AN-NAJAH NATIONAL UNIVERSITY

FACULTY OF ENGINEERING & INFORMATION TECHNOLOGY

DEPARTMENT OF COMPUTER ENGINEERING

GRADUATION PROJECT II

TahiniRoute

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Disclaimer:

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Abstract:

TahiniRoute is an automation system used to simplify the traditional method used for the production of Tahini. With its design being focused on small scale production and home usage, the user is able to select the desired amount of tahini, such as 200 or 300ml, which can be done through the built in keyboard or through a connected mobile app. Moreover, the user is also able to customize the flavor of their tahini by choosing the amount of salt and pepper added through simple options such as "low", "medium," or "none."

TahiniRoute's operation starts by checking if there are enough sesame seeds in its tank. If there's enough, the machine will then automatically send the correct amount to the grinder based on the user's input. Once the sesame has been grounded into fine powder, the mixture will be moved to a mixing unit where oil, salt, and pepper can be added based on the operator's preference. Next in line, when everything is mixed into creamy tahini, the mixture is poured into containers that are sealed automatically.

Through its operation, TahiniRoute uses its sensors, mechanical automation, and integrated IoT technologies to offer a clean, modern, and customizable user experience.

1. Introduction

With the constant evolution of machine automation and smart technologies, the integration of these advances into food production has become essential, as well as highly beneficial for mass production. Moreover, there's no denying that traditional methods carry great cultural significance, nevertheless, they can still fall short in terms of precision, hygiene, and efficiency. All these qualities are what is normally expected by today's user, and that is especially true in the case of products like tahini that involve several steps such as grinding, mixing, and packaging. Hence, TahiniRoute can play its role as an instrument for simplifying and automating the production process of tahini, as well as allowing its users to customize their product to their own taste.

TahiniRoute aims to produce a fully automated tahini making machine that takes into account user preference. For example, users can select the amount of tahini they wish to output, as well as choose the level of salt and pepper (medium or low or none) that is added into their tahini. These preferences will be input through a built user interface and keypad or through a connected Web page. After the user has input their preferences, the machine will handle the production process, including checking if enough sesame is available, then grinding, mixing with oil and species, blending the ingredients, and eventually dispensing the tahini into a sealed container.

By combining sensors, mechanical automation, and IoT technologies, TahiniRoute offers its users accuracy, precision, cleanliness, and a smooth experience. The system will be aimed towards home users, small businesses, or local producers who aim to offer tahini as a product, while being tailored to their liking.

This report will be structured as follows; an introduction will start off the paper, then the current state of the art research will be showcased in a literature review, followed by the used methodologies, including the development process and tools used. Moreover, this will be followed by a results and results analysis section that will include data comparisons based on predefined criteria . To end, the report will conclude with a summary of the main outcomes and offer suggestions for potential future improvements.

2. Constraints, Standards, and earlier course work

2.1 Constraints

2.1.1 Cost Efficiency

The cost of manufacturing the instrument must stay within the specified budget by using affordable components

2.1.2 Ease of Use

Since no previous technical experience will be required to operate the machine, the user interface and machine operation need to be intuitive.

2.1.3 Processing Time

To ensure user satisfaction and an efficient operation, the working cycle of the instrument, including grinding, mixing, and packaging, must be completed within a reasonable time

2.1.4 Hardware Availability

In order to allow for larger production later, the parts used in the production of this machine must be components usually available in the local market.

2.2 Standards

• Our code is developed using the C++-written Arduino IDE, which supports many libraries and functions which help us in writing code, making it easy for us to control the hardware components via Arduino platform. The software system is written and designed to be in compliance with the standards and guidelines for the hardware components.

• We developed the web page using the React Native platform to enable users to control the machine and place orders remotely, separation of concerns and facilitating easier maintenance.

2.3 Earlier course work

Our university courses played a major role in shaping our skills and guiding the development of our project. The Microcontroller Using PIC course gave us hands-on experience in programming microcontrollers and working with different components. It also introduced us to key communication tools like I2C, which were crucial in building our system. The Circuits and Electronics courses helped us understand how electronic components work and how to design circuits—knowledge that was especially useful during the hardware phase. The Critical Thinking and Research Skills course taught us how to write clear, well-structured scientific reports and strengthened our ability to search for reliable sources. Finally, the Networking course gave us a solid grasp of how network communication works, which allowed us to add remote control features through a web interface. Altogether, these courses gave us the technical background and practical skills we needed to bring our project to life.

3. Literature review

Tahini is a paste rich in proteins and oils extracted from sesame seeds, and it has been an essential part of the eastern and Middle Eastern cuisine for centuries. (Wikipedia, 2025)

The roots of this paste goes back to ancient civilizations that used it as a rich and health food source. With the growing global awareness of healthy nutrition, and with many consumers turning to vegan based diets, Tahini had a great increase in demand world wide.

According to industrial reports, tahini sales market was worth approximately 1.68billion dollars in 2024, with expectations for annual growth of 5.3% until 2030. (Grand View Research, 2024)

Other estimations indicate the market's worth at 1.27 billion dollars in the same year, with expected annual growth of 4.9% until 2032. (Verified Market Research, 2024)

Historically, Tahini production was done by hand by using stone grinders, requiring gradual steps including choosing the sesame seeds, grinding them, then mixing them with oil. This process with labor intensive, as well as time consuming. Furthermore, the need for quality, cleanliness, and efficiency, and the increased demand for this product caused the need for automation of this production process. In this regard, most of the currently available machinery on the market are expensive and large in size, making it unsuitable for small production operations, or home use.

In the tahini production process, the grinding and mixing stages are definitely the most crucial parts of the production. This is because they determine the final texture, and greatly affect the taste of the product. Additionally, other factors such as the percent of oil used and mixing time are main factors affecting the quality of the product. Hence, studies in the field of nutrition technologies are focused on optimizing these factors in order to maintain nutritional value while providing smooth tahini with a balanced taste.

In most recent years, advances in automation, IoT technologies, and sensors allowed for great advancement in the field of food production. Merging these technologies in smaller factor machines that can be used at home or small production operations, such as coffee machines or bread making machines has allowed the end user greater control over the ingredients and the properties of their product. Hence, in the light of these advancements, TahiniRoute will aim to mix both traditional technique and modern hardware. The system will use precise sensors to determine the quantities of sesame and oil, and control the levels of spices added as per the user's preference. In addition to automatic grinding, mixing, and packing operations. Hence, this system will be similar in principle to smart coffee machines, and will aim to provide specialized tahini easily, whether that is for home use or small businesses.

4. Methodology

In this chapter, we will explain the system setup, the hardware parts, the complete design, and the web application in detail.

4.1 Choosing the idea

The most important step in the project was defining the project idea. We explored several ideas, but none were suitable. Through our frequent observations of markets and grocery stores, we noticed the high demand for tahini and its widespread consumption in food. This led to the idea of building an automated machine to prepare tahini quickly and easily, streamlining the production process and saving time and effort.

4.2 System structure

The complete project design is shown in the Figure 1.

Figure 1: The complete project design

The system consists of several stages, which we will discuss in detail step by step.

4.2.1 Dispensing white sesame seeds

This is the first step in the tahini machine. It has one container that holds white sesame seeds. The container drops the seeds by turning a knob connected to a motor. The motor is set to drop the right number of seeds based on what the user wants. This step is shown in Figure 2.

Figure 2: Dispensing white sesame seeds

4.2.2 Grinding sesame seeds

This is the second stage, which includes a grinding mill connected to two motors. The first motor turns the mill to the left to allow ingredients to be added, then turns it to the right to let the ground mixture fall into the blender for packaging. The second motor lifts the mill up so it can be closed tightly, then turns it on to start grinding. When grinding is done, the motor lowers the mill back to its original spot. See Figure 3.

Figure 3: Grinding sesame seeds

4.2.3 Adding oil

At this stage, a liquid pump is used to add an appropriate amount of oil to the mixer. This step is shown in Figure 4.

Figure 4: Adding oil

4.2.4 Adding salt and black pepper

In this stage, the user can customize the flavor of the tahini by selecting whether to add salt, black pepper, or both, with quantity options including a small amount, a medium amount, or none at all for each ingredient. The dispensing mechanism for salt and black pepper is controlled using servo motors, which are programmed to rotate specific angles corresponding to the selected quantity. This step is shown in Figure 5.

Figure 5: Adding salt and black pepper

4.2.5 Mixing the ingredients

After all selected ingredients have been dispensed, they are transferred into a blender where they are thoroughly mixed to form a smooth and consistent tahini mixture. The operation of the blender is controlled using a relay module, which acts as a switch to turn the blender on or off based on the system's logic. See Figure 6.

Figure 6: Mixing the ingredients

4.2.6 Packaging box

This is the final stage, which consists of many processes.

4.2.6.1 Unload the box

As shown in the Figure 7, this is a 3D printed design that holds the tahini boxes and is connected to a motor that rotates to allow the box to reach the production line.

Figure 7: Unload the box

4.2.6.2 Production line

We created it as in the Figure 8, Its main job is to move the box smoothly and accurately without any problems. This is done using an object sensor connected to a motor, which keeps the box moving until it reaches the first station — where the tahini mixture is poured from the mixer into the box. Then the box moves to the second station, where it stops so the box can be properly closed.

Figure 8: first station in production line

4.2.6.3 Lids line

We made it with a slight tilt so it works like a small storage area for the lids. This tilt helps the lid slide down easily and land right on the box when it passes underneath on the production line. As shown in the Figure 9.

Figure 9: Lids line

4.2.6.4 Closing box

We created it as shown here. This part was created using a 3D design, as shown in Figure 10. When the box arrives with the lid on, one motor moves a piece down to compress the lid tightly. A second motor then rotates to ensure the lid is tightly closed. The first motor then lifts the piece so the box can continue moving.

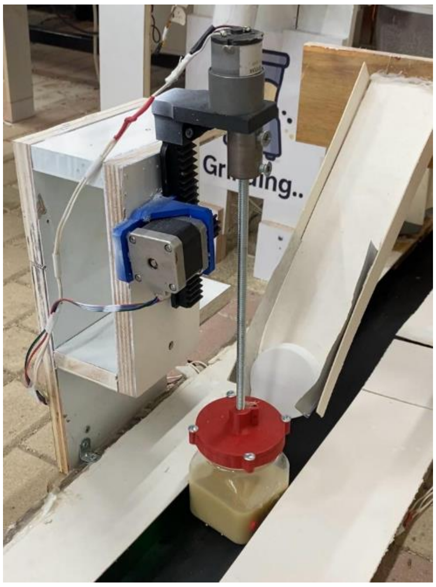

Figure 10: Closing box

4.3 Hardware components

4.3.1 Microcontrollers

Arduino Mega 2560

The Arduino Mega 2560 is a microcontroller board that uses the ATmega2560 chip. It has 54 digital input/output pins (15 of them can work as PWM outputs), 16 analog inputs, 4 serial ports, a 16 MHz crystal oscillator, a USB port, a power jack, a reset button, and an ICSP header.

The main chip on the board, ATmega2560, runs at 16 MHz and has many input and output pins, which makes it easy to connect different parts like motors, sensors, relays, and other hardware used in our project. The board also includes a USB-to-serial chip (ATmega16U2) that handles communication between the USB port and the main processor. See Figure 11.

Figure 11: Arduino mega 2560

Esp32-WROOM-32

The ESP32-WROOM-32 is a small development board that's great for IoT projects. It's based on the ESP8266 Wi-Fi module and uses the CH340 chip for USB connection. It supports 2.4 GHz Wi-Fi with 802.11 b/g/n standards, has built-in support for TCP/IP, and includes several interfaces like UART, I2C, I2S, PWM, and more. The board also has a built-in antenna, a micro-USB port, and a reset button. It can be programmed using the Arduino IDE and supports other languages like LUA. In our project, we used it to connect with the mobile app we developed. See Figure 12

Figure 12: Esp32

4.3.2 Input/Output Devices

LCD and I2C

The LCD screen we used (Figure 14) is a 16x2 display, meaning it can show two rows of text, each row with up to 16 characters. The text appears in white on a blue background, making it easy to read. Since our project involves connecting many components to the Arduino, we tried to save as many pins as possible to avoid needing another board. Also, too many wires can make things messy. That's why we used the I2C version of the LCD (Figure 13), which only needs 4 pins: VCC, GND, SDA, and SCL — instead of at least 6. This helped us reduce the number of used pins and made wiring simpler. We used the screen to show instructions to the user, like how to choose the coffee type and amount, and to display their selections from the keypad.

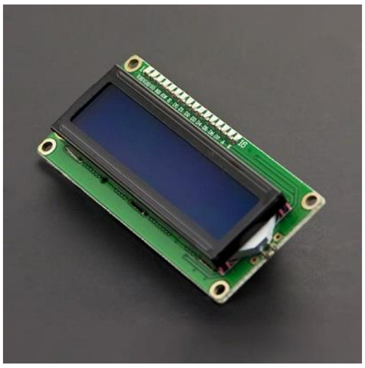

Figure 14: LCD

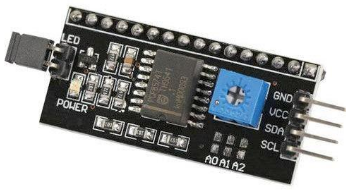

Figure 13: I2C

Keypad

The keypad we used is a 4×4 matrix type, which means it has buttons arranged in rows and columns. When you press a button, it connects a specific row with a column, and the system can figure out which button was pressed by checking those connections. It usually has 8 pins — 4 for the rows and 4 for the columns — and they can be connected to any digital pins on the Arduino. See Figure 15.

*Figure 15: Keypad 4*4*

In our project, we used keypad to help the user choose the options they want for their order by pressing the assigned buttons.

After the LCD shows the message “Welcome to Tahini Route!”, it displays these messages:

- Choose tahini amount: 1. 300ml 2. 200ml
- Enter number of cups
- Choose salt amount: 1. None 2. Low 3. Medium
- Choose pepper amount: 1. None 2. Low 3. Medium
- If the user presses *, the message “Starting… Production” appears
- If the user presses #, the previous menu is shown again, so the user can change their choices if they made a mistake or want to select something else
- If the user presses a wrong number, the message “Please choose a correct number!” appears
- If the amount of sesame in the containers is not enough according to the ultrasonic sensor, the message “Insufficient material!” appears.

4.3.3 Power Devices

Power Supply

We used an ISO-450 ATX computer power supply with 350W, providing 12V at 16A and 5V at 32A. It gave us different voltages: 12V, 5V, 3.3V, and Ground. We used the 12V to power the motors, and the 3.3V and 5V to power the lasers. See Figure 16.

Figure 16: Power supply

4.3.4 Pumps and Tubes

We used a 12-volt pump in our machine. It pumps the appropriate amount of oil into the blender, depending on the user's desired quantity of tahini—200 or 300 ml. See Figure 17.

Figure 17: Pumps and tubes

4.3.5 Sensors

4.3.5.1 Ultrasonic Sensor

The HC-SR04 is an inexpensive and easy-to-use distance sensor that can measure distances between 2 cm and 400 cm. The device works by emitting sound waves to determine an object's distance. We used two of these sensors to check the amount of sesame in the container and to measure the amount of tahini filling the box from the blender. These sensors tell us whether the container is empty. If the amount of sesame in the container is low or insufficient to prepare the user's order, or if the amount of tahini in the box is suitable for the user's choice of 200 or 300 ml, a notification message appears on the LCD screen, as explained previously in the Input/Output Devices section. See Figure 18.

Figure 18: Ultrasonic sensor

4.3.5.2 LDR Sensor and Laser

This sensor is a type of photoresistor, whose resistance changes with light intensity. The lighter, the lower the resistance.

We aimed a laser directly at the LDR sensor. As long as the laser light hits the sensor, its signal remains high, indicating that no object is obstructing it. However, if anything obstructs the laser's path, the signal changes to low, indicating that an object has been detected. See Figures 19&20.

We used two LDR sensors, each equipped with its own laser. The first detects the arrival of the moving tahini container to a specific location under the blender. The second detects the arrival of the container to the point where the lid is pressed to close it.

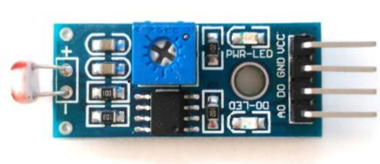

Figure 20: LDR sensor

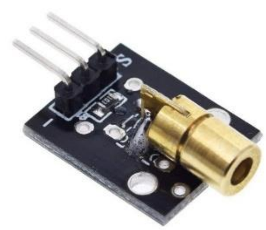

Figure 19: Laser

4.3.6 Servo Motors

The function of a servo motor is to control the position, speed, and torque of mechanical systems with high precision. The servo motor operates by receiving a control signal representing the desired output position and adjusting its motion accordingly. We used two gates to control the drop of salt and pepper ingredients, controlling them according to the user's desired quantity

Figure 21: Servo motor

4.3.7 Motors and Drivers

4.3.7.1 Stepper Motors

NEMA 23 Stepper Motor

The NEMA 23 is a stepper motor with a front size of about 5.8 x 5.8 cm and a step angle of 1.8°, meaning it takes 200 steps to make a full turn. It runs at 3.2V and uses 2.8 amps per phase, giving it a torque of 19 kg-cm.

Figure 22: NEMA23 stepper motor

In our project, we used four of these motors for different tasks. The first one was used to release the sesame seeds from the container, and we connected it to a TB6600 2 Phase Micro step Motor. Driver (9–42V DC, 0.5–3.5A). This driver is useful because it supports high voltage and current, and allows smooth and accurate control thanks to its micro stepping feature.

The second motor was used to move the grinder left and right, and it also used the same TB6600 driver. Using the same type of driver helped us keep the control simple and stable, especially because it handles longer operation without heating up too much.

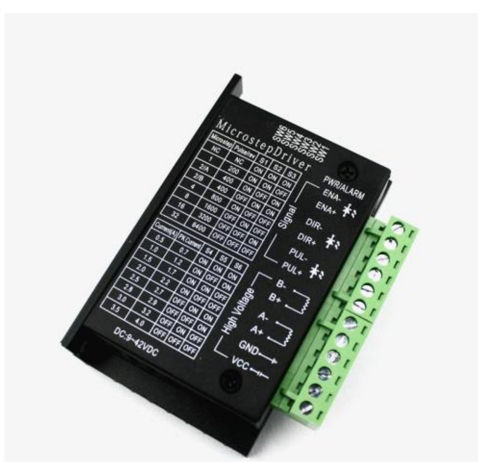

Figure 23: TB6600 driver

For the third motor, which was responsible for opening and closing the mixer tap, we used the L298N Dual H-Bridge Motor Driver (Red Board). It’s a good choice for this part because it can control two motors at once and is easy to use with Arduino boards. It also includes basic protection against overcurrent or overheating.

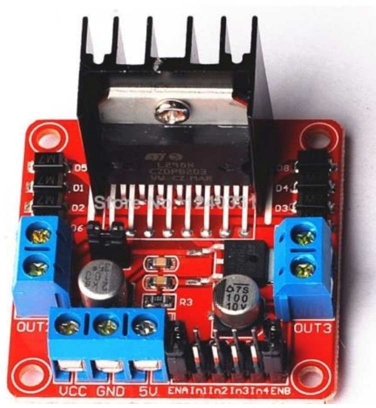

Figure 24: H-bridge driver

The fourth motor(J-5718HB2401 Stepper Motor) was used to move the scraping tool along the production line. This one needed more power, so we used a) YS-DIV268N Driver-5A) stepper Motor Driver. It’s strong and reliable, especially for parts of the system that need steady and powerful motion without interruptions.

Figure 25: YS-DIV268N Driver-5A driver

NEMA17 Stepper Motor

The National Electrical Manufacturers Association (NEMA) sets standards for many devices, including stepper motors. These motors are classified by size, such as "Size 11," "Size 23," and "Size 34." A common type is the NEMA 17 stepper motor, which has a step angle of 1.8 degrees, meaning it takes 200 steps to complete one full turn. It's a bipolar, four-wire motor that can rotate in both directions—clockwise and counterclockwise. Each coil supports up to 3.5 amps and works at voltages between 3 and 12 volts.

In our project, we used two NEMA 17 motors: one for lowering the empty box onto the production line, and the other for lowering and lifting the part that seals the box. To control both motors, we used H-Bridge motor drivers, which are ideal for changing the direction of rotation and provide smooth and reliable control. This setup helped us manage the movement easily and ensure accurate positioning during the packaging process.

Figure 26: NEMA17 stepper motor

4.3.7.2 DC Motors

SG37BL-A DC Brushless Gear Motor

In our project, we used this motor to rotate the part that presses the lid against the box, ensuring it closes tightly. The motor rotates in one direction to close the lid, and we used an H-bridge motor to control it. This motor allows us to rotate the motor in specific steps to ensure the box closes tightly.

Figure 27: SG37BL-A DC Brushless Gear Motor

Other type of DC Motor:

In our project, we reused a motor originally designed for automotive windshield wipers. This motor operates as a regular DC motor (see Figure). We used a single motor to raise and lower the grinding mill to close its cover. This motor was controlled using relay 2 channel. We chose them for their robustness and ease of handling the weight of the mill.

Figure 28: Wiper motor

4.3.8 Other Components

4.3.8.1 Relays

A relay is an electronic switch that lets us control devices that use high voltage or high current using a small signal. It helps turn other devices on or off, either in the same system or a different one.

In our project, we used three relays. The first one was a single-channel relay, and we used it to control the oil pump—turning it on and off for a short time. The second one was a two-channel relay: one channel was connected to the grinder, and the other to the mixer. Both were set to run for specific periods. The third relay was also a two-channel type, connected to a DC motor that moves in both directions to raise and lower the grinding mill.

Relays are simple to use and program, and they make it easy to control how long a device should stay on or off.

Figure 29: Relay 1 channel

Figure 30: Relay 2 channel

4.3.8.2 Spice grinder

We used this machine to grind white sesame seeds. It operates on 220 volts and is connected to a two-channel relay, so we use one channel to turn it on and off as needed.

Figure 31: Spice grinder

4.3.8.3 Blender

We used this machine to mix oil, white sesame powder, salt, and pepper together. It operates on 220 volts and is connected to a two-channel relay, so we use one channel to turn it on and off as needed.

Figure 32: Blender

4.3.8.4 Wires

We used them to connect and wire the different parts of the system, and their length helped us reach all the needed components easily.

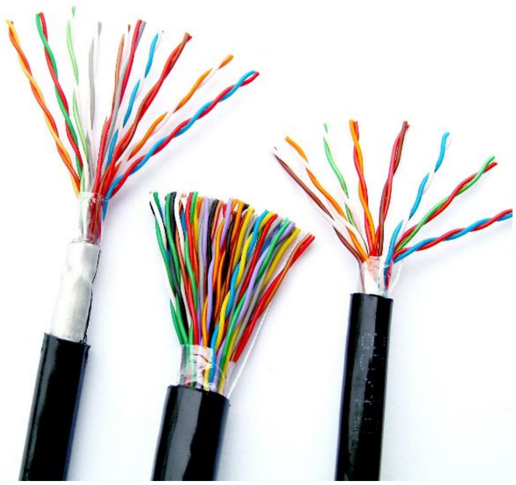

Figure 33: Intercom wires

Arduino Wires

We used them to connect the components to the Arduino.

Figure 34: Arduino wires

4.4 Web Application

A web app (built using **React** and **TypeScript**) was developed to control the system. The user can place an order through the app, replicating the keypad functionality. The following images demonstrate the app screens.

4.4.1 Welcome Page

This is the main screen the user sees when opening the app. When the user clicks the Start button, it takes them to the Home page to place an order.

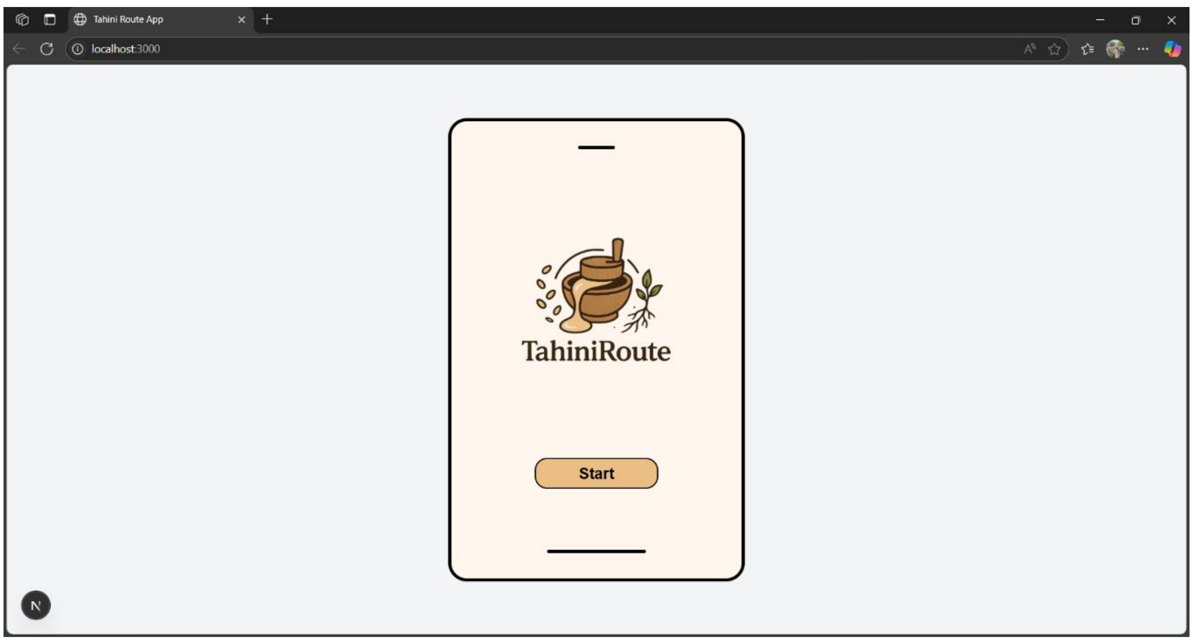

Figure 35: Welcome page

4.4.2 Order Page

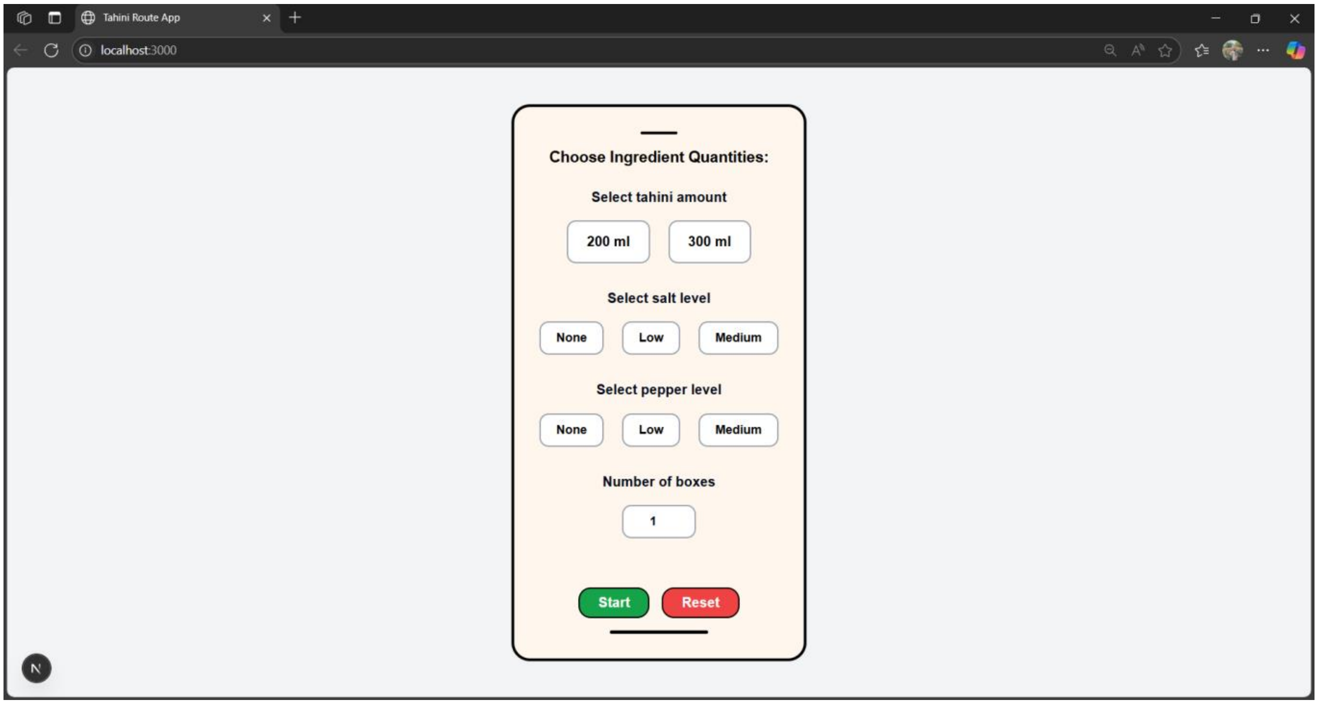

Figure 36: Order page

This user interface is part of the Tahini Route App. It allows the user to choose the ingredients and quantities needed for preparing tahini boxes. The user can:

- Select the amount of tahini (200 ml or 300 ml).
- Choose the level of salt (None, Low, or Medium).
- Choose the level of pepper (None, Low, or Medium).
- Enter the number of boxes to produce.
- At the bottom, there are two buttons:
- Start to begin the process, and reset to clear all the selections.

The design is clean and user-friendly, making it easy to use.

4.4.3 Feedback Page

This page displays the request steps received from the ESP32. The steps are updated automatically every few seconds. There is also a timer that starts counting from zero and continues to the final step.

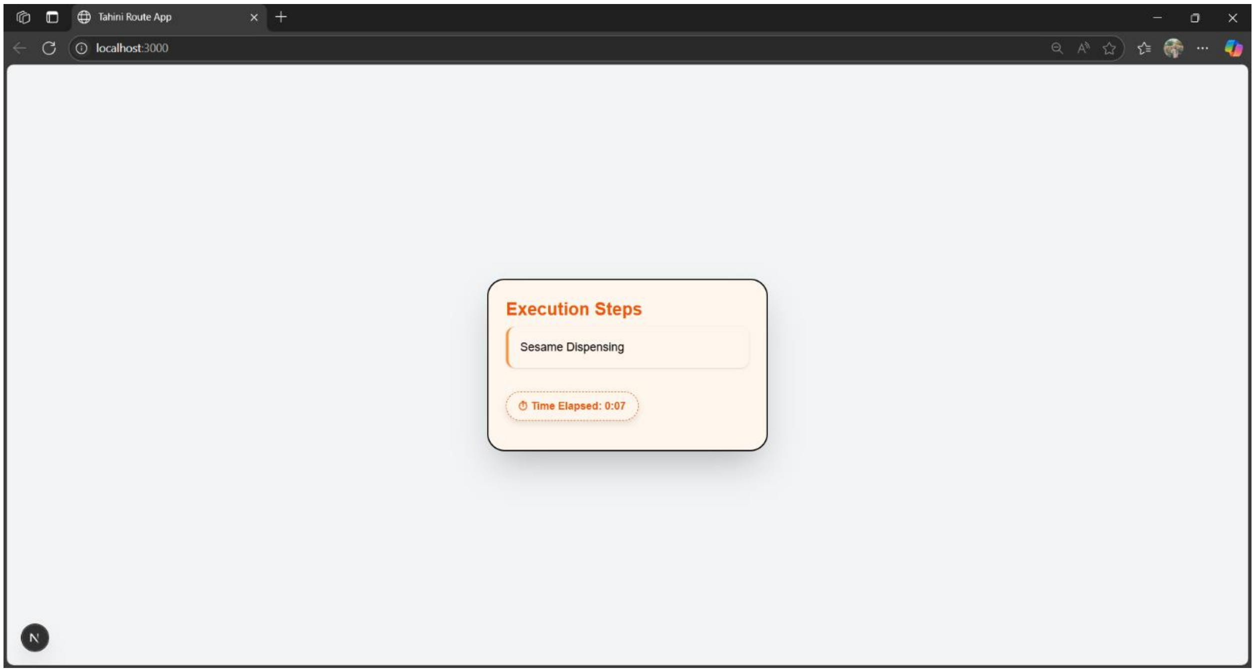

Figure 38: Execution steps start

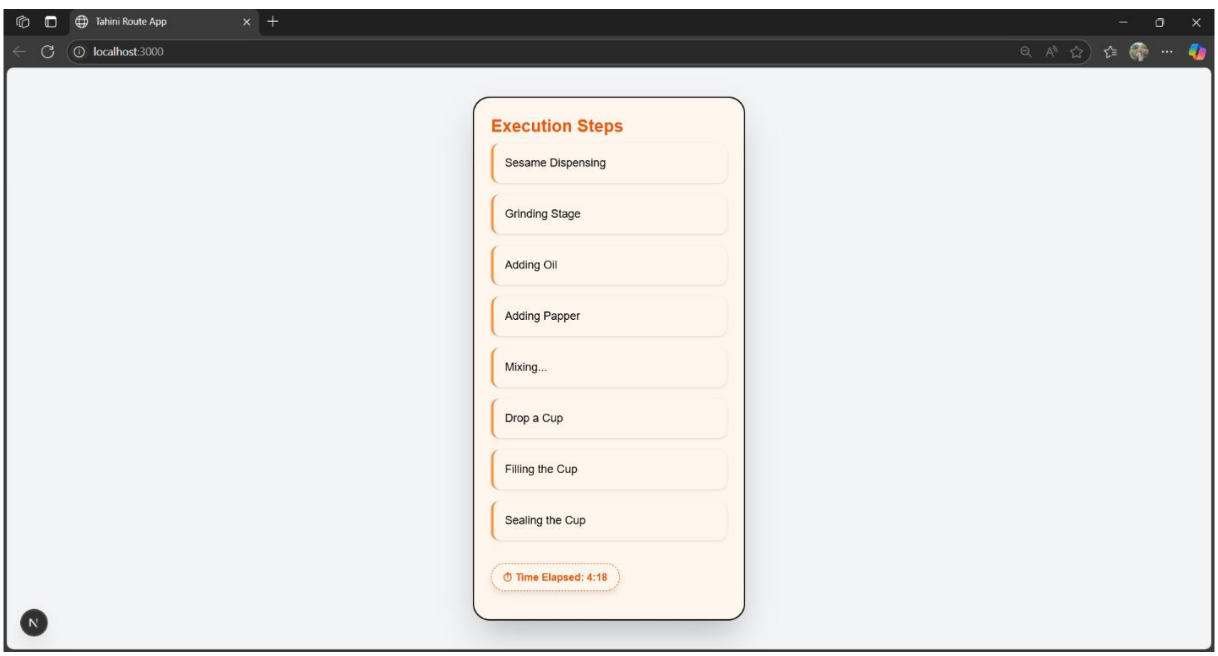

Figure 37: Execution steps end

4.4.4 Order Ready Page

This page shows a message that the order is ready. It plays a celebration sound with an option to turn the sound on or off. There are buttons to replay the sound and to start a new order.

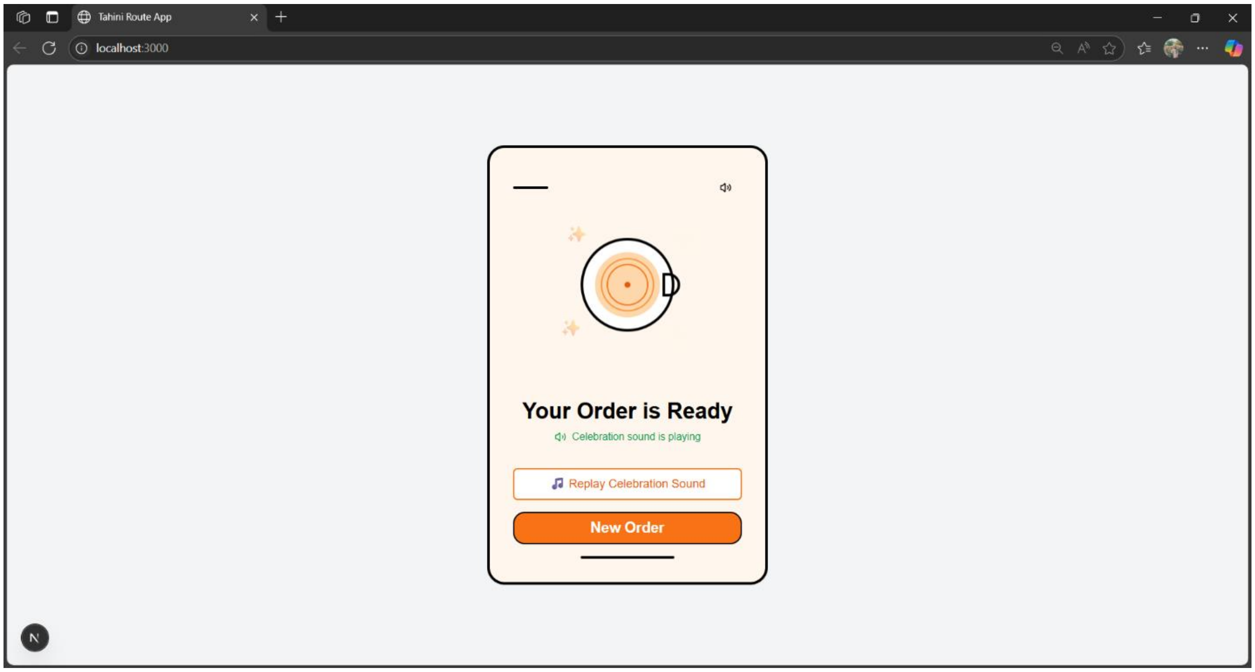

Figure 39: Order ready page

4.5 Flow Chart of system

The system works as follow:

4.5.1 Order Selection Stage:

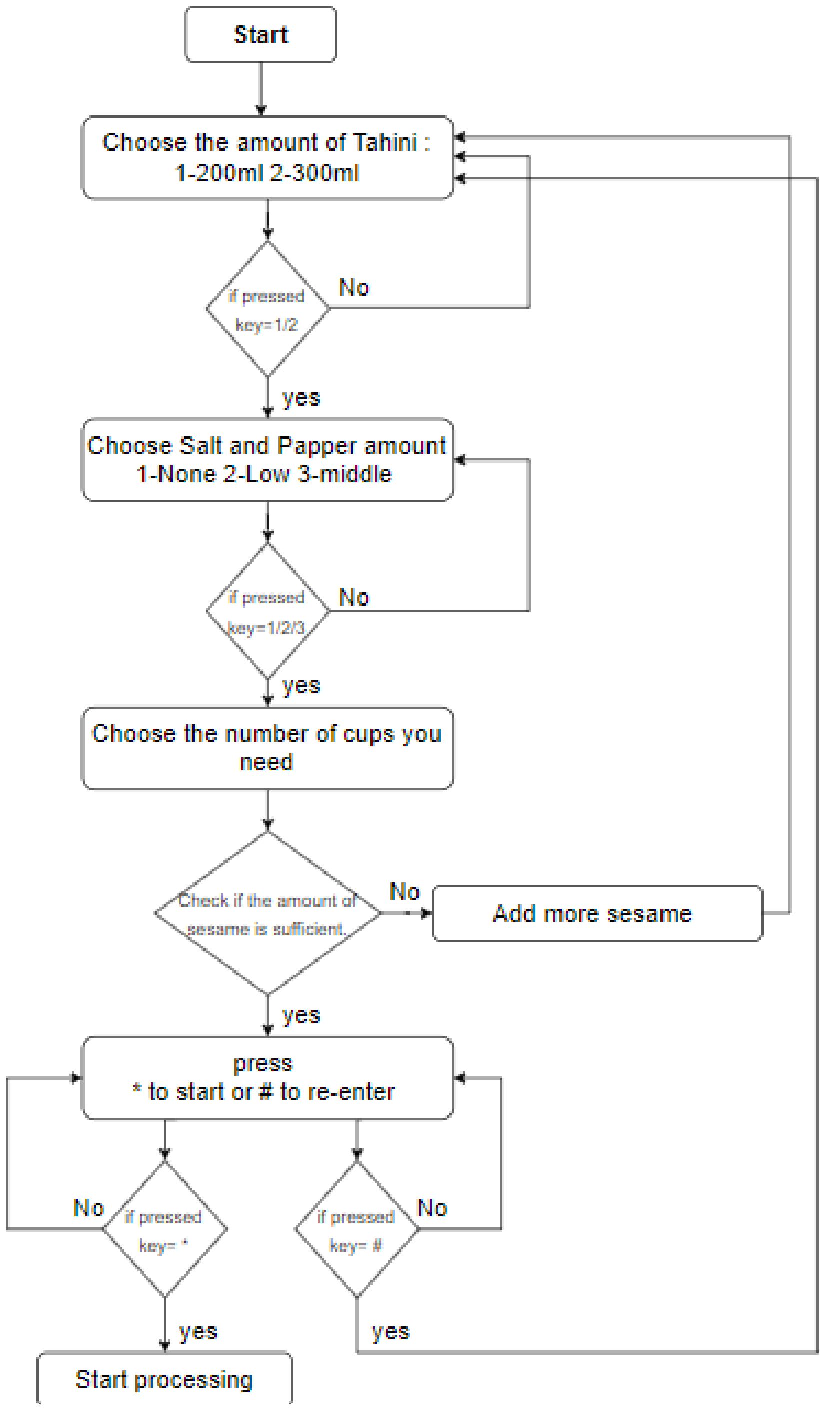

Figure 40: Order selection stage chart

4.5.2 Sesame dispensing and grinding:

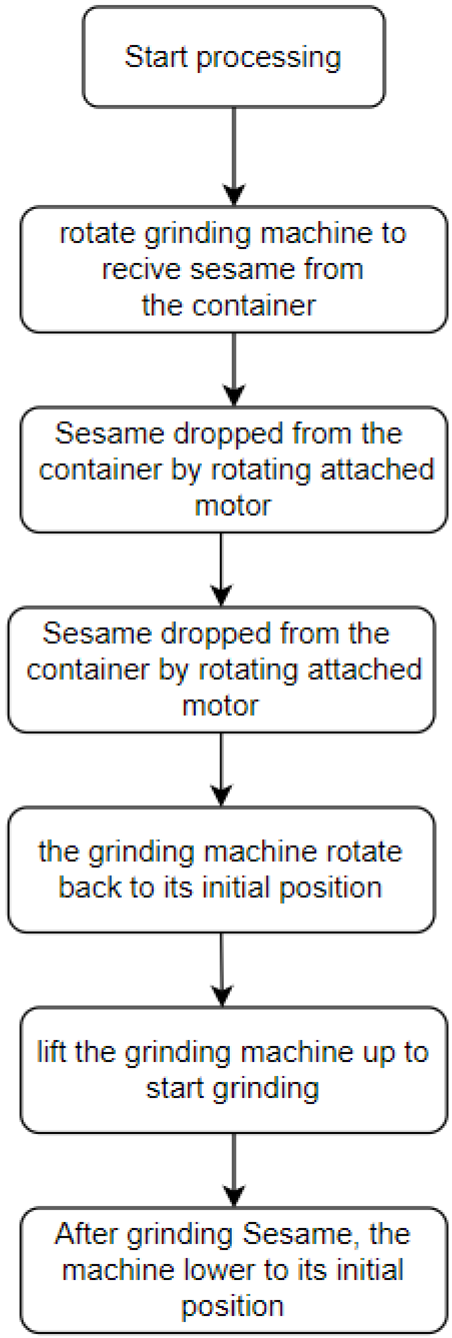

Figure 41: Sesame dispensing and grinding stages chart

4.5.3 Oil, Salt, and Pepper Addition and Mixing Stage:

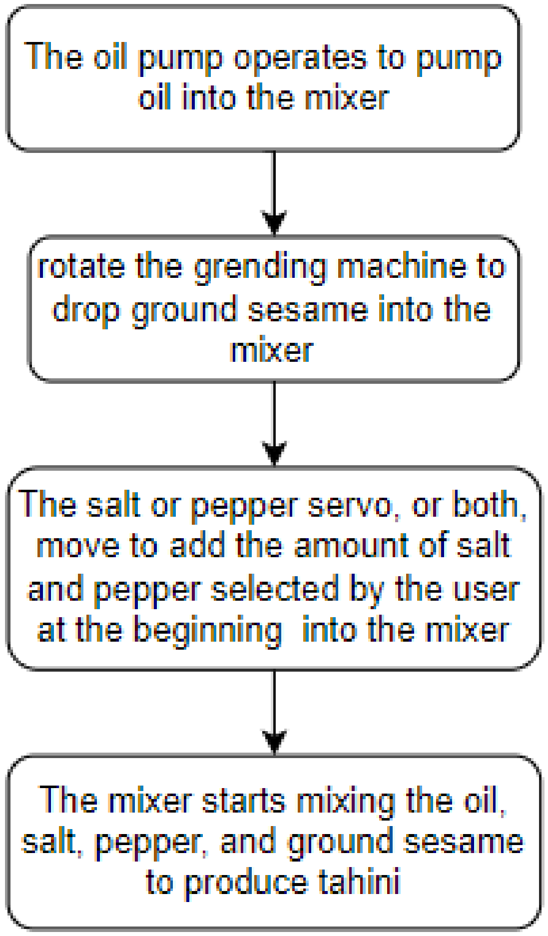

Figure 42: Oil, salt, and pepper addition and mixing stage chart

4.5.4 Filling Stage:

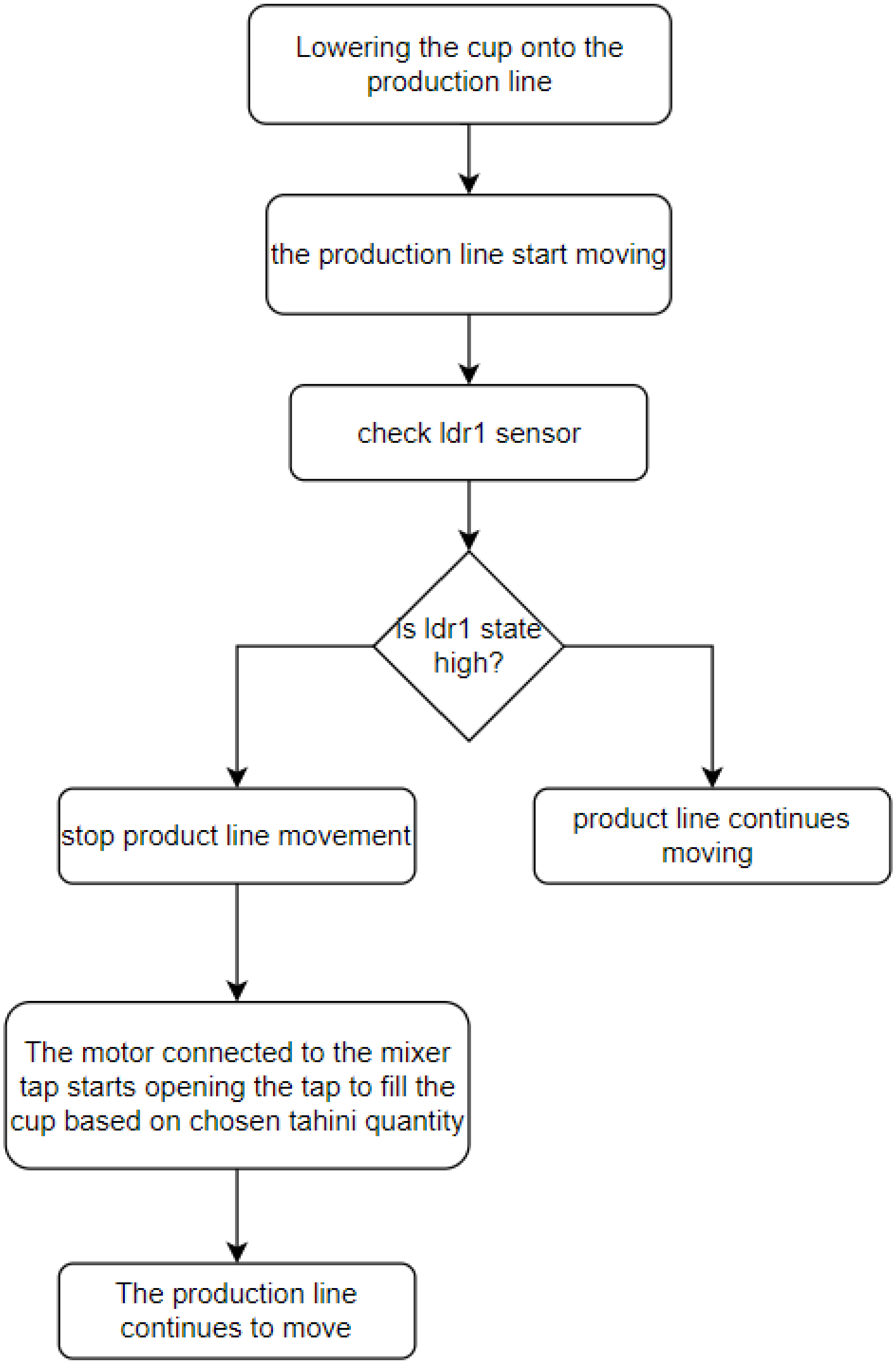

Figure 43: Filling stage chart

4.5.5 Sealing Stage:

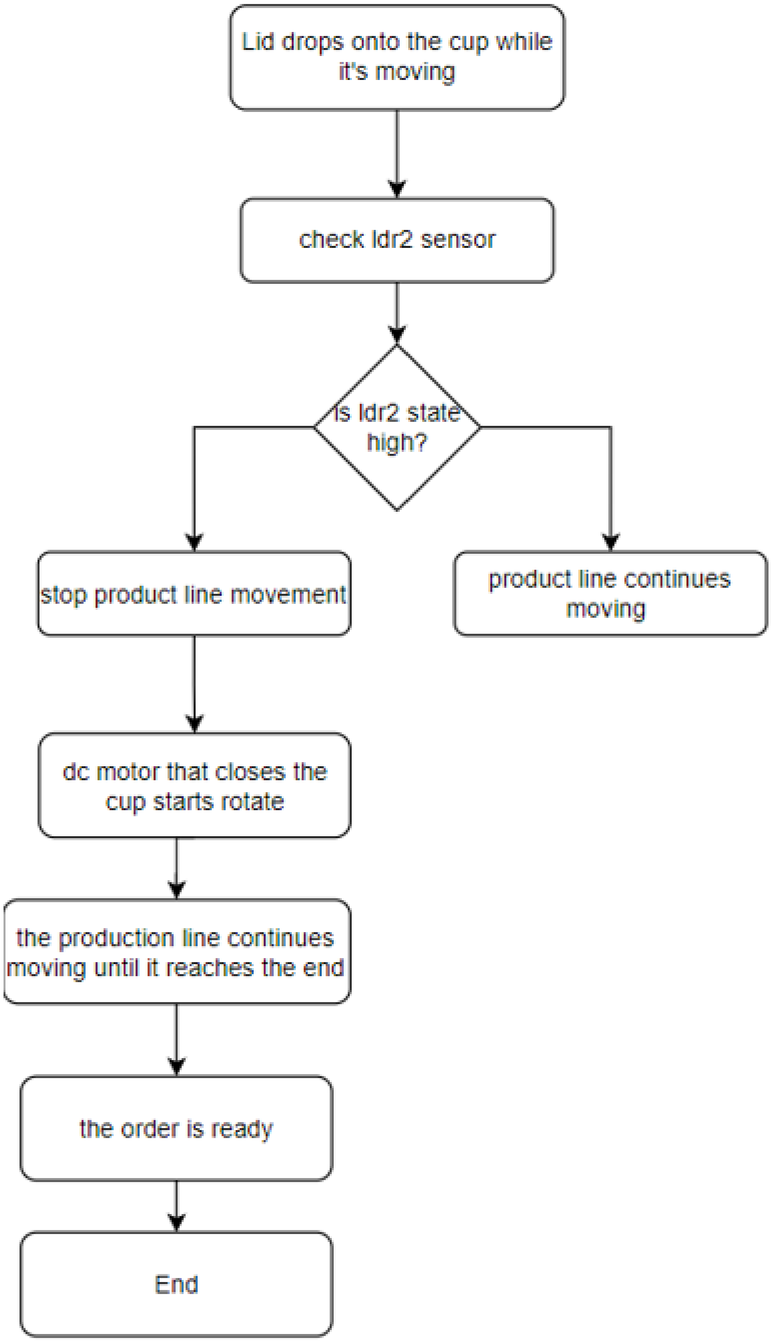

Figure 44: Sealing stage chart

At every stage, feedback is sent to the user by displaying it on the LCD.

Figure 45: Feedback in LCD

5 Discussion

The aim of this project was to design Tahini Route, a tahini pastes preparation automated system that includes grinding, mixing, and filling operations for the product, as well as providing the ability to optimize the product and change it to the user's liking. Hence, after executing the project, and preliminary testing and evaluation, it was determined that the main goal of automating the tahini production process while maintaining an easy user interface and good product quality was a success. This was done through practical problem solving of the issues that arose while preparing tahini in the traditional method, such as non-homogeneous mixture texture, dependency on intensive labor, as well as difficulty in adjusting quantities. Tahini Route allows the user to specify the required number of spices and the amount of tahini needed. Hence, our product provides a practical and hygienic easy to use solution.

6 Result and Conclusion

In the end, the Tahini Route project achieved the goal of creating a device that streamlines tahini preparation by combining traditional methods with modern technologies. It allows Users to control the amount and the flavor level they prefer, while the system automates the grinding, mixing, and packaging steps. This solves several problems in small-scale food preparation automation by improving efficiency, maintaining consistent quality, and ensuring hygiene.

Participating in this project provided the opportunity to learn how to develop automated food processing systems and work toward addressing real-world challenges. Overcoming such challenges required advanced technologies and effective teamwork, demonstrating how crucial workload partitioning is for project success.

7 Future Works

This system has great potential for future upgrade that will improve its functionality and performance, hence increasing customer satisfaction.

First, perhaps one of the most important possible improvements is to reduce the physical size of the instrument. This will make the product more suitable for home and small business use, while still maintaining the same efficiency.

Second, the system can make use of adding an automated cleaning system that will allow the grinding and mixer to clean themselves after each use, and in turn saving time and effort for the user.

Third, the system can be expanded upon by adding the possibility of preparing other nutritional products that are made from tahini such as sauces or chocolates. This can be achieved through adding ingredients to the system chain, such as cacao, honey, or additional spices.

Fourth, the system can be upgraded through allowing larger containers for tahini filling, which makes the instrument more useful for clients who require larger amounts at once, whether for personal or business use.

The previously mentioned upgrades aim to make the system more efficiency, practical, and diverse, hence increasing the system's value to the end user.

8 References

Grand View Research. (2024, December). *Tahini Market Size, Share & Trends Analysis Report.* Retrieved from Grand View Research: https://www.grandviewresearch.com/industry-analysis/tahini-market

Verified Market Research. (2024). *Tahini Market Size, Share, Trends & Forecast.* Retrieved from Verified Market Research: https://www.verifiedmarketresearch.com/product/tahini-market

Wikipedia. (2025, June 5). *Tahini.* Retrieved from Wikipedia: https://en.wikipedia.org/wiki/Tahini