An-Najah National University

Faculty of Engineering & Information Technology

Department of Computer Engineering

Graduation Project II

Glow Gloss

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Presented in partial fulfillment of the requirements for Bachelor’s Degree in Computer Engineering

February 3, 2025

Acknowledgement

Special thank to our supervisor, Dr. Raed Qadi, Eng. Abdullah Hinnawi, and Alaa' Zorba, for their massive in this project, standing by our side, and giving us important remarks. We also would like to extend our great appreciation to all the faculty members of the Computer Science Department for their continuous support during all our studies. Special thanks are due to our families, friends and colleagues who have urged to this publication with their encouragement, belief, and continuous support. No doubt, it has been our source of strength. And we are really thankful.

Disclaimer

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Abstract

Lip gloss is a makeup product which every woman uses almost every day. It plays a circular role in their beauty routine. Women use it to enhance the appearance of their lips, adding color and hydration to their lips. Our project aims to make a high-quality lip gloss with a color chosen by customers. We plan to create an automated system that allows users to select their desired color to start the process via Arduino board connected to different components like motors and others. The process consists of mixing the color the customer wanted, then adding the other ingredients like Vaseline, Shea butter, coconut oil that will be in a heated water bath. Then the next stage is mixing all that together, and finally putting the mixture in a suitable bottle presented to the customer to enjoy the lip gloss with the wanted color. This innovation ensures a personalized beauty experience while emphasizing sustainability, and for every woman to use.

Chapter 1

Introduction

For women, Makeup is an essential part of beauty and self-expression. It enhances facial features and boosts self-confidence.

From ancient civilizations to modern times, makeup has evolved into a vast industry, offering a wide range of products that cater to different styles and preferences. Whether for daily wear or special occasions, makeup plays a significant role in personal grooming and aesthetics.

One of the most popular makeup products is lip gloss, a must-have item in many beauty routines. Women use it to enhance the appearance of their lips, adding color and hydration. With various shades and finishes available, lip gloss allows women to express their style effortlessly. Its lightweight, glossy texture makes it a perfect choice for a soft, radiant look that complements any makeup style.

The lip gloss machine: a project in support of easy lip gloss production. Our project focuses on creating lip gloss through a simple and fast process. Customers can choose their desired color, and the system will automatically mix the ingredients to produce a high-quality lip gloss. The process is efficient, ensuring that the customer receives their personalized product in a short time.

1.1 Problem statement

The process of creating Lip Gloss requires a delicate balance between beauty, quality, and safety. Manufacturers are challenged in selecting the right ingredients that provide attractive shine, effective hydration, and long-lasting wear without compromising the user's health. Additionally, there is a need to improve production processes to ensure efficiency and sustainability while meeting the growing market demand for natural, non-toxic products.

1.2 Objectives

Our main objective is to design an automated Lip Gloss- making machine to prepare Lip gloss effectively, thereby reducing the continuous need for human assistance. The following features are to be incorporated into this smart Lip Gloss machine:
1- Heat the basic ingredients (shea butter, coconut oil, Vaseline) and add appropriate amounts of them.
2-Combine colors to get the color chosen by the user.
3- Mix ingredients to get the right consistency.
4- Fill the mixture into the box to get the final product.

1.3 Significance

The lip gloss making machine has many advantages. It helps the customer get the product he wants in the shortest possible time and in the color he chooses, and with organic ingredients that are not harmful to the skin.

1.4 Organizing the report

The report first of all gives an introduction to the problem statement, objectives of the project, the scope of work, and its significance.
The second chapter sets out the limitations and constraints that forced us during work on the project, also the standards we used the programs we used in coding and application, and finally earlier coursework.
The next chapter, In, takes the literature review. The work and results that are relevant will be included in that chapter.
Then, the methodology chapter follows, which gives deep information on the project, its structure, the components used in building it, the electronic hardware, and in particular talking about how this system works.
The results and analysis go to the fifth chapter, while the conclusion and discussion go to the conclusion and summarize the project, with the future work that can be done on the project.

Chapter 2

Constrains and Earlier Coursework

2.1 Constrains and limitations

1. The main problem was Finding the appropriate structure for each stage to complete its work perfectly.
2. The nature of the ingredients used in making lip gloss is difficult to deal with, for example: coconut oil is quick to freeze.
3. The number of motors used is very large, causing high cost.

2.2 Standards / Codes

1. For the development of the code, we used the environment of Arduino IDE, which allowed us to directly control the hardware by using the functionalities provided in the Arduino platform.

2. A website was created using HTML, CSS, JS, which allows users to choose the color from a distance.

2.3 Earlier Coursework

- The Critical Thinking course taught us how to research effectively, which helped a lot with documenting our work and writing reports.
- Micro-processor and Micro-controller and their Labs courses gave us Handson experience with controlling the hardware components in our project and knowing how to deal with the components' data sheets.
- The Wireless and Networks courses played a key role in helping us understand how to connect different devices, which we applied by linking the mobile app to our system using an ESP module with Arduino.
- The Electronics and Digital Circuits courses provided a strong foundation in electronic systems, which was vital for our project. Along the way, we also relied on self-learning through YouTube Arduino tutorials and independent research to deepen our understanding.

Chapter 3

Literature Review

Lip gloss has been a staple in the cosmetics industry for decades, evolving from a simple product that provides shine to a sophisticated formula offering hydration, long-lasting wear, and various aesthetic effects. Research on lip gloss formulation, market trends, and consumer preferences has expanded, contributing to the development of innovative products that align with both beauty standards and health-conscious choices.

Early lip gloss formulations primarily consisted of petroleum jelly and wax to provide shine and texture. Modern advancements have introduced a variety of emollients, such as jojoba oil, shea butter, and vitamin E.

Market research indicates that lip gloss has seen a resurgence in popularity, particularly among younger consumers who prefer glossy, natural looks over matte finishes (Davis, 2023). Social media and influencer marketing have played a significant role in shaping trends, leading to an increased demand for customizable, flavored, and scented glosses (Lopez & Carter, 2021).

Additionally, the rise of vegan and cruelty-free beauty standards has driven companies to reformulate their products to meet ethical consumer expectations. Brands that prioritize transparency in ingredient sourcing and sustainability practices have gained a competitive edge in the beauty industry (Williams, 2023).

Chapter 4

Methodology

4.1 Machine Structure

4.1.1 Machine Body

Figure 4.1: machine design.

4.1.2 Heating Stage

The heating stage consists of three metal vessels placed inside a water bath to heat them, an electric heater to heat the water, and three NEMA23 motors (one motor for each vessel) to control the opening and closing of the vessels.

Figure 4.2 : the water bath with vessels

4.1.3 Moving Stage

The bowel moves on the production line using a car motor controlled by a driver, and the stopping of this vessel at the different stations is controlled using lasers and LDR module.

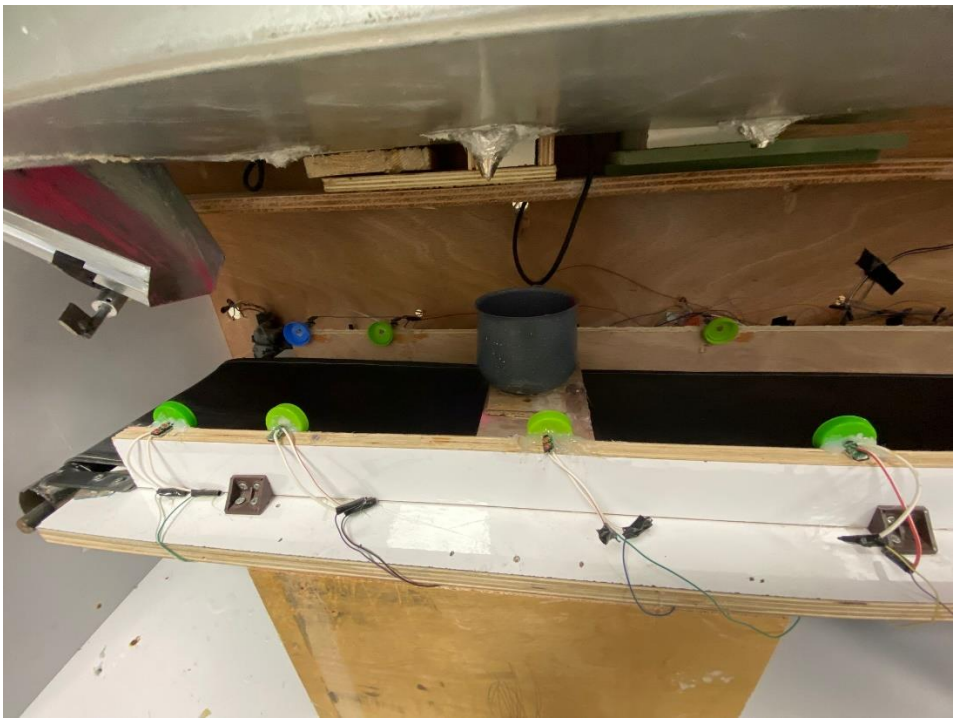

Figure 4.3: Lasers with LDRs and car motor

4.1.4 Payment Stage

The machine requires the customer to pay first so that he can then choose the color of his product to start the manufacturing process and produce the lip gloss.

We used the RFID to do this process.

Figure 4.4 : RFID

4.1.5 Choosing Color Stage

After the user has made the payment, he is required to enter the color of his product. We do this process using Keypad. After the user has entered his color, the process of dropping the colors designated for the color chosen by the customer into the bowl begins (we used RGB colors). The colors are placed in iron boxes and the opening and closing are controlled by servo motors.

A DC motor is used that is controlled by H-Bridge to create a vibration that helps the color to descend into the bowl.

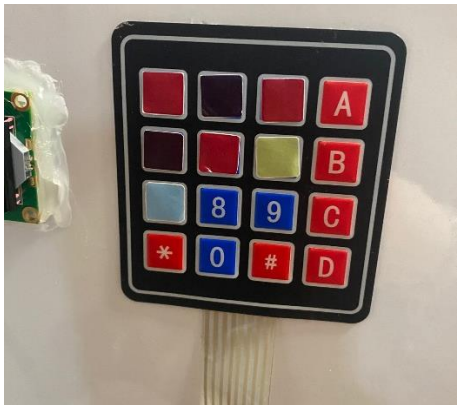

Figure 4.5 : Keypad

Figure 4.6 : Servo Motors

Figure 4.7 : RGB colors

Figure 4.8 : DC for vibration

4.1.6 Adding Ingredients Stage

Stage A

After choosing colors, the bowl moves to fill the basic materials which are Vaseline, Shea butter and coconut oil, which were previously placed in metal containers and heated. As mentioned earlier that the opening and closing of these outlets is controlled by a NEMA23 stepper motors. The bowl is filled with a certain percentage of the three basic materials and then continues on its way to the next stage.

Figure 4.9 : bowl is moving to fill basic materials using car motor.

Figure 4.10 : NEMA23 stepper motor with couplers.

Figure 4.11 : Screw connecting the coupler to the outlet.

Stage B

Adding Powder

The powder is added to the basic ingredients to help reduce the consistency of the oil (due to the large amount of oil added), and this is controlled using a servo motor.

Figure 4.12 : servo for Powder

4.1.7 Mixing Ingredients Stage

At this stage all the added ingredients are mixed using a mixer controlled by a DC motor and Relay, and another DC motor with H-Bridge to control the movement of the mixer from top to bottom and vice versa.

Figure 4.13 : The Mixer

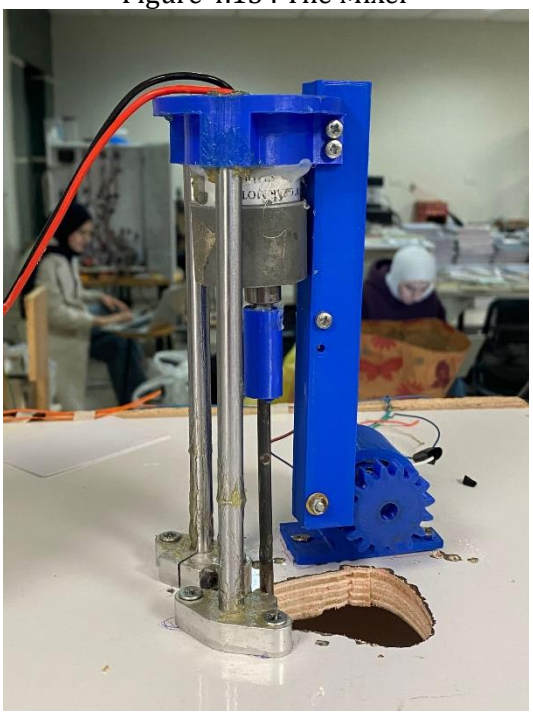

Figure 4.14 : mixer with DC motor

4.1.8 Casting Stage

At this stage, after the mixture is ready, it is poured into the can. A limit switch is used to know whether the mixture has reached the pouring station and to stop the movement of the bowl at the appropriate time for pouring. The presence of the can is also sensed in the appropriate pouring location by using a magnetic sensor, which in turn checks the presence of the can or not and stops the movement of the can, which is moved using a NEMA17 stepper motor, which is controlled using a driver. A Pouring syringe is also used to help in pouring into the can.

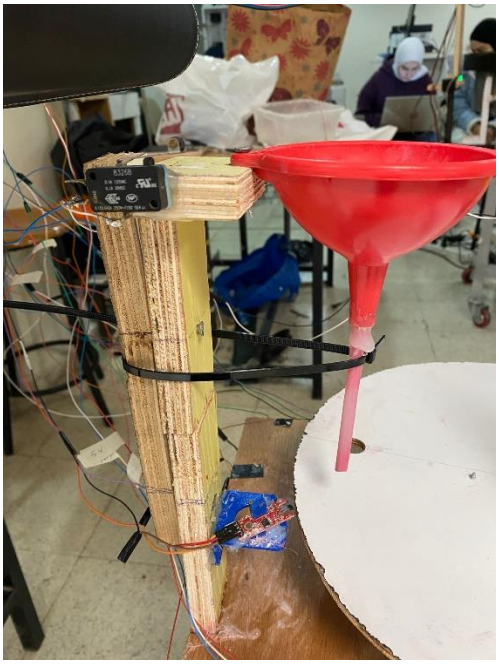

Figure 4.15 : Pouring syringe

4.1.9 Covering Stage

For the process of covering the box, the box covers were placed inside a tube, the descent of these covers is controlled by a servo motor, then the box moves until it reaches the stage of closing the cover tightly, a NEMA17 motor was used to control the ascent and descent to hold the box cover and close it tightly, and also a DC motor which in turn wraps the cover around the box to close it tightly, a special 3D printing was made to hold the box correctly and tightly close.

Figure 4.16 : tube for covers

Figure 4.17 : 3D printing with motors

4.2 Hardware components

4.2.1 Arduino Mega 250

The MEGA 2560 is designed for more complex projects. With 54 digital I/O pins, 16 analog inputs and a larger space for your sketch The Arduino Mega 2560 is a microcontroller board based on the ATmega2560[1]. It has 54 digital input/output pins (of which 15 can be used as PWM outputs), 16 analog inputs, 4 UARTs (hardware serial ports), a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller. We used it for the large number of inputs/outputs it has that we needed to get this project done. We basically connected most of the components on it like ESP32 , all the Motors (stepper ,Dc and servo) and drivers, ultra sonic sensor switches.[Arduino, 2024a].

Figure 4.18 : Arduino mega

4.2.2 ESP 32-microcontroller

The ESP32 is a versatile and widely-used microcontroller and Wi-Fi/Bluetooth system-on-chip (SoC) produced by Expressive Systems.
A SoC, is essentially an integrated circuit that takes a single platform and integrates an entire electronic system onto it, for an specific application. Contrary to a simple microcontroller (like Atmega324p Arduino Uno), that offers several general usage peripherals instead of a specific set of tools for one application. we used it to send commands between App inventor mobile application and the
Arduino created.[Arduino, 2024b].

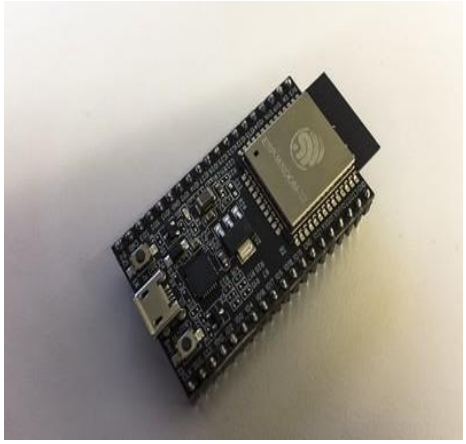

Figure 4.19 : esp32-microcontroller

4.2.3 Computer Power Supply

The desktop computer power supply converts the alternating current (AC) from a wall socket of mains electricity to a low-voltage direct current (DC) we used it to get 12 and 5 volt.

Figure 4.20 : power supply

4.2.4 Car Dc Motor

The car wiper motor is a slow but sturdy DC motor capable of bearing weight. We used it to control the movement of the bowl along the production line.

Figure 4.21 : car DC motor

4.2.5 DC Motor

we used 12-volt DC motor capable of operating at 1000 RPM (Power, 2022) used in the mixing stage.

Figure 4.22 : DC motor

4.2.6 BTS7960 Motor Driver

The BTS7960 stands as a highly integrated half-bridge module meticulously crafted to cater to the demands of high-current motor control applications. It proudly resides within the NovalithICTM family, housing a p-channel high-side MOSFET and an n-channel low-side MOSFET, together with an integrated driver IC, all compactly packaged as a single unit. used to run the car dc motor and the dc motor.

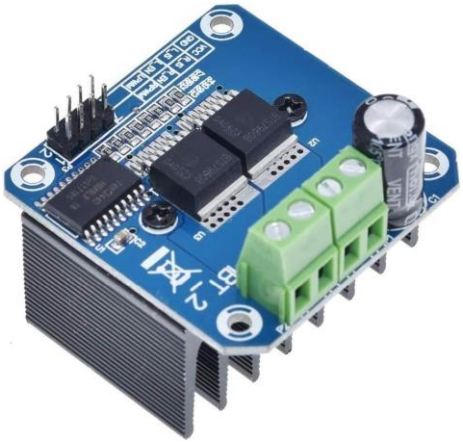

Figure 4.23: BTS7960

4.2.7 Servo Motor

The function of a servo motor is to control the position, speed, and torque of mechanical systems with high precision A servo motor operates by receiving a control signal that represents the desired output position and adjusting its motion accordingly we used it to as gate in order to control the dropping of
Ingredients.

Figure 4.24: servo motor

4.2.8 Nema 23 stepper Motor

NEMA 23 is a stepper motor with a 2.3×2.3 inch (58.4×58.5 mm) faceplate and 1.8° step angle (200 steps/revolution). Each phase draws 2.8 A at 3.2 V, allowing for a holding torque of 19 kg-cm. NEMA 23 Stepper motor is generally used in Printers, CNC machine, Linear actuators and hard drives. Used to control opening and closing the vessels.

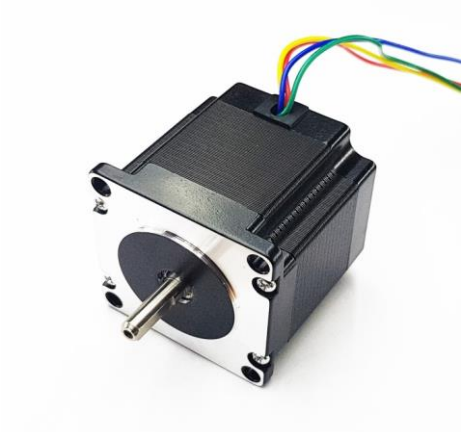

Figure 4.25: Nema 23 stepper motor

4.2.9 TB6600 Microstep Driver

we went with the TB6600 since it could handle the huge load which was required for our project. Unlike smaller drivers like an H-bridge, it proved much more efficient in handling the load accordingly.

Figure 4.26: TB6600 Microstep Driver

4.2.10 Limit Switch

Limit switches provide a straightforward and effective way to prevent a bowl from moving beyond its designated limits. When pressed, the car motor stops and the casting process begins.

Figure 4.27: Limit Switch

4.2.11 Relays

A relay is an electrically operated switch that allows a low-power control signal to control a higher-power circuit. used to control many dc motors.

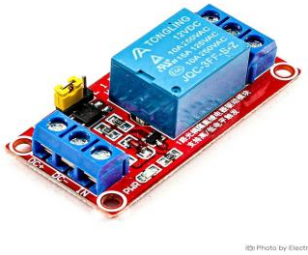

Figure 4.28: Relay

4.2.12 Intercom Wires

used to connect different components together.

Figure 4.29: Intercom Wires

4.2.13 Arduino Wires

To connect ICs to the Arduino.

Figure 4.30: Arduino Wires

4.2.14 DC Gearbox Motor

A DC gear motor is a combination of a DC motor and a gearbox. It works on the principle of electromagnetic induction, where a current-carrying conductor placed in magnetic fields, experiences a force and causes the rotation of the motor. Used for vibration and covering, in each it controlled using Relay.

Figure 4.31: DC Gearbox Motor

4.2.15 Nema 17 Stepper motor

A NEMA 17 stepper motor is a stepper motor with a 1.7 x 1.7 inch (43.18 x 43.18 mm) faceplate. The NEMA 17 is larger and generally heavier than for example a NEMA 14, but this also means it has more room to put a higher torque. However, its size is not an indication of its power. Used for covering and moving the can.

Figure 4.32: Nema 17 stepper motor

4.2.16 Keypad

Keypad is a library for using matrix style keypads with the Arduino. As of version 3.0 it now supports multiple keypresses. This library is based upon the Keypad Tutorial. It was created to promote Hardware Abstraction. It improves readability of the code by hiding the pinMode and digitalRead calls for the user .

Figure 4.33: Keypad

4.2.17 Lcd and I2c

An I2C LCD1602 consists of a normal LCD1602 and an I2C module that is attached to the back of the LCD. The I2C module is a chip that can expand the I/O ports of the Arduino using the I2C protocol. The I2C protocol is a serial communication protocol that uses two wires: SDA (serial data) and SCL (serial clock). Used to let the connection easier with the user.

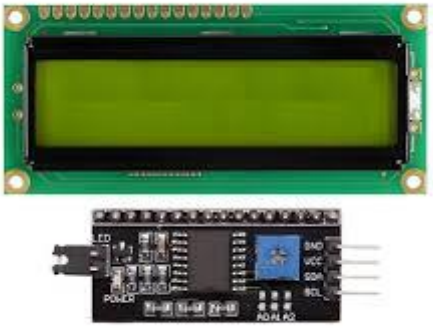

Figure 4.34: Lcd and I2c

4.2.18 RFID

RC522 is the highly integrated RFID card reader which works on non-contact 13.56mhz communication, is designed by NXP as low power consumption, low cost and compact size read and write chip, is the best choice in the development of smart meters and portable hand-held devices. Used to let the user pay and check the payment.

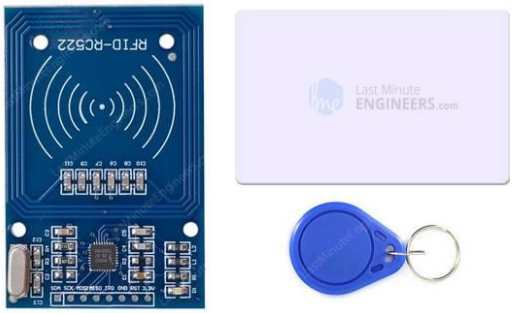

Figure 4.35: RFID

4.2.19 Magnetic sensor

A magnetic sensor is a sensor that detects the magnitude of magnetism and geomagnetism generated by a magnet or current. Used in the casting and covering stages.

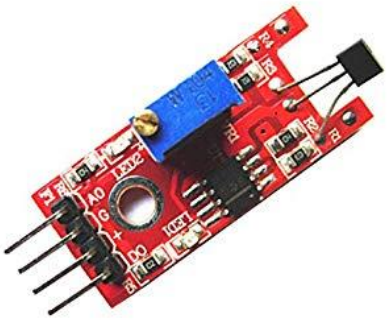

Figure 4.36: Magnetic sensor

4.2.20 LDR module

Light Dependent Resistor is as the name suggests a resistor that changes it's properties with the light's intensity. Used in movement stage.

Figure 4.37: LDR module

4.2.21 Laser

Used in movement stage.

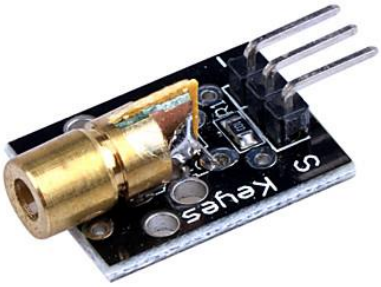

Figure 4.38: Laser

4.2.22 Heater

Figure 4.39: Heater

4.3 Website

A website is done using HTML, CSS, JS to let the user be able to choose his own color with the ability to see the color level before the manufacturing process begins.

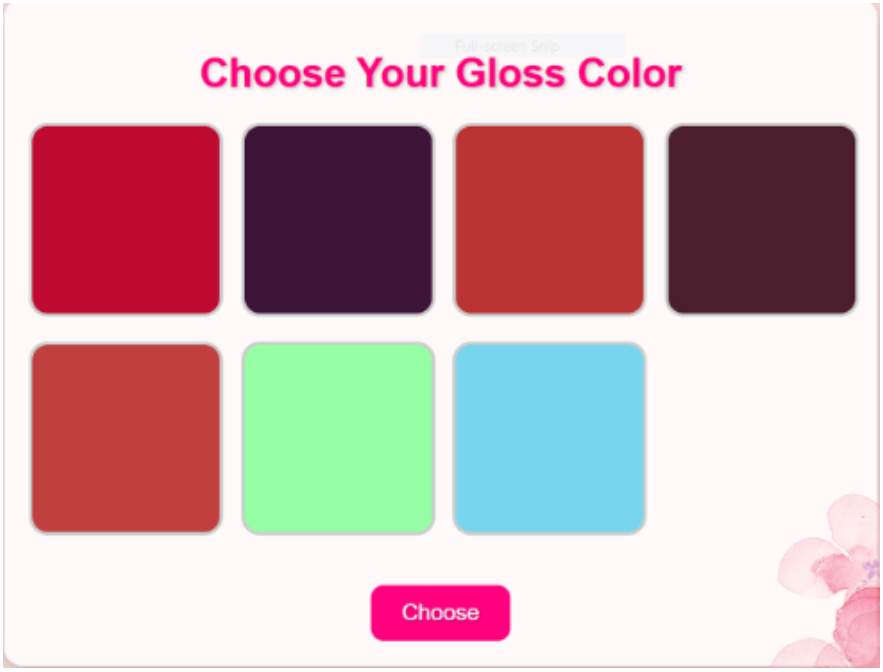

Figure 4.40 : Website

Chapter 5

Results and Dissection

We have succeeded in making a lip gloss product in an effective, fast and easy way for the customer, the customer was able to get his own lip gloss with the push of a button and without any effort from him. We are pleased with the outcome, having carried out the project as we initially desired.

Here are some of the problems we faced in making the lip gloss machine:

We faced a problem in dealing with coconut oil because it freezes quickly, in this cold weather it froze very quickly, which forced us to change the type of oil used to another type of coconut oil.

We faced a problem in the process of covering the product, we were not able to achieve what was required in our first attempt, but after several attempts we were able to create a method that suits our product and covers it well.

Figure 4.41 : The final result

Chapter 6

6.1 Conclusion

Based on Arduino and various motors, the Glow Gloss model is an example of how one machine could potentially automate every aspect of Lip Gloss making. It adds all the ingredients together and mixes them efficiently to get the right consistency. It also provides with enhanced convenience, safety and efficiency. The system is described as an example of automation against a backdrop where more machines are likely to be widely deployed in the makeup industry due to their adoption of the advantages that come with the application of digital technology, opening up other opportunities for the elements of the cosmetics industry.

6.2 Future work

- Increase the number of colors that the machine can make.
- The cleaning feature works and removes color residues in each process.
- Enabling the customer to choose specific proportions of colors to obtain the color he created by choosing those proportions (the color is the customer's responsibility).

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