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DESIGN AND MANUFACTURING OF CLASSIC BREWER (TEA WENDING MACHINE)

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ABSTRACT:

The-go beverage solutions. This project endeavors to revolutionize the tea-drinking experience by incorporating advanced technology and user-centric The Design and Manufacturing of Classic Brewer, a sophisticated tea vending machine, responds to the increasing demand for convenient on-design principles. The machine boasts multiple canisters for storing various tea ingredients, allowing users to personalize their tea preferences with precision and ease. With an intuitive touchscreen interface, users can navigate through a selection of tea options, adjust sweetness levels, and tailor the tea strength to their liking, ensuring a tailored experience for each user.

Furthermore, this automated tea vending machine prioritizes hygiene and cleanliness through innovative features such as self-cleaning components and easily maintainable surfaces, meeting stringent health standards. Additionally, energy efficiency is a key focus, achieved through intelligent heating and standby modes, aligning with sustainability goals in operational practices. By merging technological innovation with user satisfaction and sustainability, this project aims to address both the practical aspects of automated tea preparation and the evolving expectations of consumers for a quick, customizable, and enjoyable tea-drinking experience across various settings

KEYWORDS : Automated Tea wending machine .

INTRODUCTION

Tea vending machines, like their counterparts, leverage mechatronics systems seamlessly integrating sensor networks, microcontrollers, and actuation mechanisms. While the origin of vending machines dates back to the 1880s, their evolution continues to modernize, catering to diverse consumer needs. Coffee and tea vending machines offer convenience, providing piping hot beverages at the touch of a button without manual preparation. These Introducing the Classic Brewer, a groundbreaking machine set to revolutionize tea enjoyment by effortlessly crafting ginger or elaichi (cardamom) flavored tea from scratch, promising a delightful and aromatic experience every time. This project's essence lies in automating the traditional art of tea-making, providing a seamless solution to savor the rich flavors of ginger and elaichi tea. The Classic Brewer is meticulously engineered to operate autonomously, eliminating the need for manual intervention once raw materials are provided. This innovative machine blends cutting-edge technology with the warmth of traditional tea, catering to the diverse tastes of tea enthusiasts and connoisseursmachines feature insulated containers with independent electric heating elements to maintain or instantly heat drinks upon order.

The culinary industry, particularly coffee shops, has flourished, meeting the demands of modern lifestyles. The coffee machine plays a crucial role in defining coffee flavors, influenced by factors such as temperature, water pressure, and coffee grounds. With the rise in coffee consumption, driven by urban gatherings and evolving tastes, the coffee shop business remains promising. However, the longevity of this trend depends on coffee's enduring appeal and its ability to adapt to consumer preferences.

As technology advances, automatic coffee machines with computer-based control systems replace manual counterparts, offering standardized coffee experiences. These sophisticated systems enable baristas to consistently deliver quality coffee, ensuring uniformity in size and taste.

Automatic machines alleviate limitations associated with manual techniques, enhancing efficiency and precision in coffee preparation.

OBJECTIVE:

- Consistent Quality
- Time Reduction
- User-Friendly Interface
- Innovative Technology

PROBLEM STATEMENT:

The problem definition for the design and manufacturing of the Classic Brewer encompasses several key aspects and considerations to ensure the successful development of a functional, efficient, and user-friendly tea vending machine. The following components outline the problem definition:

1. **Purpose and Scope:**
    - Define the purpose of the Classic Brewer, which is to automate the process of preparing ginger or elaichi (cardamom) flavored tea from raw ingredients.
    - Clearly outline the scope of the project, including the desired functionalities, features, and performance requirements of the tea vending machine.
2. **User Requirements:**
    - Identify and prioritize the requirements of the end-users, including tea enthusiasts, consumers, and operators of the vending machine.
    - Consider factors such as ease of use, convenience, taste consistency, customization options, and overall user experience.
3. **Technical Specifications:**
    - Specify the technical requirements and constraints of the Classic Brewer, including size, dimensions, capacity, power consumption, brewing time, and temperature control.
    - Define the desired automation level, sensor integration, microcontroller functionality, and actuation mechanisms required for autonomous operation.
4. **Quality Standards:**
    - Establish quality assurance criteria to ensure consistent taste, flavor, and product quality with every brew.
    - Define metrics for evaluating the reliability, durability, and performance of the tea vending machine, aligning with industry standards and regulations.

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SCOPE :

The scope of the project for the design and manufacturing of the Classic Brewer tea vending machine encompasses various aspects, functionalities, and deliverables. The following outlines the scope of the project:

1. **Functional Requirements:**
    - Design and develop a fully automated tea vending machine capable of preparing ginger or elaichi flavored tea from raw ingredients.
    - Implement a user-friendly interface for effortless operation, including options for selecting tea type, flavor strength, and serving size.
    - Ensure precise ingredient measurement and dispensing mechanisms to guarantee consistent taste, flavor, and quality with every brew.
2. **Technical Specifications:**
    - Specify the dimensions, capacity, power requirements, and performance parameters of the Classic Brewer, including brewing time, temperature control, and brewing capacity.
    - Integrate sensors, microcontrollers, actuators, and heating elements to enable autonomous operation and control of the tea brewing process.
    - Incorporate safety features and fail-safe mechanisms to prevent accidents and ensure user and equipment safety during operation.

3. **Design Considerations:**
    - Design the Classic Brewer with a sleek and modern aesthetic to enhance its visual appeal and complement various settings, including office spaces, cafes, and public areas.
    - Optimize the layout and ergonomics of the machine to maximize space efficiency, ease of maintenance, and accessibility for users and service personnel.
    - Explore modular design concepts to facilitate scalability, customization, and future upgrades or expansions of the Classic Brewer platform.
4. **Quality Assurance and Testing:**
    - Establish quality assurance protocols to validate the performance, reliability, and durability of the Classic Brewer under different operating conditions and usage scenarios.

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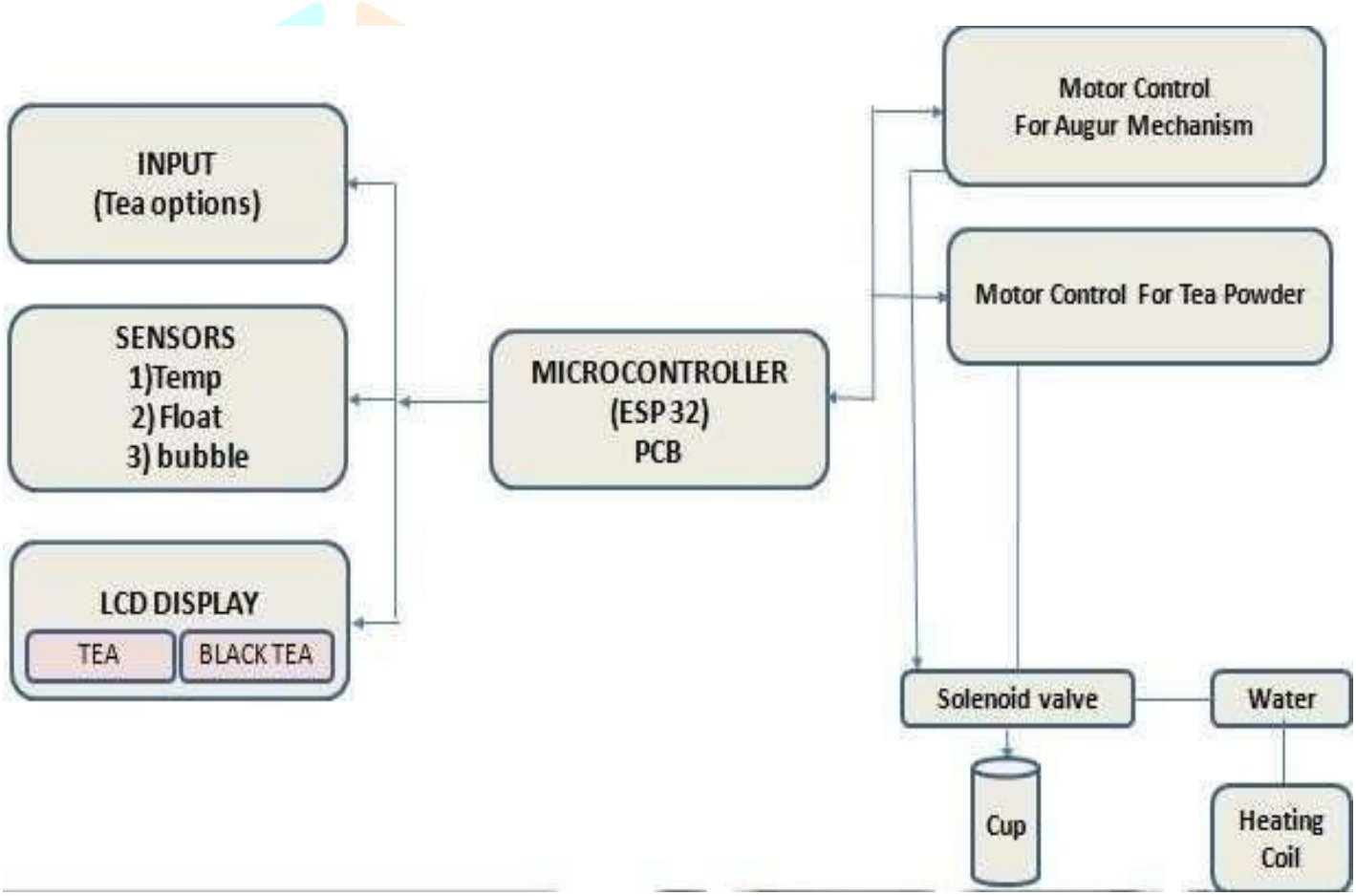
METHODOLOGY:



This image represents a block diagram of a microcontroller-based system designed for an automated tea vending machine. Let me explain the different components and their working:

1. Input (Tea options): This block represents the user interface where the user can select the desired tea option, such as regular tea or black tea.
2. Sensors: The system has three sensors - Temperature, Float, and Bubble. The temperature sensor monitors the temperature of the water, the float sensor detects the water level in the cup, and the bubble sensor likely checks for the presence of bubbles or foaming during the tea preparation process.

3. LCD Display: There is an LCD display that shows the selected tea option (Tea or Black Tea) to the user.
4. Microcontroller (ESP32): The microcontroller, in this case, an ESP32, is the central processing unit that controls the overall operation of the system. It receives inputs from the user interface and sensors, processes the data, and controls the various actuators and output devices.
5. Motor Control for Augur Mechanism: This block likely represents a motor control system that operates an augur mechanism responsible for dispensing the appropriate amount of tea powder or leaves into the cup.
6. Motor Control for Tea Powder: This block controls a separate motor or mechanism for dispensing the desired quantity of tea powder into the cup.
7. Solenoid Valve: The solenoid valve is an electromechanical valve controlled by the microcontroller to regulate the flow of water into the cup.
8. Cup: This is the container where the tea is prepared by mixing the water, tea powder/leaves, and potentially heating the mixture.
9. Heating Coil: The heating coil is used to heat the water or the prepared tea in the cup to the desired temperature.

The overall working of the system involves the user selecting the desired tea option, which is processed by the microcontroller. Based on the selection, the microcontroller activates the appropriate mechanisms to dispense the correct amount of tea powder or leaves into the cup. It also controls the solenoid valve to regulate the water flow and the heating coil to heat the water or the prepared tea mixture. The sensors provide feedback to the microcontroller for monitoring and controlling the various processes involved in preparing the tea.

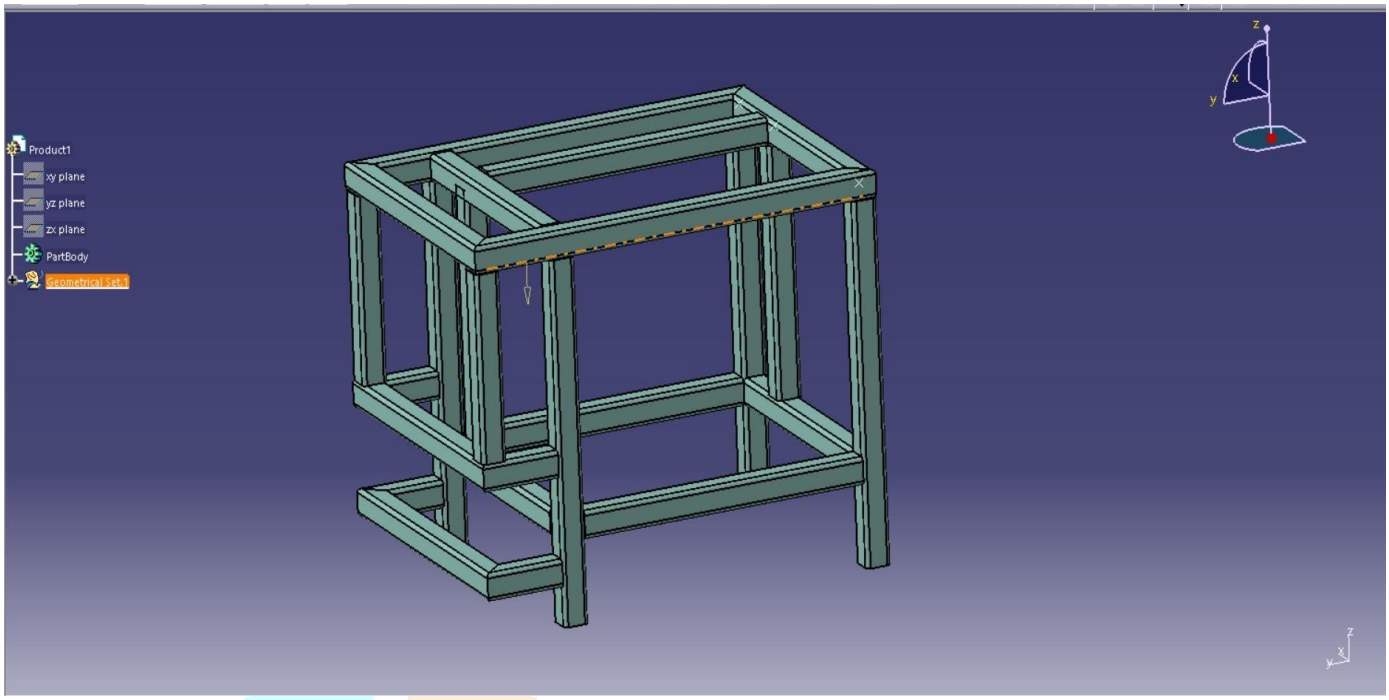
WORKING:

Experimental Procedure for Testing the Automated Tea Vending Machine:

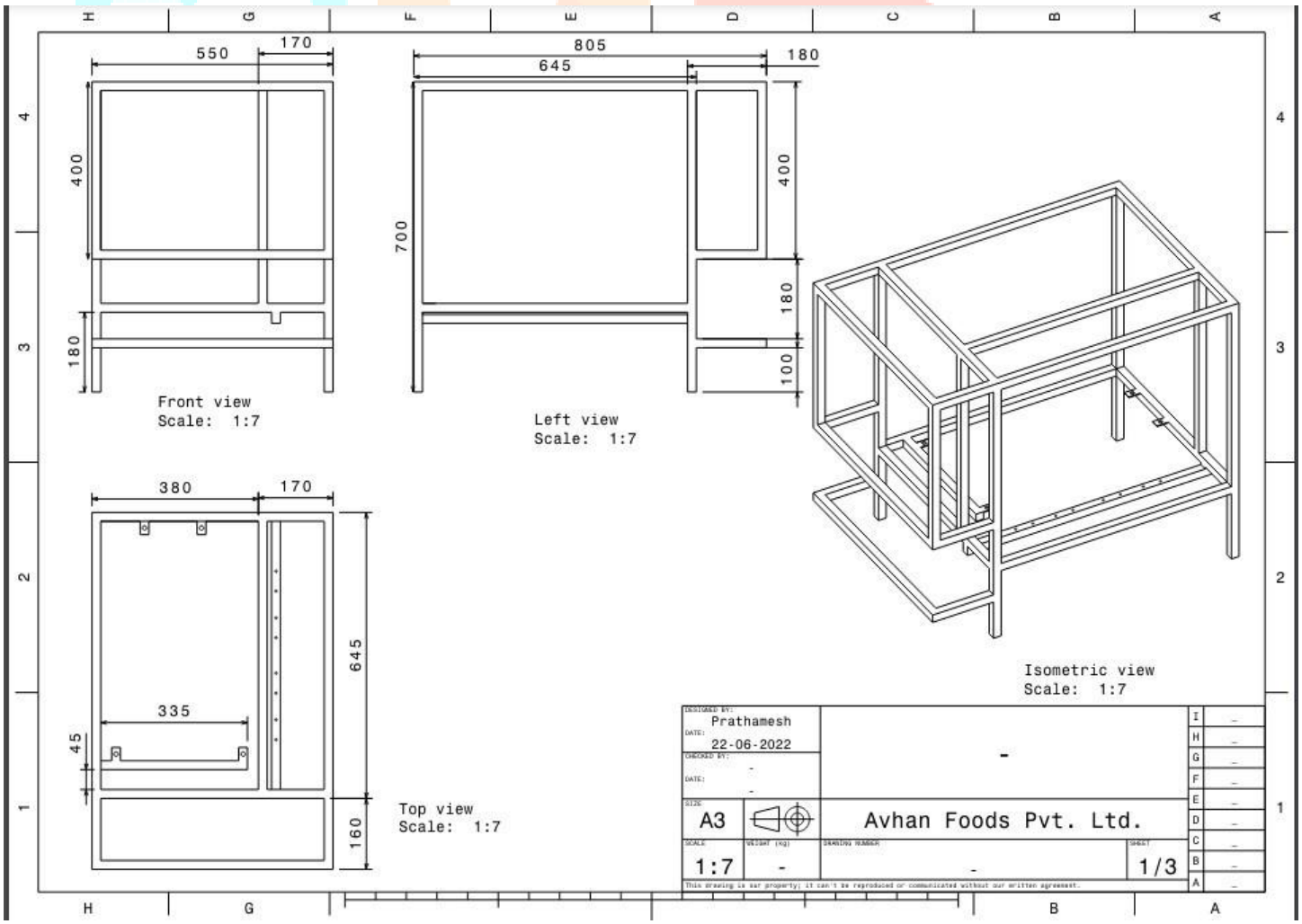
1. **Setup and Preparation:**
   - Ensure that the tea vending machine is properly installed and connected to power and water sources.
   - Check all electrical connections, sensors, actuators, and display units for proper functioning.
   - Fill the ingredients canisters with the required tea powder or leaves, water, and any other additives.
2. **Initial System Check:**
   - Power on the tea vending machine and allow it to initialize.
   - Verify that the LCD display is functioning correctly and shows the available tea options.
   - Test the user interface by selecting different tea options and verifying the response.
3. **Temperature Sensor Calibration:**
   - Place the temperature sensor probe in a container of water and ensure that it accurately measures the temperature.
   - Compare the temperature reading on the LCD display with the actual water temperature to ensure accuracy.

4. **Float Sensor Testing:**
    - Fill a cup with water and place it under the dispenser.
    - Gradually increase the water level in the cup and observe the response of the float sensor.
    - Verify that the sensor accurately detects the water level and triggers the appropriate actions.
5. **Bubble Sensor Verification:**
    - Prepare a cup of tea using the vending machine and observe the tea-making process.
    - Ensure that the bubble sensor detects the presence of bubbles or foaming during the tea preparation process.
    - Verify that the sensor triggers any necessary adjustments to the tea-making process.
6. **Dispensing Mechanism Testing:**
    - Select different tea options from the user interface and observe the dispensing mechanism.
    - Ensure that the correct amount of tea powder or leaves is dispensed into the cup for each selection.
    - Test the dispensing mechanism for consistency and accuracy.
7. **Water Flow Regulation:**
    - Adjust the tea options to test different water flow rates through the solenoid valve.
    - Verify that the microcontroller effectively regulates the water flow to achieve the desired tea concentration.
8. **Heating Coil Operation:**
    - Select a tea option that requires hot water and observe the operation of the heating coil.
    - Ensure that the water is heated to the desired temperature before being dispensed into the cup.
9. **Overall System Performance:**
    - Test the automated tea vending machine under various operating conditions and scenarios.
    - Evaluate the system's overall performance, including speed, accuracy, reliability, and user-friendliness.
    - Address any issues or malfunctions encountered during testing and make necessary adjustments to improve the system's functionality.

MODEL & DESIGN:



3D MODEL STRUCTURE



2D SKETCH

CALCULATION

Sample Calculation:

Objective: Calculate the heating time required to heat a certain volume of water to the desired temperature using the heating coil.

Given:

- Volume of water to be heated: 500 ml
- Initial temperature of water: 25°C
- Desired temperature of water: 95°C
- Power rating of the heating coil: 1000 watts
- Specific heat capacity of water: 4.18 J/g°C **Assumptions:**
- Negligible heat loss to the surroundings during heating process.
- Heating coil operates at maximum power continuously.

Calculation:

1. Calculate the change in temperature (ΔT) required:
   - ΔT = Desired temperature - Initial temperature
   - ΔT = 95°C - 25°C = 70°C
2. Determine the total heat energy required to heat the water:
   - Heat energy = Mass of water × Specific heat capacity × ΔT
   - Mass of water = Volume of water × Density of water (Assuming density of water = 1 g/ml)
   - Mass of water = 500 ml × 1 g/ml = 500 grams
   - Heat energy = 500 g × 4.18 J/g°C × 70°C
   - Heat energy = 146900 J
3. Calculate the time required to supply this heat energy:
   - Power = Heat energy / Time
   - Time = Heat energy / Power
   - Time = 146900 J / 1000 watts
   - Time = 146.9 seconds

RESULT :

The heating coil will require approximately 146.9 seconds (or approximately 2 minutes and 27 seconds) to heat 500 ml of water from 25°C to 95°C.

This calculation helps in determining the heating time needed for the tea vending machine to prepare hot water for brewing tea.

CONCLUSION:

In conclusion, the design and manufacturing of the Classic Brewer (Tea Vending Machine) represent a significant advancement in automated tea preparation technology. Through meticulous engineering and innovative design, the Classic Brewer offers a convenient and efficient solution for preparing a variety of tea options with minimal user intervention.

The comprehensive system architecture, comprising intuitive user interfaces, precise sensor systems, and robust microcontroller control, ensures smooth operation and consistent tea quality. The integration of temperature, float, and bubble sensors allows for accurate monitoring and control of the brewing process, guaranteeing optimal tea flavor and temperature.

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