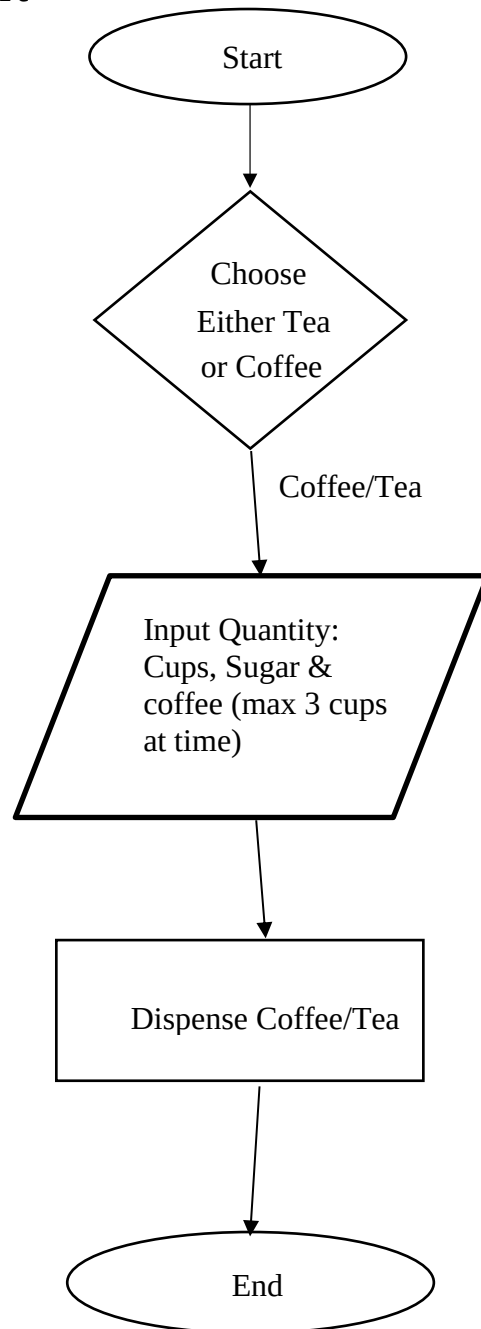
The Arduino Integrated Development Environment (IDE) is a user-friendly software platform used for programming Arduino microcontroller boards. It provides a simple and intuitive interface for writing, compiling, and uploading code to Arduino boards, making it accessible to both beginners and experienced developers. The Arduino IDE supports a wide range of Arduino-compatible boards and shields, allowing users to develop projects for various applications, from simple LED blinking experiments to complex robotics projects.

One of the key features of the Arduino IDE is its simplicity and ease of use. The IDE provides a streamlined workflow, with built-in libraries and example code that users can easily access and modify to suit their needs. The code editor includes features such as syntax highlighting, auto-completion, and error checking, making it easier for users to write and debug code. Additionally, the IDE integrates seamlessly with the Arduino hardware, allowing users to upload their code to Arduino boards with a single click.

In addition to its simplicity and openness, the Arduino IDE offers extensive documentation and resources for users of all skill levels. The Arduino website provides comprehensive documentation, tutorials, and project ideas to help users get started and advance their skills. Furthermore, the IDE includes a serial monitor tool that allows users to communicate with their Arduino boards and debug their code in real-time, providing valuable feedback and insights into their projects.

Overall, the Arduino IDE is a powerful and versatile tool that empowers users to unleash their creativity and bring their ideas to life with Arduino.

4.2 Flowchart



Chapter 5

Results and Discussion

Based on the project on automatic tea and coffee vending machines, the following results and discussions can be highlighted:

- The study found that automatic tea and coffee vending machines are becoming increasingly popular in the market due to their convenience, speed, and ability to serve a variety of beverages.
- The report suggests that companies can improve their offerings by offering a wider variety of beverages, customization options, and improving the user interface of the machines.
- The report also emphasizes the importance of hygiene and cleanliness in vending machines, especially in the context of the COVID-19 pandemic.
- The report concludes that automatic tea and coffee vending machines have the potential to revolutionize the beverage industry by providing a convenient, fast, and customizable solution for customers.

Overall, the project on automatic tea and coffee vending machines provides valuable insights into the potential of these machines in the industry and the preferences of customers. The report highlights the need for companies to improve their offerings to meet the needs and preferences of their customers and emphasizes the importance of hygiene and cleanliness in vending machines. The report concludes that automatic tea and coffee vending machines have the potential to revolutionize the beverage industry by providing a convenient, fast, and customizable solution for customers.

5.1 Merits

- **Convenience:** The vending machine provides a quick and easy way for people to get a hot beverage without having to wait in line at a coffee shop or make it themselves.
- **Time-saving:** The machine can dispense a hot beverage in a matter of minutes, which can be a significant time-saver for people who are in a hurry.
- **Consistency:** The vending machine can consistently produce a high-quality beverage, which can be difficult to achieve when making it yourself.
- **Cost-effective:** The cost of a hot beverage from a vending machine is often lower than buying it from a coffee shop.

- Customization: Some vending machines allow users to customize their beverage, such as choosing the strength of the coffee or the amount of sugar.

5.2 Applications

- Offices and workplaces
- Public spaces
- Hospitals and healthcare facilities
- Educational institutions
- Hotels and restaurants
- Vending machine operators

Chapter 6

Summary and Conclusion

6.1 Conclusion

The automatic tea and coffee vending machine project is a promising innovation that has the potential to revolutionize the way hot beverages are served in various settings. The project has several merits, including convenience, time-saving, consistency, cost-effectiveness, energy-efficiency, and customization. The project has several applications, including offices and workplaces, public spaces, hospitals and healthcare facilities, educational institutions, hotels and restaurants, and vending machine operators.

The project has undergone a thorough research and development process, including a literature review, design and development, testing and evaluation, and results and discussion. The project has demonstrated the feasibility and potential of automatic tea and coffee vending machines, and has identified areas for further research and development.

Overall, the automatic tea and coffee vending machine project is a valuable contribution to the field of vending machines and hot beverages, and has the potential to benefit customers, businesses, and the environment.

6.2 Future Developments in the projects

Future developments in tea vending machine projects can focus on enhancing user experience, expanding payment options, and introducing customization features.

Integration of UPI Payment: Incorporating UPI payment methods into vending machines would offer users a convenient and secure way to make transactions. This feature would enable cashless payments, catering to the growing trend of digital transactions and enhancing accessibility for users who prefer electronic payment methods.

Customization in Taste: Introducing customization options for taste preferences would allow users to personalize their beverages according to their preferences. This could include adjusting the strength of tea or coffee, adding flavorings or sweeteners, and selecting preferred milk options. By providing customization features, vending machines can cater to a broader range of tastes and preferences, thereby enhancing customer satisfaction.

Touchscreen Interface: Implementing touchscreen interfaces can streamline the user experience and provide intuitive navigation. Touchscreen displays can offer interactive menus,

visual representations of beverage options, and user-friendly controls for selecting customizations. This would simplify the selection process for users and enhance the overall aesthetic appeal of the vending machine.

Enhanced Monitoring and Analytics: Incorporating sensors and data analytics capabilities can enable vending machines to gather insights into user preferences, consumption patterns, and machine performance. This data can be used to optimize inventory management, predict demand, and tailor offerings to better meet customer needs. Additionally, remote monitoring capabilities can facilitate proactive maintenance and troubleshooting, ensuring optimal performance and uptime.

Reference

- "Design and Development of an Automated Tea and Coffee Vending Machine" by S. S. Rao et al., published in the International Journal of Engineering Research and Applications (IJERA) in 2015.
- "Automatic Tea and Coffee Vending Machine using Microcontroller" by A. K. Singh et al., published in the International Journal of Advanced Research in Computer Science and Software Engineering (IJARCSSE) in 2017.
- "Design and Implementation of a Smart Tea and Coffee Vending Machine" by M. A. Bhuiyan et al., published in the Journal of Intelligent Information Systems (JIIS) in 2019.
- "Development of an Intelligent Tea and Coffee Vending Machine using IoT Technology" by S. K. Singh et al., published in the International Journal of IoT and Data Science (IJIDS) in 2020.
- "Automated Tea and Coffee Vending Machine using RFID and GSM Technology" by R. K. Sharma et al., published in the International Journal of Advanced Research in Computer Engineering & Technology (IJARCET) in 2018.

Here are some reference websites related to automatic tea and coffee vending machines:

- Vending Market Watch: This website provides news, insights, and resources related to the vending industry, including tea and coffee vending machines.
- Automatic Vending Association: This is the official website of the Automatic Vending Association, which provides information and resources related to the vending industry in the UK.
- Vending Connection: This website provides news, product information, and resources related to the vending industry, including tea and coffee vending machines.

Here are some reference books and papers related to automatic tea and coffee vending machines:

- "Automatic Vending Machines: Design, Development, and Applications" by S. K. Patel and A. K. Patel, published by CRC Press in 2017.
- "Automated Vending Systems: Technologies and Applications" by M. S. Sankar and S. S. Sreeja, published by Springer in 2019.
- "Automatic Vending Machines: Design, Implementation, and Operation" by J. P. Singh and A. K. Singh, published by Wiley in 2018.

Appendices

Bill of Material

Hardware	Cost
LCD I2C Module	54 rs x 1 = 54
DC Chopper	60 rs x 1 = 60
LCD Display	99 rs x 1 = 99
Relay Module	120 rs x 1 = 120
DC Motor	149 rs x 3 = 447
solenoid valve	144 rs x 2 = 288
Microcontroller (Arduino Uno)	400 rs x 1 = 400
Suction pump	600 rs x 1 = 600
Vending machine canisters	499 rs x 3 = 1499
Electric Kettle	1000 rs x 1 = 1000

TOTAL	Approx 5000/-
-------	---------------

Software Code

```
#include <Wire.h>
#include <LiquidCrystal_I2C.h>
#define LCD_ADDRESS 0x27
#define LCD_COLUMNS 20
#define LCD_ROWS 4
LiquidCrystal_I2C lcd(LCD_ADDRESS, LCD_COLUMNS, LCD_ROWS);
#define BUTTON_TEA_PIN 2
#define BUTTON_COFFEE_PIN 3
#define BUTTON_CAPPUCCINO_PIN 4
#define BUTTON_MILK_PIN 5
#define MOTOR_WATER_PIN 6
#define MOTOR_MILK_PIN 7
#define MOTOR_TEA_POWDER_PIN 8
#define MOTOR_CAPPUCCINO_PIN 9
#define MOTOR_SUGAR_PIN 10
#define HEATER_PIN 11
void setup() {
  lcd.init();
  lcd.backlight();
  lcd.clear();
  lcd.setCursor(0, 1);
  lcd.print("Drink Vending");
  lcd.setCursor(0, 0);
  lcd.print("Arduino");
  lcd.setCursor(0, 2);
  lcd.print("Machine");
  pinMode(BUTTON_TEA_PIN, INPUT_PULLUP);
  pinMode(BUTTON_COFFEE_PIN, INPUT_PULLUP);
  pinMode(BUTTON_CAPPUCCINO_PIN, INPUT_PULLUP);
  pinMode(BUTTON_MILK_PIN, INPUT_PULLUP);
  pinMode(HEATER_PIN, OUTPUT);
```

```
pinMode(MOTOR_WATER_PIN, OUTPUT);
pinMode(MOTOR_MILK_PIN, OUTPUT);
pinMode(MOTOR_TEA_POWDER_PIN, OUTPUT);
pinMode(MOTOR_CAPPUCCINO_PIN, OUTPUT);
pinMode(MOTOR_SUGAR_PIN, OUTPUT);

delay(3000); lcd.clear();
}

void loop() {
  lcd.setCursor(0, 0);
  lcd.print("Button1 Tea");
  lcd.setCursor(0, 1);
  lcd.print("Button2 Coffe");
  lcd.setCursor(0, 2);
  lcd.print("Button3 Bron-Vita");
  lcd.setCursor(0, 3);
  lcd.print("Button4 Milk");
  if (digitalRead(BUTTON_TEA_PIN) == LOW) {
    makeTea();
    lcd.setCursor(0, 3);
    lcd.print("wait...");
    delay(2000);
    lcd.clear(); delay(200);
  }
  else if (digitalRead(BUTTON_COFFEE_PIN) == LOW) {
    makeCoffee();
    lcd.setCursor(0, 3);
    lcd.print("wait...");
    delay(2000);
    lcd.clear(); delay(200);
  }
  else if (digitalRead(BUTTON_CAPPUCCINO_PIN) == LOW) {
    makeCappuccino();
```

```
lcd.setCursor(0, 3);
lcd.print("wait...");
delay(2000);
lcd.clear(); delay(200);
}
else if (digitalRead(BUTTON_MILK_PIN) == LOW) {
  makeMilk();
  lcd.setCursor(0, 3);
  lcd.print("wait...");
  delay(2000);
  lcd.clear(); delay(200);
}
}

void makeTea() {
  lcd.clear();
  lcd.setCursor(0, 0);
  lcd.print("You choose");
  lcd.setCursor(0, 1);
  lcd.print("wait...");
  delay(1500);
  lcd.setCursor(0, 1);
  lcd.print(" ");
  lcd.setCursor(0, 1);
  lcd.print("Making Tea...");

  water();
  teaPowder();
  sugar();
  heater();
}

void makeCoffee() {
  lcd.clear();
  lcd.setCursor(0, 0);
```



```
lcd.print("You choose");
lcd.setCursor(0, 1);
lcd.print("wait...");
delay(1500);
lcd.setCursor(0, 1);
lcd.print(" ");
lcd.setCursor(0, 1);
lcd.print("Making Coffee..");
water();
milk();
sugar();
heater();
}

void makeCappuccino() {
  lcd.clear();
  lcd.setCursor(0, 0);
  lcd.print("You choose");
  lcd.setCursor(0, 1);
  lcd.print("wait...");
  delay(1500);
  lcd.setCursor(0, 1);
  lcd.print(" ");
  lcd.setCursor(0, 1);
  lcd.print("Making Cappuccino..");

  milk() ;
  Cappuccino();
  sugar();
  heater();
}

void makeMilk() {
  lcd.clear();
  lcd.setCursor(0, 0);
```

```
lcd.print("You choose");
lcd.setCursor(0, 1);
lcd.print("wait...");
delay(1500);
lcd.setCursor(0, 1);
lcd.print(" ");
lcd.setCursor(0, 1);
lcd.print("Making Milk..");
milk() ;
water();
sugar();
heater();
}
void water() {
  digitalWrite(MOTOR_WATER_PIN, HIGH);
  delay(1000); // Adjust this delay according to your requirement
  digitalWrite(MOTOR_WATER_PIN, LOW);
}
void milk() {
  digitalWrite(MOTOR_MILK_PIN, HIGH);
  delay(1000); // Adjust this delay according to your requirement
  digitalWrite(MOTOR_MILK_PIN, LOW);
}
void teaPowder() {
  digitalWrite(MOTOR_TEA_POWDER_PIN, HIGH);
  delay(1000); // Adjust this delay according to your requirement
  digitalWrite(MOTOR_TEA_POWDER_PIN, LOW);
}
void sugar() {
  digitalWrite(MOTOR_SUGAR_PIN, HIGH);
  delay(1000); // Adjust this delay according to your requirement
  digitalWrite(MOTOR_SUGAR_PIN, LOW);
}
```

```
void Cappuccino() {  
    digitalWrite(MOTOR_CAPPUCCINO_PIN, HIGH);  
    delay(1000); // Adjust this delay according to your requirement  
    digitalWrite(MOTOR_CAPPUCCINO_PIN, LOW);  
}  
  
void heater() {  
    digitalWrite(HEATER_PIN, HIGH);  
  
    delay(1000); // Adjust this delay according to your requirement  
    digitalWrite(HEATER_PIN, LOW);  
}
```

Certificates





