AN-NAJAH NATIONAL UNIVERSITY
FACULTY OF ENGINEERING & INFORMATION TECHNOLOGY
DEPARTMENT OF COMPUTER ENGINEERING

GRADUATION PROJECT II

Cheesecake Flow

Automated Cheesecake Production Line

Prepared by:

Raghad Eid

Bayan Futyan

Supervised by:

Luai Malhis

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Disclaimer

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Abstract

Recently, reliance on automated food production systems has become increasingly widespread. This shift aims to reduce dependence on manual labor due to inconsistencies in product quality, the difficulty of maintaining continuous 24-hour operations, and the increased time required compared to automated systems. Automation allows production processes to operate continuously while improving consistency and efficiency.

This is where the idea for our project, “Cheesecake Flow,” originated. The project is designed to produce ready-made cheesecake cups through an automated production line. The user places an order through a dedicated user interface, tracks the order progress via a web application, and specifies certain features, such as the height of the biscuit layer and the type of jelly. Payment is processed automatically, and the customer receives the order ready for pickup. Human involvement is limited to refilling the containers for cream, powdered jelly, and biscuits.

The proposed system aims to provide a practical automated solution for small-scale dessert production by reducing manual effort, improving product consistency, and offering a modern user experience.

Chapter 1

Introduction

The food production field has changed over the years, and many businesses now depend more on automated systems rather than manual work. In dessert preparation, several steps are repeated daily and usually rely on workers. This often requires time and effort, and the final product may vary in quality.

Automation helps reduce these issues by organizing the production process and making it more stable. It also allows production to continue for longer hours without interruptions. For customers, automation makes ordering easier, as orders can be placed in advance and collected ready-made without long waiting times. This approach has become more suitable for modern lifestyles.

1.1 Problem Statement

The problem of relying on manual labor in the food preparation sector lies in several aspects. One of the main issues is that dependence on human labor requires a very large workforce. This workforce is costly on a monthly basis and demands significant physical effort from workers. In addition, manually prepared products may suffer from variations in quality.

Moreover, human labor requires a considerable amount of time, and in some cases it is not easy to operate for 24 hours, especially during late-night hours.

1.2 Objectives

Our project primarily aims to develop an automated cheesecake making machine. This will be achieved through an interface where users can place orders, select features, and view the exact status of their order on a screen.

The machine will be user-friendly and efficient, offering the following functions:

- Allows the user to choose the desired biscuit layer height and preferred glaze type.
- Enables the user to track their order's progress and current stage.
- The machine can complete the entire process without requiring assistance, except for refilling the material storage compartments.
- We maintain consistent quality and output across all products.

1.3 Scope of Work

The scope of this project includes the production of fully prepared cheesecake cups through an automated system. The process begins when the user enters an order using a keypad and a display screen. After that, the system produces the cheesecake cup through the following stages:

- A dedicated mechanism is used to release a single empty cup from a stack of cups. The cup is then transferred to the next stage using a conveyor belt.
- A designated biscuit storage unit dispenses a specific quantity of biscuits based on the user’s selection. The biscuits are then crushed and dropped into the cup.
- A dedicated cream station dispenses the cream and places it inside the cup.
- A jelly preparation station heats water to a suitable temperature and pumps it into a designated container, where powdered jelly is added. The mixture is then stirred and dispensed into the cup.
- A final station places and presses the cup lid securely, after which the customer receives the completed order.

Human involvement is limited to refilling raw materials and basic system supervision.

1.4 Significance

This automated cheesecake production system is significant for several reasons. It introduces automation into the dessert preparation process, transforming traditional manual methods into a more organized and efficient system. By integrating mechanical components with electronic control, the project demonstrates how technology can be applied to improve food preparation while maintaining consistency and quality.

Automating the cheesecake production process helps reduce the time and effort required from workers and minimizes variations between products. This makes the system suitable for environments that require repeated and consistent preparation, especially in small food businesses where efficiency and reliability are essential.

In addition, the system enhances the customer experience by allowing orders to be placed and tracked digitally, reducing waiting time and improving convenience. By limiting human involvement to material refilling and supervision, the project offers a practical solution that supports continuous operation and modern consumer expectations. Overall, this project highlights the importance of automation in food production by providing a cost-effective, efficient, and user-oriented approach to dessert preparation.

1.5 Organization of the report

This report is organized into several chapters. Chapter One introduces the project by presenting the background, problem statement, objectives, scope of work, and the significance of the proposed system.

Chapter Two discusses the constraints and limitations encountered during the development of the project, along with the standards and tools used and references to related coursework. Chapter Three presents a review of relevant literature and related work.

Chapter Four describes the methodology of the project, including the system structure, hardware components, electronic elements, and a detailed explanation of how the system operates. Chapter Five presents the results and discussion. Finally, Chapter Six concludes the report and provides recommendations for future improvements.

Chapter2

2.1 Constraints

During the development of the Cheesecake Flow system, several practical challenges were encountered. One of the main challenges was preventing the mixing of the cream layer with the jelly layer due to the high temperature required for jelly preparation. This issue was addressed by heating the water at the beginning of the process and allowing it to cool slightly before use, which helped maintain clear separation between layers. Another challenge involved achieving uniform distribution of the cream over the biscuit base. To overcome this, the cup was designed to stop at the beginning of the cream dispensing stage and then move slightly during dispensing to ensure even spreading. In addition, inaccurate movement of the cup along the production line initially caused misalignment at certain stages. This problem was resolved by implementing a defined guiding path to control the cup's movement precisely. Furthermore, heating the jelly in the same preparation area posed a risk of solidification and valve blockage. To solve this, the heating process was separated into an independent unit where water is heated before being mixed with the jelly powder. Addressing these challenges contributed to improving system reliability and ensuring stable operation throughout the production process.

2.2 Standards / Codes

- The control system of the project was developed using the Arduino Mega 2560 microcontroller. The main program was written using the Arduino IDE, which was used to manage and control the hardware components of the system.
- The system software was implemented using the C programming language, which allowed efficient control of sensors, actuators, and system logic.
- The user interface was developed and deployed on the ESP platform, enabling users to place orders and monitor the system operation through a wireless connection.

- Communication between the control system and the user interface was handled through the ESP module, allowing real-time interaction and system monitoring.

2.3 Earlier Coursework

- During the Microprocessor and Microcontroller courses, we gained practical skills in programming and controlling hardware components, which were directly applied in managing sensors, actuators, and control logic in this project.
- Courses related to Electronics provided a solid understanding of electronic components and circuits, which was essential for designing and integrating the electronic parts of the system.
- The Wireless Networks course contributed to understanding communication between devices, which was important when integrating the ESP module for system monitoring and user interaction.
- The Critical Thinking course helped in researching relevant topics, analyzing system requirements, and improving technical documentation and report writing skills.
- In addition to formal coursework, self-learning through Arduino tutorials, online resources, and research materials played an important role in enhancing practical implementation skills required for this project.

Chapter 3

Literature Review

Automation has become an essential part of modern food production systems, especially in applications that require consistency, speed, and reduced manual effort. Automated food preparation systems are widely used to perform repetitive tasks, ensuring uniform product quality and minimizing human error.

In dessert preparation, automation is commonly applied to ingredient dispensing, mixing, and packaging processes. These systems help maintain consistent portion sizes and product appearance, which can be difficult to achieve through manual preparation. Automated systems also reduce the dependency on continuous human labor and allow production to operate for extended periods.

Conveyor-based production lines are frequently used in small and medium-scale automated food systems, as they provide organized movement between different preparation stages. Additionally, integrating user interfaces into such systems allows customers to place orders efficiently and receive products with minimal waiting time. Previous studies and projects in food automation demonstrate that such approaches improve efficiency, reliability, and overall customer experience.

Chapter 4

Methodology

4.1 System Structure

4.1.1 Machine Body

The machine body represents the main structure on which all stations are mounted and where the entire production process takes place, as shown in Figure 1.

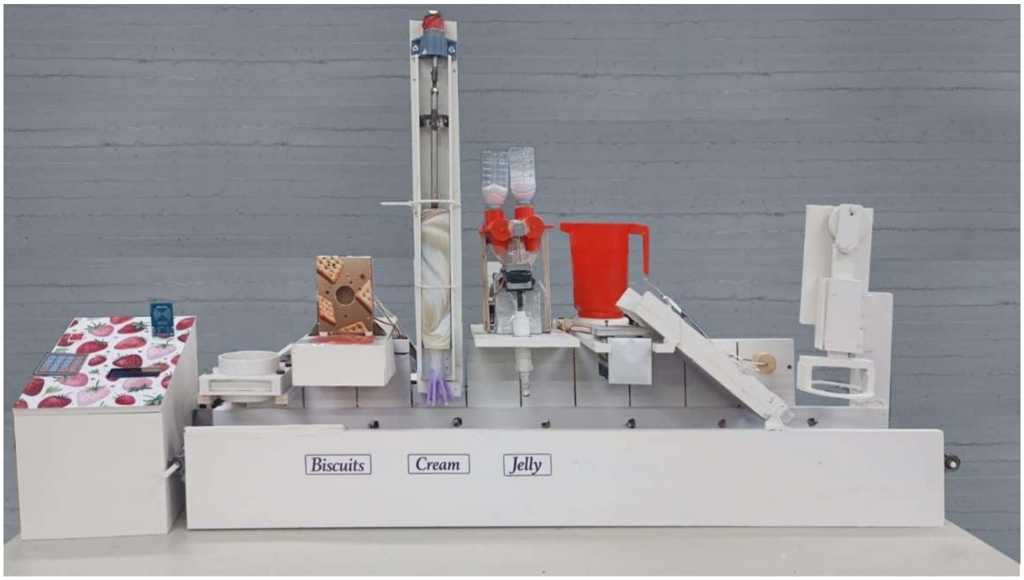

Figure 1 : Machine Body

4.1.2 User Interface and Control Unit

The user interface and control unit is located at the beginning of the system and is responsible for handling user interaction and system control. Through this unit, the user can place an order and select the desired biscuit layer thickness and jelly type using a keypad.
An LCD display is used to show system information, including the current stage of the order and its progress throughout the production process.

In addition, an RFID module is integrated to enable payment or order confirmation. A control button is also provided to start and stop the entire system, allowing safe and controlled operation of the machine.

Figure 2 : User Interface and Control Unit

4.1.3 Conveyor Belt System

The conveyor belt system is responsible for transporting the cup between the different stages located on the machine body. It moves the cup in a controlled and consistent manner throughout all stages of the production process.
The conveyor belt stops when motion is detected by the sensors, allowing each stage to perform its function accurately. This organized

stopping mechanism helps keep the cup properly positioned and prevents spillage of ingredients during the dispensing process.

4.1.4 First Stage: Cup Feeding Mechanism

The cup feeding mechanism is designed to release a single empty cup from a stack of cups at the beginning of the production process. This mechanism ensures that only one cup is fed into the system at a time, preventing congestion or misalignment on the production line.
Once the cup is released, it is placed onto the conveyor belt and transferred smoothly to the subsequent production stages.

Figure 3 : Cup Feeding Mechanism

4.1.5 Second Stage: Biscuit Dispensing and Crushing Unit

This stage is responsible for pushing the biscuits one by one from the storage container into the crushing unit, based on the layer thickness selected by the user. The number of biscuits dispensed depends on the customer's preference.
Each biscuit is pushed from the storage area into the grinder, where it is crushed and then directly dropped into the cup. This process forms the biscuit base layer of the cheesecake and ensures consistency according to the user's selection.

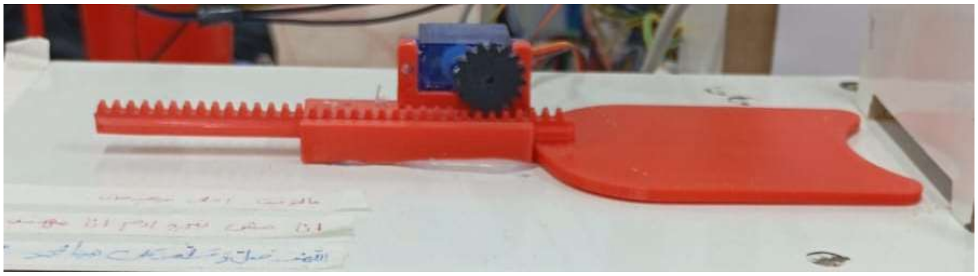

Figure 4 : Biscuit Pushing Mechanism

Figure 5 : Biscuit Storage Unit

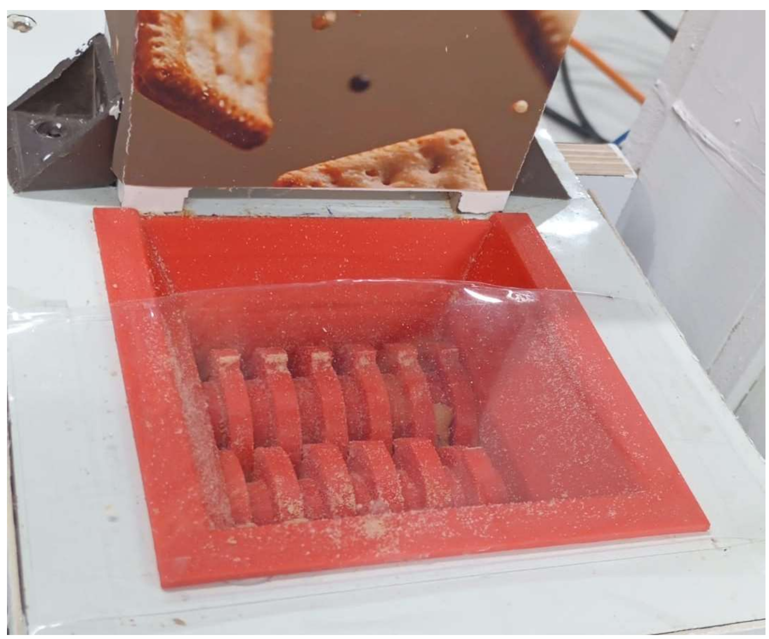

Figure 6 : Crushing Unit

4.1.6 Third Stage: Cream Dispensing Unit

The cream dispensing unit is designed to deliver the cream layer evenly over the biscuit base. During this stage, the cup initially remains stationary and then moves slightly while the cream is dispensed. This movement allows the cream to spread uniformly across the surface of the biscuit layer, resulting in a smooth and consistent layer.

Figure 7 : Cream Dispensing Unit

4.1.7 Fourth Stage: Jelly Preparation and Dispensing Unit

The jelly preparation process begins at the early stages of the overall system operation. Water is heated at the beginning of the full production process, and by the time the system reaches the jelly stage, the heater has already stopped heating, allowing the water temperature to slightly decrease to a suitable level.

The water is then pumped into a dedicated jelly preparation container. Based on the selected jelly type, the appropriate amount of jelly powder is added to the container. After that, the mixture is stirred to ensure proper mixing and consistency.
Once the jelly is fully prepared, a valve is opened to dispense the jelly into the cup. After the required amount is released, the valve is closed, completing the jelly dispensing stage.

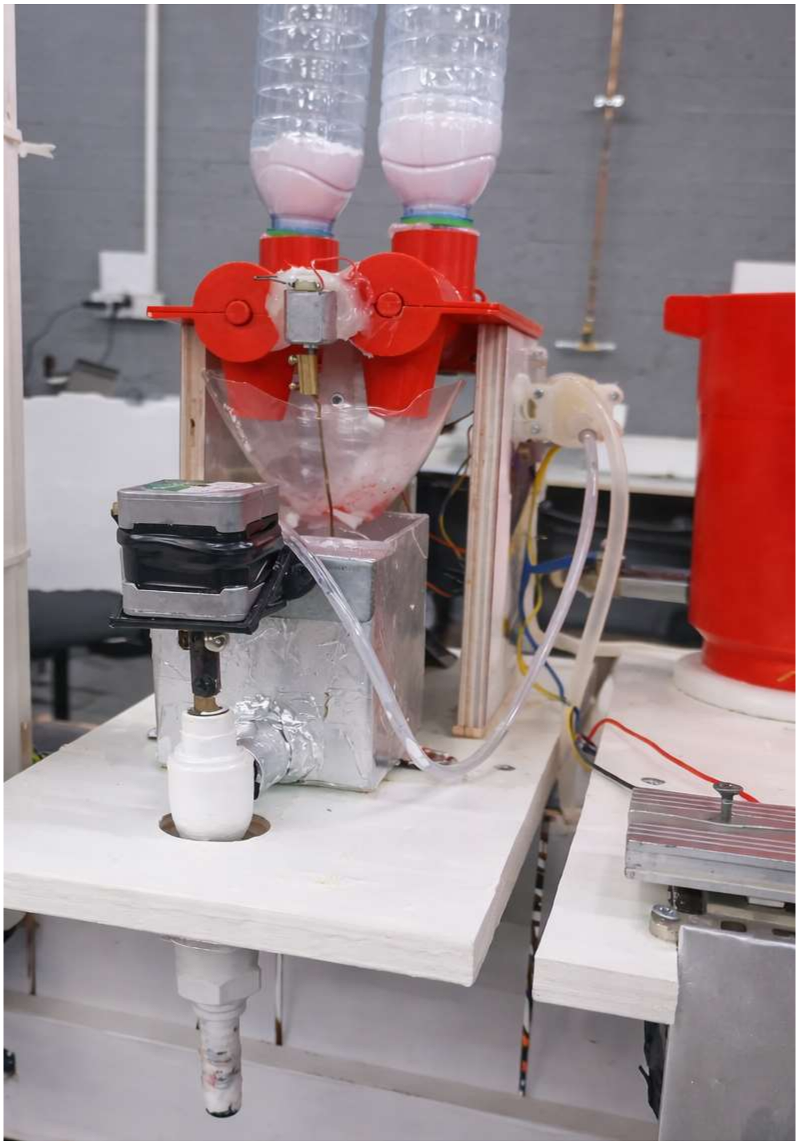

Figure 8 : Jelly Preparation

4.1.8 Fifth Stage: Cooling Stage

The cooling stage is activated after the jelly dispensing process. This stage is designed to reduce the temperature of the product before moving to the next step. A cooling fan operates for approximately 10 seconds to help lower the temperature of the jelly layer. This cooling stage improves overall product quality.

Figure 9 : Cooling Stage

4.1.9 Sixth Stage: Lid Placement Unit

The lid placement unit is the final stage in the production line. During this stage, the cup moves along the conveyor belt and automatically picks up the lid while in motion. After that, the cup reaches a designated position where it stops.

Once the cup is properly positioned, pressure is applied to the lid to secure it firmly onto the cup. This ensures that the lid is correctly sealed before the product is released. After completing this stage, the cheesecake cup is ready for pickup by the customer.

Figure 10 : Cooling Unit

4.2 Hardware components

4.2.1 Arduino MEGA 2560

The Arduino Mega 2560 was used as the main controller for the Cheesecake Flow project. The board is based on the ATmega2560 microcontroller and provides 54 digital input/output pins, including multiple PWM outputs, 16 analog inputs, and several UART ports. These features made it suitable for controlling the various components of the automated system.

The Arduino Mega 2560 was responsible for managing the overall system operation, including reading user inputs from the keypad, updating the LCD display, controlling motors, pumps, sensors, and coordinating the different stages of the cheesecake production line. Using a single controller helped simplify system integration and ensured reliable communication between all hardware components.

With its 16 MHz crystal oscillator, USB connectivity, power jack, and reset button, the Arduino Mega 2560 provided a stable and efficient platform for controlling the automated cheesecake production workflow.

Figure 11 : Arduino MEGA 2560

4.2.2 Power Supply

The power supply unit is responsible for providing the required electrical power to all electronic and mechanical components of the system. It delivers different voltage levels to operate various parts of the machine, ensuring that each component receives the appropriate voltage needed for safe and efficient operation.
This allows low-voltage components such as the Arduino, sensors, and display to operate correctly, while supplying sufficient power to higher-load components such as motors and pumps.

Figure 12 : Power Supbply

4.2.3 H-Bridge (L298N Motor Driver)

The L298N H-bridge motor driver was used in the Cheesecake Flow project to control the main DC motors that require higher current and bidirectional control. It allows precise control of motor direction and speed using PWM signals, which is essential for operating the mechanical components of the production line.

The L298N driver was used to control the DC motors responsible for driving the conveyor belt, operating the biscuit grinding unit, dispensing the cream, and pressing the cup lid during the final stage. The driver supports operating voltages ranging from 5V to 35V and can handle currents of up to 2A per motor, making it suitable for these load-demanding components.

Smaller DC motors with low power requirements, such as the mixing motor, were not connected to the H-bridge driver and were controlled separately due to their limited current demand.

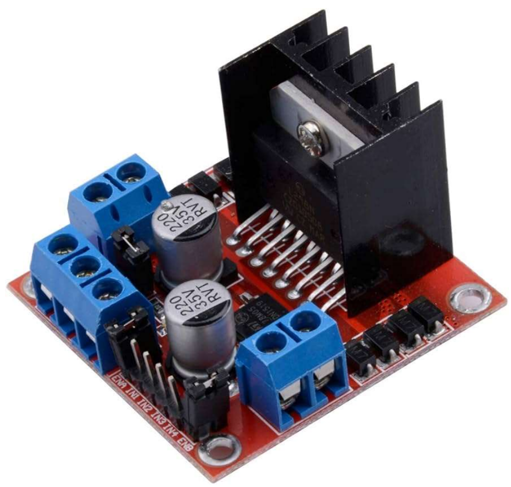

Figure 13 : H-Bridge

4.2.4 DC Motors

DC motors were used in several parts of the Cheesecake Flow system due to their simplicity, reliability, and ease of control. These motors played a key role in driving the mechanical movement of the production line.

High-power DC motors were used to operate the conveyor belt, the biscuit grinding mechanism, the cream dispensing unit, and the lid closing mechanism. These motors required controlled direction and speed and were therefore driven using the H-bridge motor driver.

In addition, a small DC motor was used in the mixing unit to stir the jelly mixture. Due to its low power and current requirements, this motor was controlled directly without using the H-bridge driver. The appropriate use of different motor control methods ensured efficient operation and protected the system components.

Figure 14 : DC Motors

4.2.5 Stepper Motor Driver (TB6600)

A stepper motor driver was used in the Cheesecake Flow project to control the stepper motors that require precise movement and positioning. The driver operates using pulse (PUL), direction (DIR), and enable (ENA) control signals, which allow accurate control of motor speed, direction, and number of steps.

The driver used in this project is a high-current stepper motor driver (TB6600-type driver) that supports an output current of up to 3.3 A, making it suitable for applications that require higher torque and stable performance. This type of driver is commonly used in automation systems and CNC applications due to its reliability and ability to handle demanding loads.

Using a dedicated stepper motor driver improved motion accuracy, reduced vibration, and ensured smooth operation throughout the production process.

Figure 15 : Stepper Motor Driver

4.2.6 Stepper Motors

Stepper motors were used in the Cheesecake Flow system to perform movements that require high precision and repeatability. These motors move in discrete steps, allowing accurate positioning without the need for complex feedback systems.

In this project, stepper motors were mainly used for **cup positioning and jelly dispensing mechanisms**, where controlled movement is critical to ensure correct alignment and accurate dispensing. The stepper motors were driven by a dedicated stepper motor driver, enabling precise control of motion and consistent system performance.

The use of stepper motors contributed to improved accuracy, reliability, and synchronization between different stages of the automated production line.

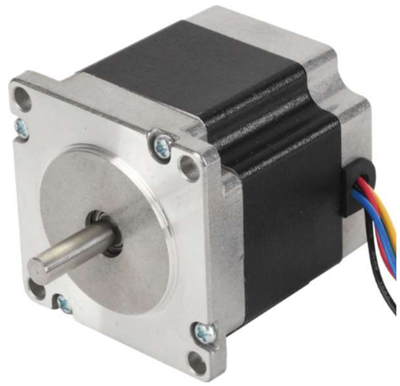

Figure 16 : Stepper Motors

4.2.7 Servo Motor 360°

A single servo motor was used in the Cheesecake Flow project to control the biscuit feeding mechanism. The servo motor is responsible for pushing the biscuits one by one from the storage area into the grinding unit.

Due to its ability to rotate with high precision, the servo motor ensures accurate positioning and controlled movement during the biscuit dispensing process. The servo performs a controlled rotational movement to push each biscuit smoothly and consistently, preventing jamming and ensuring the correct number of biscuits is delivered based on the user's selection.

The use of a servo motor in this stage provided reliable operation and precise control, which contributed to the overall accuracy and consistency of the biscuit base layer.

Figure 17 : Servo Motor 360°

4.2.8 Relay Modules

Two single-channel relay modules were used in the Cheesecake Flow project to control high-power components that cannot be driven directly by the Arduino due to voltage and current limitations.

The first relay module was used to control the **water heater**, allowing the Arduino to safely turn the heater on and off during the initial stage of the production process. This ensures that the water reaches the required temperature before being used in the jelly preparation stage.

The second relay module was dedicated to controlling the **water pump**, enabling precise control over pumping water into the jelly preparation container at the correct time. Using a relay for the pump allowed accurate timing and safe operation without placing additional load on the Arduino.

The use of relay modules provided electrical isolation between the low-voltage control circuitry and high-power components, ensuring safe, reliable, and efficient system operation.

Figure 18 : Relay Modules

4.2.9 Water Heater

A water heater was used in the Cheesecake Flow project to heat the water required for the jelly preparation process. The heater operates during the initial stage of the system operation to raise the water temperature to a suitable level before it is pumped into the jelly preparation container.

The heater is controlled using a relay module, allowing the Arduino to safely switch it on and off without direct electrical connection. This ensured controlled heating, improved safety, and reliable operation during the jelly preparation stage.

Figure 19 : Water Heater

4.2.10 Water Pump

A water pump was used in the Cheesecake Flow project to transfer heated water to the jelly preparation container. The pump plays an essential role in the jelly preparation process by ensuring that the required amount of water is delivered at the correct time.

The pump is controlled using a relay module, which allows the Arduino to turn the pump on and off safely and precisely. This control ensures proper timing during operation and prevents unnecessary water flow, contributing to accurate jelly preparation and overall system reliability.

Figure 20 : Water Pump

4.2.11 Keypad

A keypad was used in the Cheesecake Flow system as the primary input device for user interaction. Through the keypad, the user can enter their order and select different options, such as the desired biscuit layer thickness and jelly type.

The keypad provides a simple and reliable method for entering commands, making the system easy to use without requiring complex interfaces. User selections entered through the keypad are processed by the Arduino Mega, which then controls the corresponding stages of the production process accordingly.

Figure 21 : Keypad

4.2.12 LCD Display

An LCD display was integrated into the system to provide real-time feedback to the user. The display shows important system information, including the current status of the order, the active production stage, and system messages.

By using the LCD, the user can easily track the progress of their order from the beginning of the process until completion. This improves the user experience and allows clear communication between the system and the user throughout the production workflow.

Figure 22 : LCD Display

4.2.13 RFID Module

An RFID module was used in the Cheesecake Flow project to enable user identification and payment confirmation. The RFID card functions as a payment card, allowing the user to confirm and pay for the order before the production process begins.

When the RFID card is scanned, the system verifies the transaction and grants permission to proceed with the order. This method provides a fast, contactless, and secure way to handle payment and order authorization, reducing the need for manual payment handling.

Figure 23 : RFID Module

4.2.14 System Control Button

A dedicated control button was added to the system to manage the overall operation of the machine. This button allows the user or operator to turn the entire system on or off when needed.

The control button acts as a safety and control feature, enabling immediate shutdown of the system in case of maintenance, emergency situations, or system reset. This ensures safe operation and provides an additional layer of control over the automated production process.

Figure 24 : System Control Button

4.2.15 Cooling Fan

A cooling fan was used in the Cheesecake Flow system to generate airflow for removing heat from the cooling assembly. The fan helps circulate air over the heat dissipation components, allowing excess heat to be expelled efficiently.

The cooling fan plays an important role in maintaining stable operating conditions and enhancing the overall effectiveness of the cooling process after the jelly dispensing stage.

Figure 25 : Cooling Fan

4.2.16 Heat Sink

A heat sink was integrated into the cooling system to absorb and dissipate heat generated during the cooling process. The heat sink increases the surface area exposed to air, allowing heat to be transferred away efficiently.

By dissipating heat effectively, the heat sink prevents heat accumulation and supports continuous and reliable system operation.

Figure 26 : Heat Sink

4.2.17 Thermoelectric Cooling Element (TEC1)

A thermoelectric cooling element (TEC1) was used in the Cheesecake Flow system to provide active cooling. The TEC1 element creates a temperature difference when electrical current is applied, allowing heat to be transferred away from the product surface.

This cooling method enables rapid temperature reduction after the jelly stage, improving product stability and preparing the cheesecake cup for the final sealing process.

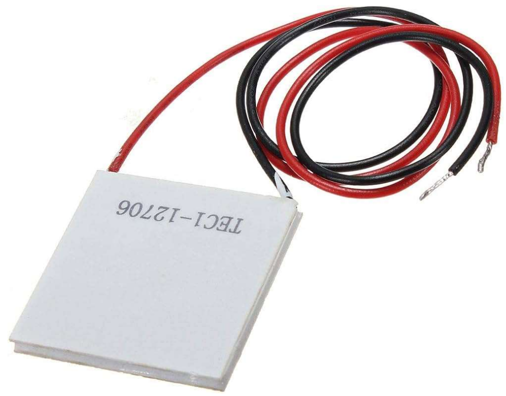

Figure 27 : TEC1

4.2.18 IR Sensors

Infrared (IR) sensors were used in the Cheesecake Flow system to detect the presence and position of the cup at each production stage. These sensors play a key role in controlling the movement of the conveyor belt and ensuring accurate stopping at each stage.

The IR sensors detect when the cup reaches a specific station and send a signal to the Arduino Mega to stop the conveyor temporarily. This allows each stage, such as biscuit dispensing, cream pouring, jelly dispensing, and cooling, to operate accurately without misalignment or spillage.

By using IR sensors at each stage, the system achieves precise synchronization between movement and operation. This improves overall system reliability, ensures consistent product positioning, and contributes to a smooth and organized workflow throughout the automated production line.

Figure 28 : IR Sensors

4.2.19 Temperature Sensor (DS18B20)

A temperature sensor (DS18B20) was used in the Cheesecake Flow system to monitor the water temperature during the jelly preparation process. The sensor was placed inside the water container to provide real-time temperature measurements.

The primary function of this sensor is to detect when the water reaches the desired temperature. Once the predefined temperature threshold is achieved, the Arduino Mega automatically turns off the water heater to prevent overheating and ensure safe operation.

Using the DS18B20 sensor allows precise temperature control, improves system safety, and ensures consistent jelly preparation by maintaining the water at an appropriate temperature level.

Figure 29 : Temperature Sensor

4.2.20 Ultrasonic Sensor

An ultrasonic sensor was used in the Cheesecake Flow system to monitor the biscuit level inside the storage container. The sensor measures the distance between its position and the surface of the biscuits to determine whether a sufficient quantity is available.

By continuously checking the biscuit level, the system can detect when the storage container is running low or becomes empty. This information allows the system to alert the operator or stop the production process to prevent incomplete or incorrect orders.

The use of an ultrasonic sensor improves system reliability by ensuring that the required amount of biscuits is available before dispensing. It also supports efficient resource management and reduces the risk of production interruptions due to empty containers.

Figure 30 : Ultrasonic Sensor

4.2.21 ESP32 Module

An ESP32 module was used in the Cheesecake Flow system to enable wireless communication between the machine and the user application. The ESP32 acts as a communication interface that allows the system to exchange data with the application in real time.

Through the ESP32 module, users can place orders, send commands, and monitor the status of the production process remotely. The module communicates with the main controller (Arduino Mega) to transfer user inputs and system updates efficiently.

The use of ESP32 enhances system flexibility and user experience by supporting wireless connectivity, reducing the need for direct physical interaction with the machine, and enabling future expansion such as remote monitoring and data logging.

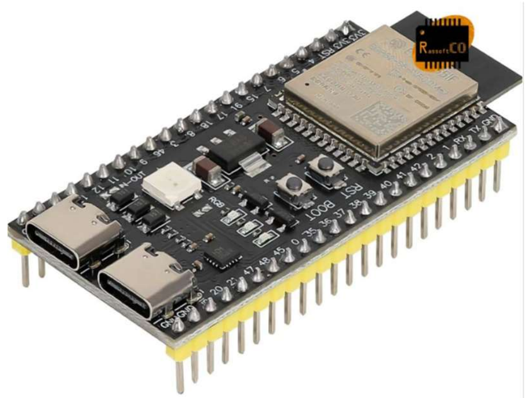

Figure 31 : ESP32 Module

4.2.22 Arduino Wires

Arduino wires were used in the Cheesecake Flow system to establish electrical connections between the Arduino Mega and the various electronic components, including sensors, actuators, and modules. These wires ensure proper signal transmission and power distribution throughout the system.

Using organized and secure wiring helped maintain system reliability, reduce signal interference, and simplify maintenance and troubleshooting.

Figure 32 : Arduino Wires

4.2.23 Speaker Wires

Speaker wires were used in the Cheesecake Flow system to handle power and signal connections that require higher current capacity, particularly for motors, heaters, and other high-load components.

These wires provide reliable electrical conduction and help ensure safe and stable operation of components that demand higher electrical power.

Figure 33 : Speaker Wires

4.2.24 Intercom Wires

Intercom wires were used in the Cheesecake Flow system to connect the keypad with the main controller (Arduino Mega). These wires were utilized to transmit input signals from the keypad buttons to the controller reliably.

The use of intercom wires provided flexible and organized connections, ensuring stable signal transmission and proper user input detection during system operation.

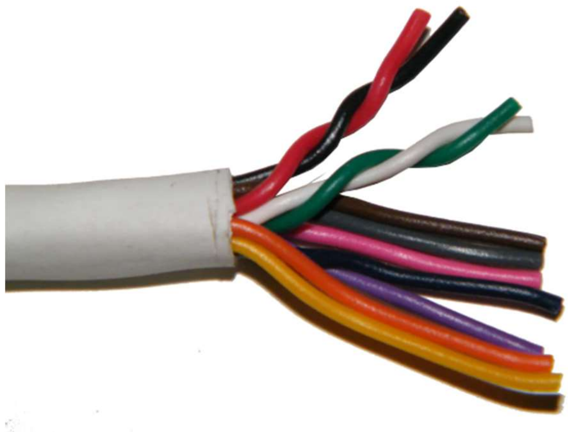

Figure 34 : Intercom Wires

4.3 Application

The Cheesecake Flow system is an automated dessert production solution designed to meet the needs of modern small and medium-scale food businesses. The system is suitable for use in dessert shops, self-service kiosks, and semi-industrial environments where consistent product quality and reduced manual effort are required. Customers interact with the system through a dedicated user interface that allows them to place customized orders by selecting options such as biscuit layer thickness and jelly type. Once the order is confirmed, the system autonomously executes the entire production process.This application significantly reduces the dependence on manual labor, which in turn minimizes human error and variability in product quality. By automating repetitive tasks such as ingredient dispensing, mixing, and packaging, the system ensures uniformity across all produced cheesecake cups. In addition, the integration of a web-based system allows order tracking and system monitoring, enhancing both customer experience and operational efficiency. Overall, the Cheesecake Flow system represents a practical and scalable application of automation in the food production sector.

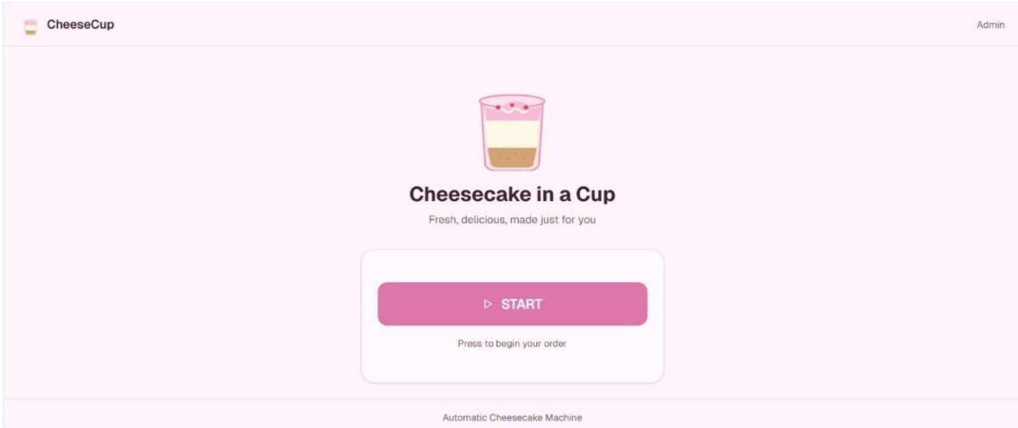

Figure 35 ： User Interface – Home Screen

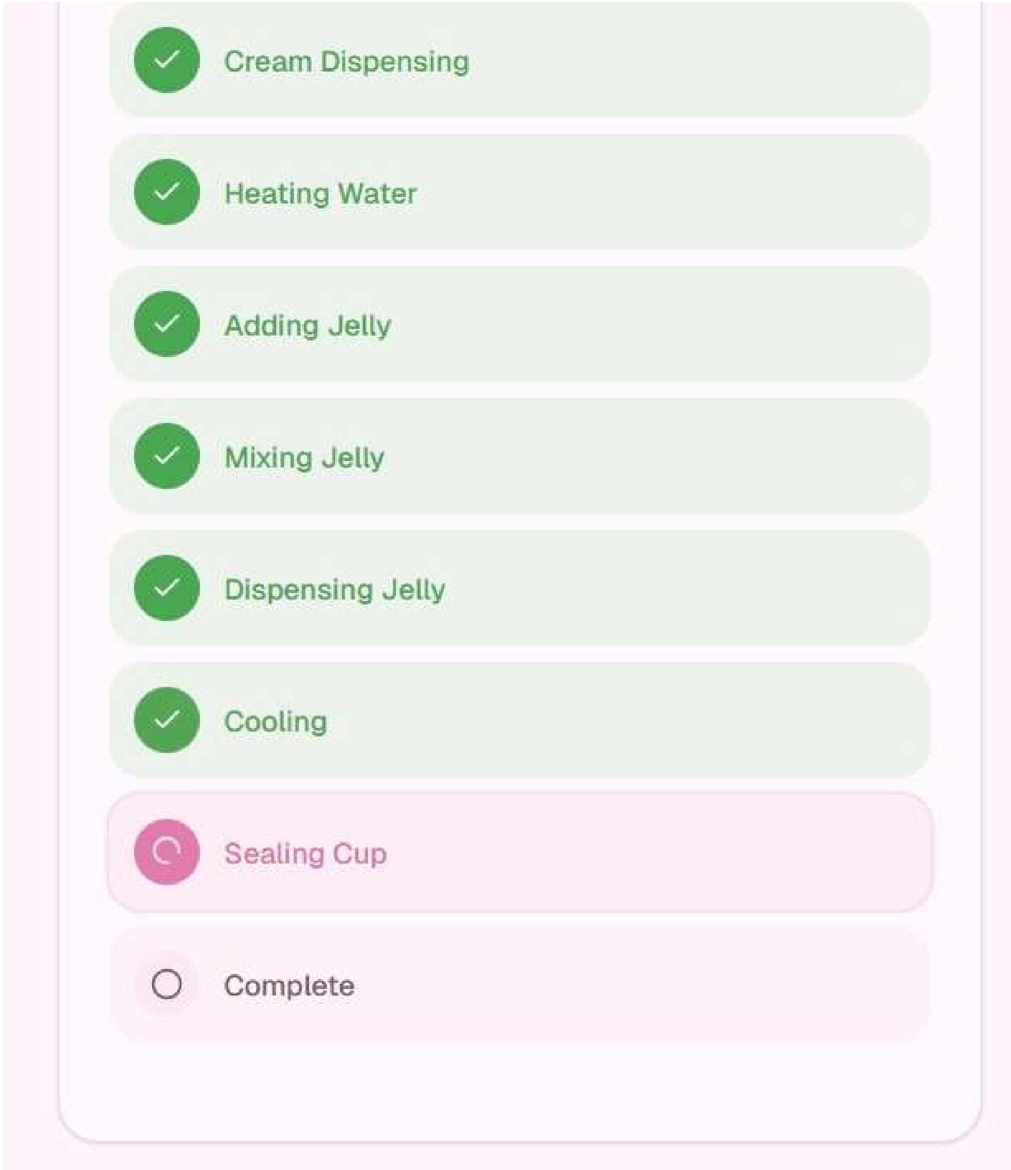

Figure 36 : Process Tracking Interface

4.4 How the System Works

The operation of the Cheesecake Flow system begins when the customer places an order through the user interface and selects the desired customization options. After receiving the order, the control unit initializes the system and activates the production sequence. An empty cup is first released from a stacked cup feeder and positioned onto the conveyor belt. The conveyor then transports the cup through the different production stages in a controlled and sequential manner.

At the biscuit dispensing and crushing stage, biscuits are dispensed according to the user's selected layer thickness, crushed, and deposited into the cup to form the base layer. The cup then moves to the cream dispensing unit, where cream is evenly distributed over the biscuit layer using controlled motion to ensure uniform coverage. Next, the jelly preparation unit dispenses heated water and mixes it with powdered jelly based on the selected flavor, after which the jelly is poured into the cup.

Following the jelly dispensing process, the cooling stage is activated to reduce the product temperature and improve layer stability. Finally, the cup reaches the lid placement unit, where the lid is automatically positioned and securely pressed onto the cup. Once all stages are completed, the finished cheesecake cup is delivered to the customer, ready for pickup. Throughout the process, sensors and controllers ensure accurate positioning, timing, and safe system operation.

Chapter 5

Results and Discussion

The Cheesecake Flow system was successfully implemented and tested, demonstrating its capability to produce cheesecake cups automatically with a high level of consistency and reliability. The system achieved accurate coordination between mechanical movement, electronic control, and software logic across all production stages. The results showed that the automated dispensing of biscuits, cream, and jelly produced uniform layers that met the design requirements.

Several challenges were identified during testing, including cup alignment, temperature control during jelly preparation, and layer separation. These challenges were addressed through design refinements such as guided movement paths, controlled heating timing, and optimized dispensing sequences. As a result, the system achieved stable operation with minimal human intervention. The discussion of results confirms that the proposed system is effective and suitable for automated dessert production applications.

Chapter 6

6.1 Conclusion

This project presented the design and development of an automated cheesecake production system known as Cheesecake Flow. The system successfully integrates mechanical components, electronic control, and software applications to deliver a fully automated dessert production process. By reducing reliance on manual labor, the system improves efficiency, consistency, and reliability in cheesecake preparation.

The project demonstrates how automation technologies can be applied in food production to enhance product quality and customer experience. Through the use of a user interface and a web-based system, customers can place and track orders easily, while the production process is handled automatically. Overall, the Cheesecake Flow system provides a practical and innovative solution for modern automated food production environments.

6.2 Future Work

Future work on the Cheesecake Flow system can focus on further enhancing its capabilities and adaptability. One potential improvement is transforming the system into a complete production pipeline that can handle higher throughput and continuous operation. In addition, the system can be expanded to support a wider range of flavors and ingredients, increasing its flexibility and appeal to a broader customer base.

Another important area for future development is improving the cleaning and sanitation stage to ensure higher hygiene standards and easier maintenance. This may include automated cleaning mechanisms and improved material handling. These enhancements would make the system more suitable for commercial deployment and long-term operation in real-world food production environments.