Faculty of Information Technology

IN1901

Foot Relaxing Machine

Group No: 12

Index Numbers and Names:

214157F – A.R.S. Prathibhani

214040P – D.T.A. Wijesekara

214136P – H.S. Muthumala

214153N – W.S.C.Y. Indunilperuma

214191D – A.S.S. Sewwandi

Supervisor's Name: …Mr. Upulanka Premasiri……

Date of Submission: ..…2023-09-30.........

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Introduction

In today's modern workplaces, air-conditioned environments are the norm, providing a comfortable atmosphere for productivity. However, they also bring about specific challenges for employees, particularly in terms of physical discomfort.

Extended exposure to conditioned air in office settings often leads to physical discomfort, as employees frequently report sensations of numbness and enduring coldness in their legs and feet. This persistent chill, resulting from the air conditioning, can disrupt blood circulation and reduce overall sensitivity in the lower extremities. Simultaneously, the demands of heavy workloads and extended working hours contribute to elevated stress levels among employees, which can significantly impact their overall well-being in the workplace. Such stressors may lead to fatigue, reduced job satisfaction, and even health issues.

To address these multifaceted challenges, we have introduced a comprehensive solution: the Foot Massaging Machine. This innovative device offers an approach to enhance employee well-being. It provides soothing heat to the feet, alleviating coldness and enhancing blood circulation, thus reducing numbness. The machine also offers a relaxing foot massage, promoting stress relief and pain reduction. Additionally, it incorporates a pulse rate measurement feature to gauge the user's physiological response.

By implementing the Foot Massaging Machine, we prioritize both the physical and mental well-being of our employees, creating a more supportive and comfortable work environment. This proactive approach demonstrates our commitment to fostering employee satisfaction, productivity, and overall health, effectively addressing the challenges posed by modern office conditions.

Aim and Objectives

Aim:

To make a foot relaxing machine which gives a therapy to reduce numbness, pain and relax the legs.

Objectives:

1. Pain and Stress Relief of the Leg: The Foot Massaging Machine offers a soothing and effective solution to alleviate leg pain and reduce stress, enhancing overall well-being.

2. Numbness Reduction: Through targeted massage and heat, this machine combats numbness in the legs and feet, restoring sensation and comfort.

3. Heart Rate Monitoring: It includes an integrated heart rate monitor, providing users with real-time feedback on their physiological response during therapy sessions

4. Customizable Therapy: Users can tailor their massage experience, selecting from a range of settings to suit their unique preferences and needs.

5. Ease of Use: Designed with user-friendliness in mind, the machine offers a straightforward and intuitive interface for effortless operation and maximum convenience.

System Description

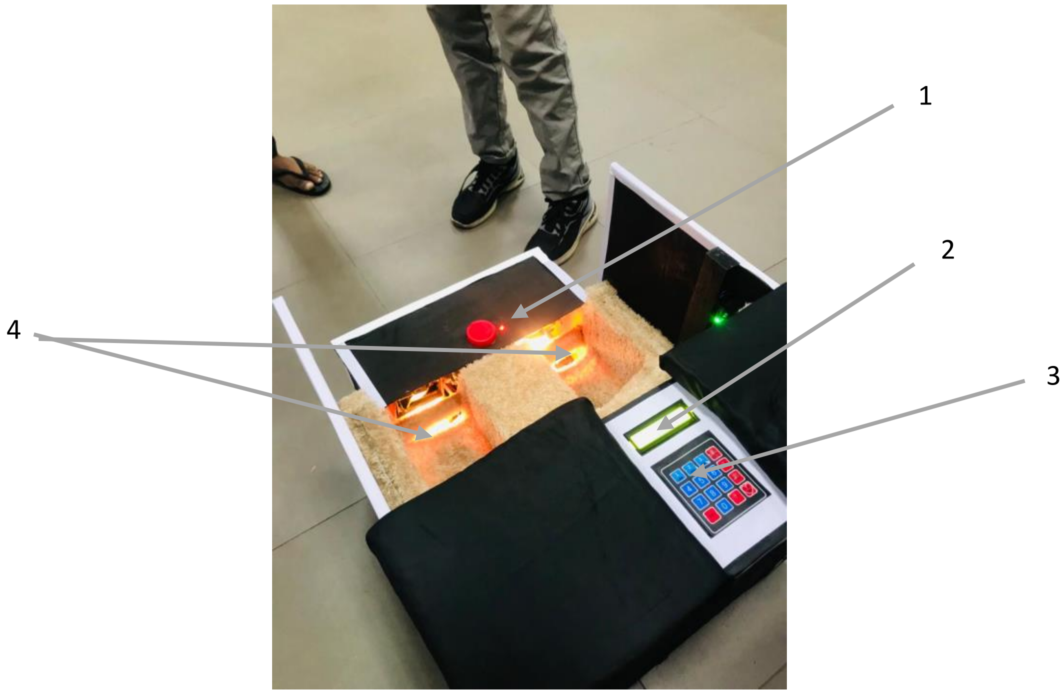

Figure 1.0

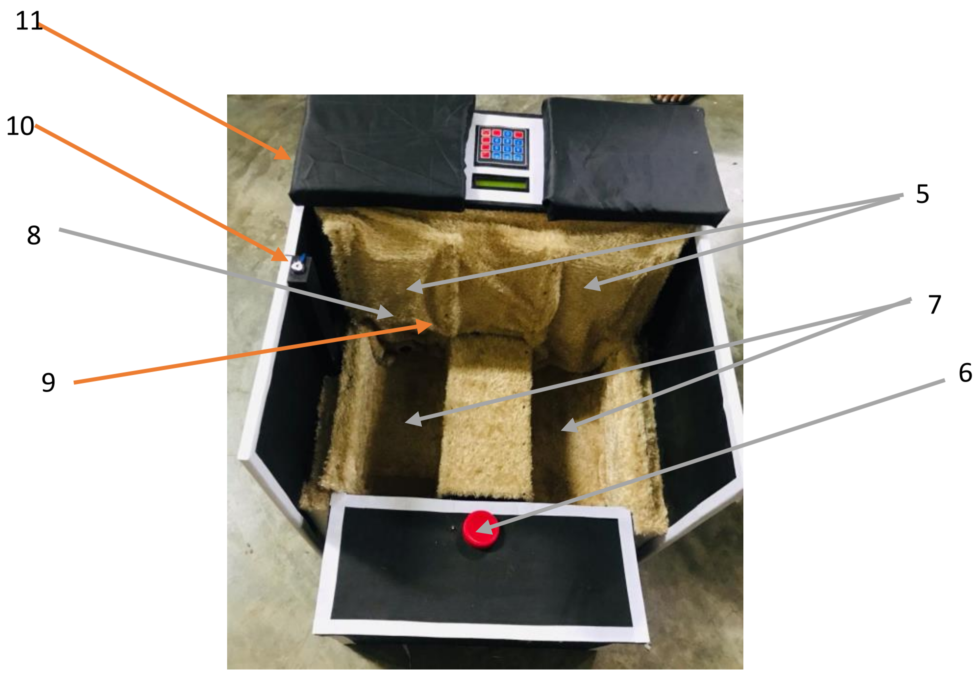

Figure 2.0

12

Figure 3.0

1)LED

2)LCD display

3)Key membrane

4)Heating fans with Filament bulbs

5)Calf muscles massaging pads

6)Pain relief spray liquid container with water level sensor

7) Feet massaging pads

8)IR sensor

9)Temperature sensor

10)Pulse sensor

11)Buzzer

12)Ultrasonic mist maker

To initiate the machine, users need to switch it on. When a user places their leg on the machine, an infrared (IR) sensor detects the presence of the leg. The machine is equipped with a temperature sensor that continually measures the temperature of the leg's environment, ensuring comfort and safety. The machine features an LCD display and a user-friendly key membrane. Users can start or stop the massage session by pressing the designated "Start/Stop" button. For added comfort, there is a "Fan On/Off" button. This allows users to activate or deactivate the heating fan during the massage. The heating fan provides warmth to the legs. Importantly, it's designed to automatically turn off when the temperature exceeds the average temperature value to prevent overheating. Users can opt for a pain relief liquid spray during the massage. There is a dedicated "Spray On/Off" button for easy control. For health-conscious users, the machine includes a "Heart Rate" button. This feature enables users to measure their heart rate in real-time while enjoying the massage, promoting a holistic approach to well-being during the therapy session.

IR sensor (FC-51)

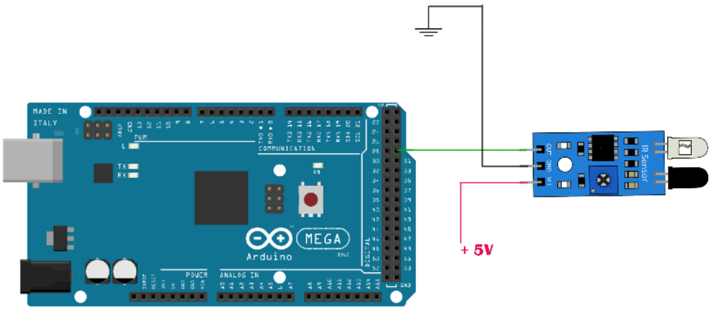

Figure 4.0

Absolute Maximum Ratings	Min	Typ	Max	Unit
Operating Temperature Range	-40		+85	°C
Input Voltage Range	3		5.5	V
Output Voltage Range	0.3	Vdd/2	Vdd	V
Supply Current	3		4	mA

Figure 4.1

The Foot Massaging Machine employs an Infrared (IR) sensor as its initial point of interaction. When a user approaches the machine and places their leg on the designated area, the IR sensor is activated.

Key membrane

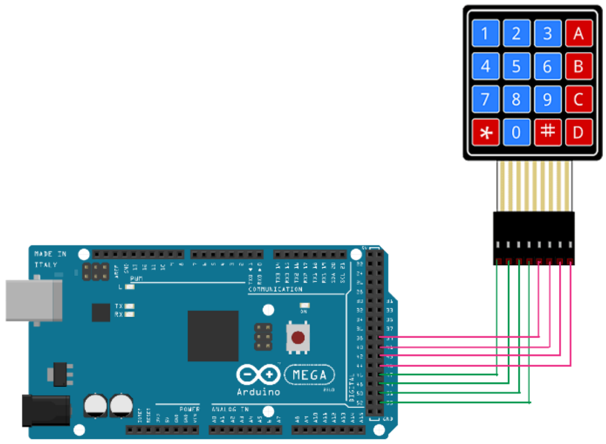

Figure 5.0

Start/Stop Button: Initiates, pauses, or stops the massage session, allowing users to set a 1-10 minute duration.

Fan On/Off Button: Controls the heating fan for foot warmth, offering on/off functionality.

Spray On/Off Button: Activates or deactivates leg spraying with a pain relief liquid during the massage.

Heart Rate Button: Measures pulse rate in real-time during the massage, promoting user well-being awareness.

A- Start/Stop

B-Fan on/off

C-Spray on/off

D-Heart rate

* -Delete

#-Ok

LCD display + I2C

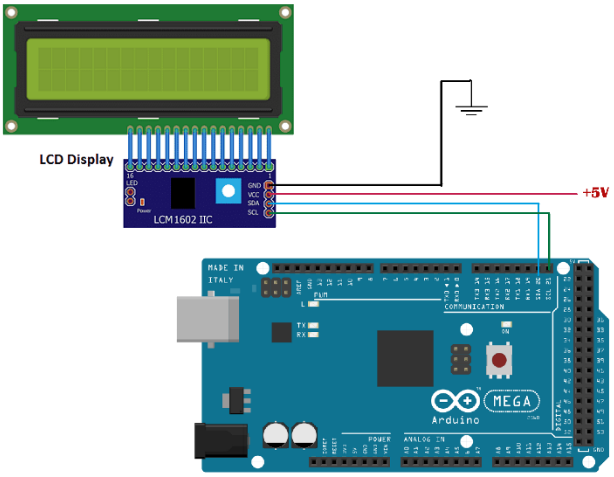

Figure 6.0

I2C is used to reduce the number of pins used by the Arduino Mega 2560.

LCD display is used to, Displays instructions and messages for user guidance, show user-selected settings and preferences and provide feedback on massage progress and system status, enhancing user interaction and understanding.

Water level sensor

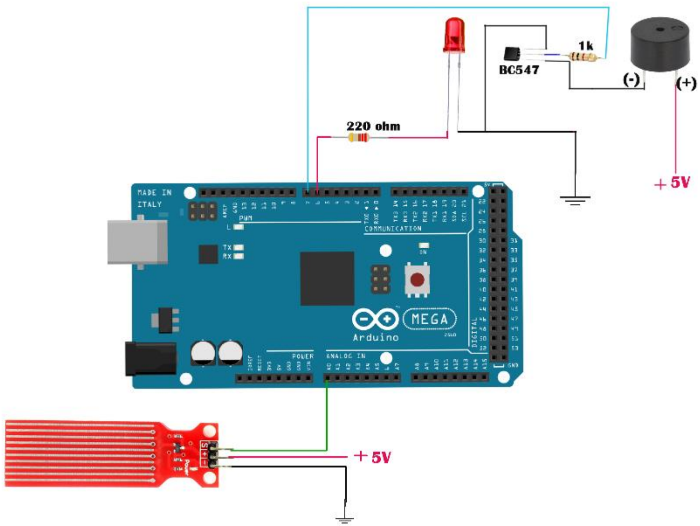

Figure 7.0

It continually monitors the pain relief liquid level, issuing a warning by blinking an LED if the liquid is low at the beginning of a session. Additionally, it acts as a safety feature, sounding a buzzer and blinking the LED to prevent the ultrasonic mist maker from activating when the container is empty. These functions ensure efficient liquid use and enhance user safety during operation.

Pulse Sensor

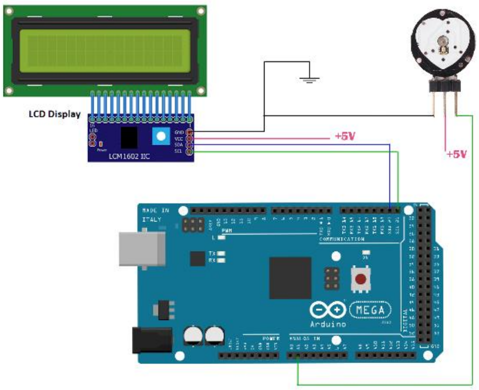

Figure 8.0

The pulse sensor integrated into the Foot Massaging Machine measures the user's pulse rate during the massage, providing real-time feedback on their physiological response to the therapy. This feature promotes a holistic approach to well-being by allowing users to monitor their heart rate while enjoying the massage, enhancing their overall experience and awareness of their physical condition.

Temperature sensor (DS18B20)

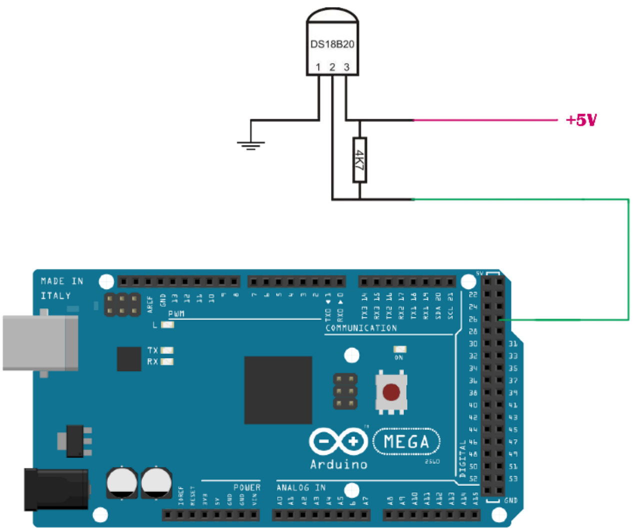

Figure 9.0

Power Supply	3V to 5.5V
Current Consumption	1mA
Temperature Range	-55 to 125°C
Accuracy	±0.5°C
Resolution	9 to 12 bit (selectable)
Conversion Time	< 750ms

Figure 9.1

It continuously monitors the temperature around the user's leg. If the temperature drops below 18 degrees Celsius, indicating discomfort, the system automatically activates the heating fan. This fan works to warm the leg area, enhancing the user's comfort. Once the temperature reaches the optimal range of 25-30 degrees Celsius, as determined by the sensor, the heating fan is automatically turned off. This intelligent temperature regulation system ensures that users enjoy a consistently comfortable and therapeutic experience during their massage sessions.

Motors

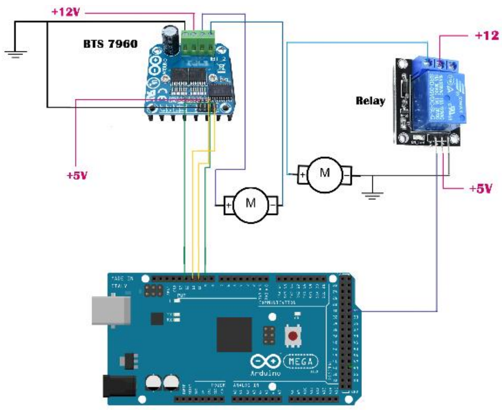

Figure 10.0

Calf massaging is done by the upper two paddals of the machine. And it works according to the signals given to the relay module. By the signals of relay the motor starts its motion .due to the force of the motor the axel rotates and the paddels starts its rhythmic motion. For proper massaging shape of paddel and carpet used to surface is important.for this we used back glass wiper motor of 60rpm hense it’s a gear motor high torque can be loaded. Motor and axel connected together with chain and two wheels.

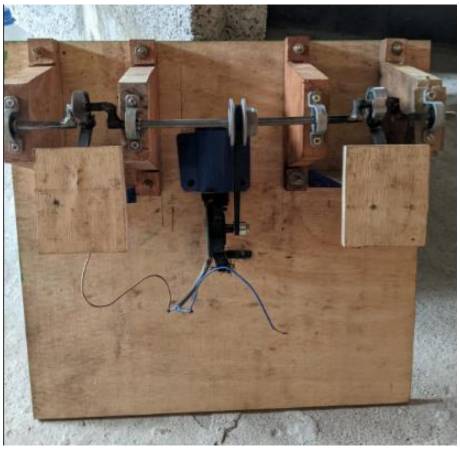

Figure 10.1

For foot massaging same method was used and to load extreamly high weight wiper motor of a front glass is used. to control the speed BTS 7960 motor driver is used . According to the signals given to motor driver axel that fixed massaging paddle's starts there motion.Ball bearings are used to make the motion more smoother. And after signal ends motor stops its motion.

Figure 10.2

Then after structure is as follows

Figure 10.3

Figure 10.4

Heating fans with filament bulb

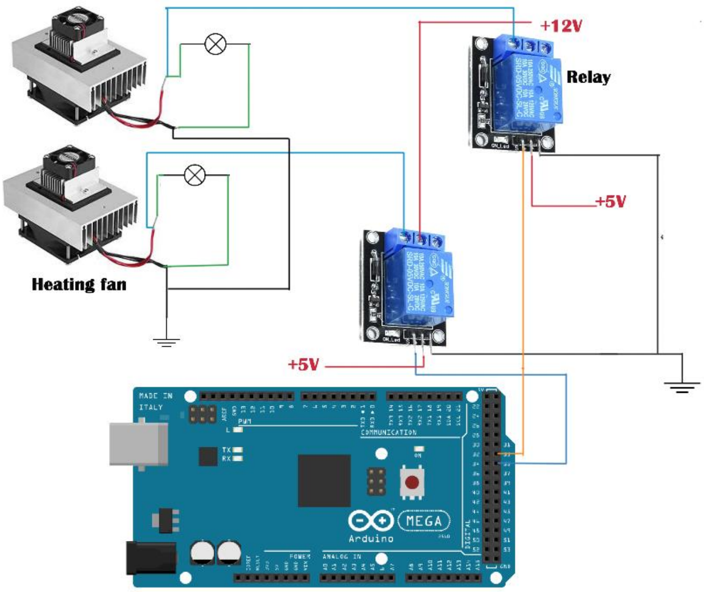

Figure 11.0

The Foot Massaging Machine features a heating system that includes both heating fans and a filament bulb to warm the user's feet during the massage. The system is designed to maintain a comfortable temperature within a specific range. If the temperature reaches the maximum desired value, the machine's intelligent control system automatically turns off both the heating fans and the filament bulb.

Figure 11.1

Ultrasonic mist maker

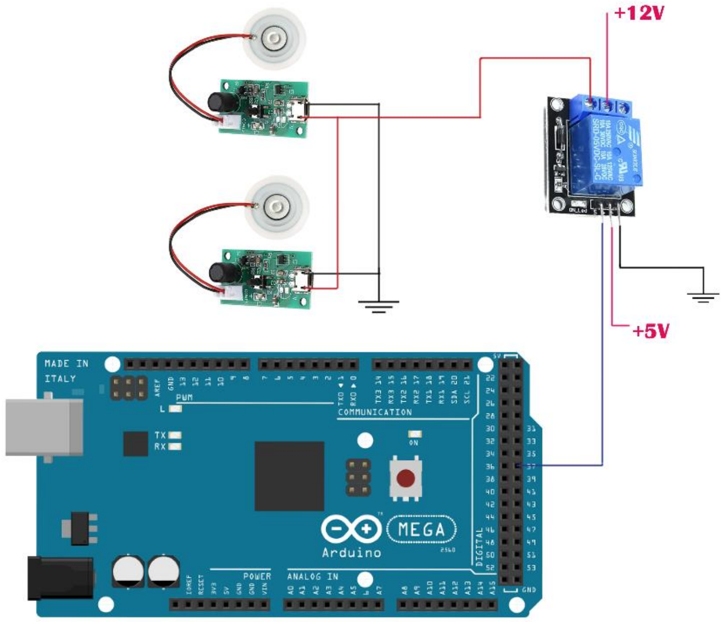

Figure 12.0

- Diameter: 20mm
- Operating Voltage: 3.7 – 12V
- Frequency: 113kHz
- Quiescent Capacitor: 3000PF
- Rated Power: 2.5W

Figure 12.1

This mist maker is responsible for spraying the pain relief liquid onto the user's feet during the massage session.

Testing and implementation

In the testing and implementation phase, the individual initially constructed and tested circuitry using a breadboard and jumper wires. Subsequently, used Proteus, a simulation software, to refine and assess the electronic components virtually. This dual approach ensured a comprehensive testing process, contributing to the successful implementation of the Foot Massaging Machine's electronics.

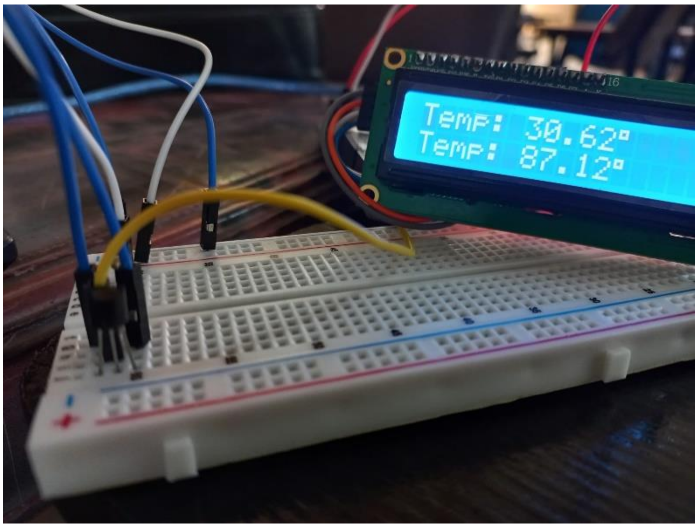

Figure 13.0

Figure 13.1

Block Diagram

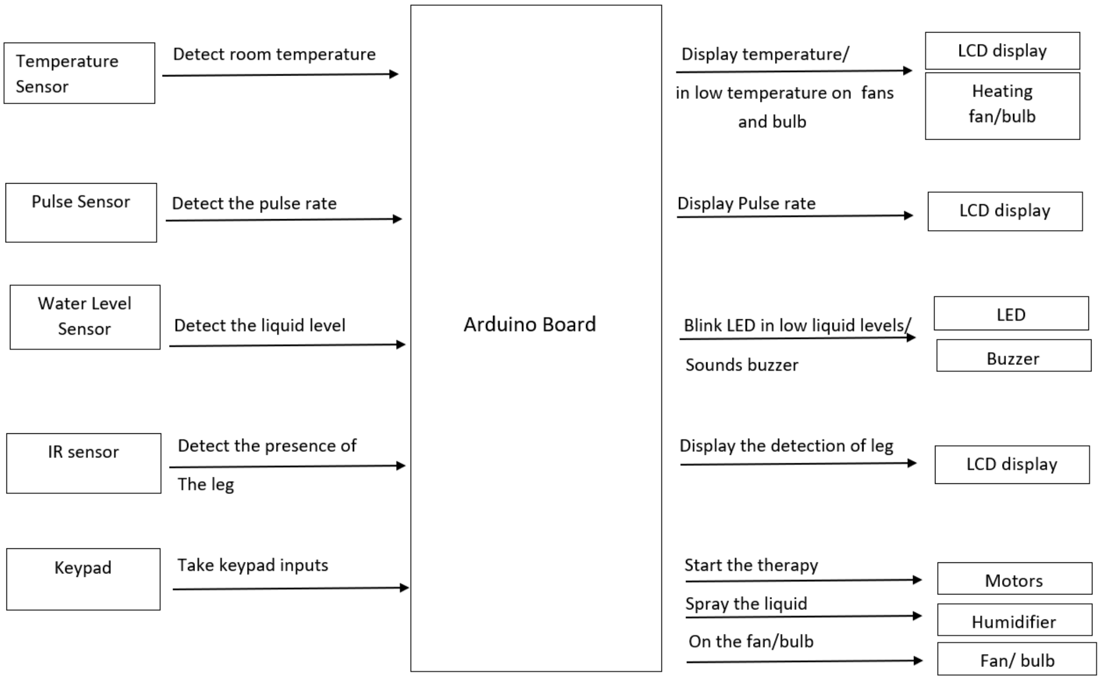

Figure 14.0

Source code

```
#include <Wire.h>
#include <LiquidCrystal_I2C_Hangul.h>
#include <Keypad.h>
#include <OneWire.h>
#include <DallasTemperature.h>


// LCD DisplY
LiquidCrystal_I2C_Hangul lcd(0x3F,16,2);  // set the LCD address to 0x3F for a 16 chars and 2 line display

#define WaterLevelSensorPin A0
#define irSensorPin 29 // IR Sensor pin 29
#define ONE_WIRE_BUS 27  // temperature sensor pin 27
OneWire oneWire(ONE_WIRE_BUS);
// Pass oneWire reference to DallasTemperature library
DallasTemperature sensors(&oneWire);

#define spray 37                        //relay 1
#define fan1 35                       //relay2
#define fan2 33                     //relay 3
#define motor 31                  //relay4
#define WaterLevelLedpin 6
#define buzzerPin 7


int const PULSE_SENSOR_PIN = A1;

int Threshold = 700;
int Signal;
int bpm;

int r_en = 10;
int l_en = 9;
//Use PWM pins
int r_pwm = 11;
int l_pwm = 12;
int pwm=180;

// Variables
boolean legDetected = false;
boolean fanOn = false;
boolean motorOn = false;
boolean sprayOn = false;
boolean buzOn = false;

int Wlevel = 0;
```

```
String inputString;
int inputInt;
int timepoint = 14;


unsigned long fanStartTime = 0;
unsigned long sprayStartTime = 0;
unsigned long massageStartTime = 0;
unsigned long legRemovedTime=0;


int fanDuration =2;
int massageDuration;
int sprayDuration=1;


const uint8_t ROWS = 4;
const uint8_t COLS = 4;
char keys[ROWS][COLS] = {
  { '1', '2', '3', 'A' },
  { '4', '5', '6', 'B' },
  { '7', '8', '9', 'C' },
  { '*', '0', '#', 'D' }
};

byte colPins[COLS] = {47,49,51,53 }; // Pins connected to C1, C2, C3,
C4
byte rowPins[ROWS] = {39,41,43,45}; // Pins connected to R1, R2, R3, R4

Keypad userKeypad = Keypad(makeKeymap(keys), rowPins, colPins, ROWS,
COLS);

void setup() {

  pinMode(irSensorPin, INPUT);
 // pinMode(PULSE_SENSOR_PIN,INPUT);
  pinMode(WaterLevelLedpin,OUTPUT);


  pinMode(fan1,OUTPUT);
  pinMode(fan2,OUTPUT);
  pinMode(motor,OUTPUT);
  pinMode(spray,OUTPUT);


  pinMode(r_en, OUTPUT);
  pinMode(l_en, OUTPUT);
  pinMode(r_pwm, OUTPUT);
  pinMode(l_pwm, OUTPUT);



  lcd.init();
  lcd.clear();
  lcd.backlight();      // Make sure backlight is on

```

```
  lcd.setCursor(2,0);    //Set cursor to character 3 on line 0
  lcd.print("Foot Massager");    // Print initial messages on the LCD
  delay(2000);
  lcd.clear();
  lcd.setCursor(0,0);
  lcd.print("Place Leg on");
  lcd.setCursor(0,1);
  lcd.print("the machine");

  sensors.begin(); // Start up the DallasTemperature library

}

void loop() {
  //Check if leg is detected by IR sensor
  //irSensorValue = digitalRead(irSensorPin);
  if((!legDetected && fanOn) || (!legDetected && motorOn) ||
(!legDetected && sprayOn)){
  if(millis()-legRemovedTime>3000){
    digitalWrite(fan1,LOW);
    digitalWrite(fan2,LOW);
    digitalWrite(motor,LOW);
    digitalWrite(r_en, LOW);
    digitalWrite(l_en, LOW);
    digitalWrite(spray,LOW);
    fanOn=false;
    motorOn=false;
    sprayOn=false;
  }
  }

  if (digitalRead(irSensorPin) == LOW) {
    if (!legDetected) {
      legDetected = true;
      lcd.clear();
      lcd.print("Leg Detected");
      delay(1000);
      lcd.clear();

    }else{

    }
    char key = userKeypad.getKey();

      if(key=='A'){
        if(motorOn){
          digitalWrite(motor,LOW);
          stopMassage();
          lcd.clear();
          buzAlert();
        }else{
          massageStartTime=functionalKeyA();
        }

      }
      if(key=='B'){
        if(fanOn){
          digitalWrite(fan1, LOW);
```

```
        digitalWrite(fan2,LOW);
        fanOn=false;
        buzAlert();
      }else{
        fanStartTime=functionalKeyB();
        Serial.print("fan start");
      }

    }
    if(key=='C'){
      if(sprayOn){
        digitalWrite(spray,LOW);
        sprayOn=false;
        buzAlert();
      }else{
        if(buzOn){
          buzOn=false;
        }else{
          sprayStartTime=functionalKeyC();
        }
      }

    }

    if(key=='D'){
      lcd.clear();
      lcd.print("Reading Pulse....");
      delay(1000);
      readPulse();
      delay(1000);
      lcd.clear();
    }

    //check whether the liquid is filled
     Wlevel = readWaterLevelSensor();

      if(Wlevel<500){
        digitalWrite(WaterLevelLedpin,HIGH);

      }else{
        digitalWrite(WaterLevelLedpin,LOW);
        buzOn=false;
      }

    int temperature = getTemperature();
    displayTemperature(temperature);

      if(temperature<=20){
      //heating fan on
        digitalWrite(fan1,HIGH);
        digitalWrite(fan2,HIGH);
        buzAlert();

      }else if(temperature>40){
        digitalWrite(fan1,LOW);
        digitalWrite(fan2,LOW);
        buzAlert();
      }
```

```
      // Measure and display pulse rate
   //    readPulse();

  delay(20);


  if(fanOn){
    if(millis()-fanStartTime>=(fanDuration*60000)){
      digitalWrite(fan1,LOW);
      digitalWrite(fan2,LOW);
      fanOn=false;
      buzAlert();
    }

  }

  if(sprayOn){
    if(millis()-sprayStartTime>=(sprayDuration*60000)){
      digitalWrite(spray,LOW);
      sprayOn=false;
      buzAlert();
    }

  }
  if(motorOn){
    if(millis()-massageStartTime>=(massageDuration*60000)){
      digitalWrite(motor,LOW);
      stopMassage();
      lcd.clear();
    }

    int leftTime = massageDuration- ((millis()-
massageStartTime)/60000);
    lcd.setCursor(0,1);
    lcd.print("Time left : ");
    lcd.setCursor(12,1 );
    lcd.print(leftTime);
    lcd.setCursor(13,1);
    lcd.print("mins");

  }
   if(buzOn){
    // digitalWrite(buzzerPin,HIGH);
     lcd.clear();
     lcd.print("Add liquid !");
     analogWrite(buzzerPin,  20);
     delay(400);
     digitalWrite(buzzerPin,LOW);
   }

  }else {
    if (legDetected) {
      legRemovedTime = millis();
      legDetected = false;
      lcd.clear();
```

```
      lcd.print("Place Leg on");
      lcd.setCursor(0, 1);
      lcd.print("the Machine");

    }
  }

}
int getTemperature(){
  sensors.requestTemperatures();        // Send the command to get
temperatures
  int temperatureC = sensors.getTempCByIndex(0);  // Read the
temperature in Celsius
  delay(500);
  return temperatureC;
}

//display temperature
void displayTemperature(int temperature) {
  lcd.setCursor(0, 0);
  lcd.print("Temp:");
  lcd.print(temperature, 1);
  lcd.print((char)223);
  lcd.print("C");
}

//display pulse
void readPulse()
{
  delay(1000);
  while(Signal<Threshold){
    Signal = analogRead(PULSE_SENSOR_PIN);
  }

  if(Signal>Threshold){
    bpm = 60000/Signal;
      lcd.clear();
      lcd.print("Heart Rate:");
      lcd.setCursor(0,1);
      lcd.print(bpm);
      lcd.setCursor(4,1);
      lcd.print("BPM");
      //lcd.display(bpm);
      delay(1000);
  }else{
    lcd.clear();
    lcd.print("Finger not detected");
    delay(1000);
  }
  Signal=0;
}


//check liquid level
int readWaterLevelSensor() {
  int wlevel = analogRead(WaterLevelSensorPin);   // Read the analog
value form sensor
  return wlevel;              // send current reading
```

```
}


void startMassage(){
  digitalWrite(r_en, HIGH);
  digitalWrite(l_en, HIGH);
  //RPM in forward and backward
  analogWrite(r_pwm, pwm);
  analogWrite(l_pwm, 0);

  motorOn=true;
  buzAlert();
}

void stopMassage(){
  digitalWrite(r_en, LOW);
  digitalWrite(l_en, LOW);
  motorOn=false;
  lcd.clear();
  buzAlert();
}

void buzAlert(){
    analogWrite(buzzerPin,  20);
    delay(400);
    digitalWrite(buzzerPin,LOW);
}

unsigned long functionalKeyA(){
        lcd.clear();
        lcd.setCursor(0, 0);
        lcd.print("Massage Time: ");
        char key;

        do{
            key = userKeypad.getKey();

          lcd.setCursor(14,0);
          if(key=='*'){
            inputString="";
             lcd.clear();
             lcd.print("Massage Time: ");
             lcd.setCursor(14,0);
          }
          if (key >= '0' && key <= '9' && inputString.length()<2)
{      // only act on numeric keys
            inputString += key;
            lcd.print(inputString);
                        // append new character to input string
          }
        }while (key!='#');  // while key!='#' i put this when the # is
not working

        lcd.setCursor(14,0);
        lcd.print(inputString);
        delay(1000);
```

```
        lcd.clear();

        if (inputString.length() > 0) {
        inputInt = inputString.toInt();// YOU GOT AN INTEGER NUMBER
        inputString = "";                  // clear input
        }else{
          inputInt=0;
        }

        if(inputInt<=15 ){
        lcd.clear();
        do{
          lcd.setCursor(0, 0);
          lcd.print("Select the Speed");
          key = userKeypad.getKey();
        }while ((key!='1') && (key!='2') && (key!='3'));

         if(key=='1'){
             pwm=180;
         }else if(key=='2'){
             pwm=200;
         }else if(key=='3'){
             pwm=220;
         }
         massageDuration=inputInt;
         digitalWrite(motor,HIGH);
         startMassage();
         lcd.clear();
         lcd.print("massaging");
         delay(1000);
        }else{
          functionalKeyA();
        }
return millis();
}

unsigned long functionalKeyB(){
            digitalWrite(fan1,HIGH);
            digitalWrite(fan2,HIGH);
            buzAlert();
            fanOn=true;
            return millis();
}

unsigned long functionalKeyC(){

        if(Wlevel>500){
          //spray on
          digitalWrite(spray,HIGH);
          buzAlert();
          sprayOn=true;
        }else{
           buzOn=true;
           lcd.clear();
           lcd.print("Add liquid !");
           delay(1000);
           lcd.clear();
        }
```

```
            Serial.print("spray on/off");
return millis();
}
```

Individuals Contribution to the Project

A.R.S. Prathibhani - 214157F

- Code integration, testing, and debugging
- PCB design
- Heating fan with peltier module
- Coordinating the whole project
- Making Structure of the machine

PCB Design

EASYEDA software is used to design the PCB. It is a single layer design.

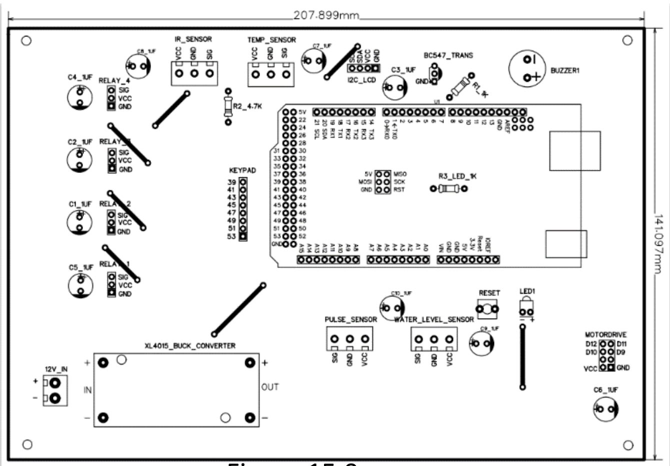

Figure 15.0

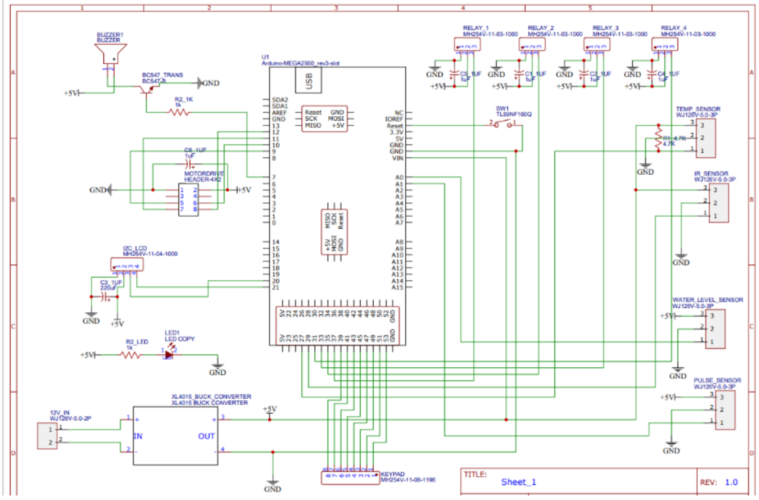

Figure 15.1

Heating Fan Unit

The custom-designed heating units, intended for enhancing the leg massage experience, are built around a combination of key components: a Peltier module, two heating fans, and two heat sinks. The Peltier module, employing thermoelectric principles, serves as the core element, generating heat to warm the targeted leg areas effectively.

Complementing the Peltier module, the two heating fans facilitate optimal temperature control and uniform heat distribution throughout the massage session. Their role is crucial in ensuring that the warmth is evenly dispersed, enhancing the overall comfort and therapeutic benefits for the user.

To regulate and manage excess heat generated during operation, we've integrated two heat sinks into the design. These heat sinks play a pivotal role in maintaining an optimal operating temperature, preventing overheating, and ultimately prolonging the operational life of the heating unit.

By combining these components synergistically, our heating units aim to elevate the massage experience by providing a soothing and comforting warmth to the legs. Additionally, this targeted heating helps alleviate coldness and numbness in the legs, promoting a more effective and rejuvenating massage therapy session.

Hot Side Temperature (° C)	25° C	50° C
Qmax (Watts)	50	57
Delta Tmax (° C)	66	75
Imax (Amps)	6.4	6.4
Vmax (Volts)	14.4	16.4
Module Resistance (Ohms)	1.98	2.30

Figure 15.2

The above table shows the surface temperatures of the peltier module.

D.T.A. Wijesekara - 214040P

- Study and implement the process of water level sensor
- Study and implement the process of wiper motors
- Design the structure
- Completing the PCB
- Preparing final report and presentation

In the Foot Massaging Machine project, the individual took the initiative to conduct thorough studies and successfully implemented the water level sensor, ensuring its seamless integration into the machine's design. The sensor assumed a critical role in monitoring the pain relief liquid's level within its container, preventing the mist maker from operating when the container was empty and issuing alerts when the liquid level dropped too low.

Furthermore, this individual's focus extended to the study and implementation of the wiper motors, which are fundamental components of the massaging process. Their diligent efforts ensured the motors were seamlessly integrated into both the hardware and software of the machine, facilitating the generation of the required mechanical movements for the massage.

Moreover, active participation was observed in the design phase of the machine's structure. The individual meticulously planned the placement of components and considered ergonomics to enhance user comfort. Lastly, their contributions extended to the completion of the PCB, a pivotal step in guaranteeing the machine's functionality and reliability.

Collectively, the individual's contributions spanned a wide range of essential tasks, encompassing sensor implementation, structural design, motor integration, and PCB development, all of which played a significant role in the successful realization of the Foot Massaging Machine project.

H.S. Muthumala - 214136P

- Study and implement the process of Temperature sensor (DS18B20)
- Study the LCD display and keypad
- Preparing the final report and presentation
- Testing and debugging program
- Making the structure of the machine

In the Foot Massaging Machine project, the individual assumed the responsibility of implementing the temperature sensor (DS18B20), a critical component vital for precise temperature monitoring around the user's legs during the massage. Their role included a thorough study of the DS18B20 sensor and its seamless integration into both the machine's hardware and software architecture. This sensor played a crucial role in ensuring a safe and comfortable massage experience. If the temperature fell below a specific threshold, the system automatically activated heating elements, providing warmth to enhance user comfort. Conversely, when the temperature reached the optimal range, typically between 25 to 30 degrees Celsius, the sensor signaled the system to deactivate the heating elements, preventing overheating. The individual's contributions were instrumental in implementing and fine-tuning this temperature regulation system, significantly impacting the overall functionality and user experience of the Foot Massaging Machine.

Additionally, their focus extended to the LCD display's functionality, ensuring effective communication with users by conveying messages, displaying user inputs, and presenting system outputs in a clear and intuitive manner. This understanding was pivotal in providing users with guidance during their massage sessions and enhancing their control over the machine's settings.

Simultaneously, the individual directed their efforts toward comprehending the keypad interface, commonly referred to as the key membrane. Their thorough understanding of this interface's design and operation was essential, as it allowed users to input preferences such as massage session duration and control various machine functions.

W.S.C.Y.I. Peruma - 214153N

- Study and implement the process of IR sensor
- Study the mechanism and structure
- Design the structure
- Making the massage spray
- Preparing the report and presentation

In the Foot Massaging Machine project, the individual initiated a comprehensive study and implementation of the IR (Infrared) sensor as a critical component of the machine's design. Their dedication to understanding the principles and functioning of the IR sensor was crucial, given its role as the initial point of interaction with the user. This sensor detected the presence of the user's leg, thereby triggering various machine components and functionalities.

Furthermore, the individual actively immersed themselves in the examination of the machine's overall mechanism and structure. This entailed a thorough assessment of the components and their interconnections, ensuring the efficient operation of the massage system. Their focus on comprehending the machine's structure played a pivotal role in optimizing its performance.

As part of their contributions, the individual also played an integral role in the design phase, making significant contributions to the structural layout and organization of the Foot Massaging Machine. This involved meticulous planning for the placement of components, with a keen eye on user accessibility and ergonomic design, all aimed at enhancing user comfort and satisfaction.

Additionally, the individual assumed a key role in the development of the massage spray mechanism, ensuring its effective functioning in dispersing the pain relief liquid onto the user's feet during the massage session. Their contributions extended beyond technical aspects to encompass considerations of safety and an enhanced user experience.

A.S.S. Sewwandi - 214191D

- Study and implement the process of Pulse sensor
- Study and make the Ultrasonic mist maker
- Preparing the final report and presentation
- Making the structure
- Program testing

In the course of the Foot Massaging Machine project, the individual embarked on a learning journey, beginning with mastering the Arduino software and comprehending the intricacies of a pulse sensor. This sensor, typically clipped to the fingertip or earlobe, was carefully integrated with the microcontroller and LCD display using jumper wires. The front side of the sensor featured a heart symbol and a small hole from which an LED light emanated. On the back side, there was a square housing a light sensor. The working principle involved the LED light penetrating the fingertip or earlobe, with the sensor subsequently capturing the light's reflection. To measure the user's heart rate, the sensor was strategically placed externally on the machine structure, ensuring accurate readings.

Initially, the individual embarked on a quest to find suitable code for the pulse sensor, specifically the hw827 model. Achieving precise measurements with hw827 proved challenging, and multiple pulse sensors were experimented with. Eventually, the hw827 was chosen due to its superior accuracy. Subsequently, the pulse sensor was affixed atop the machine to monitor the user's heart rate during usage, with real-time pulse rate data displayed on the LCD display.

As part of the project's development, the individual played a pivotal role in implementing an ultrasonic mist maker module designed to disperse pain relief liquid onto the user's feet during the massage session. This innovative module significantly enhanced the relaxation of the user's legs during the foot massage. To grant users control over this feature, a relay module was seamlessly integrated into the system, linked to an on/off button on the keyboard interface. This user-friendly customization added an element of luxury and comfort to the foot massage experience, enhancing overall satisfaction and relaxation for users.

Budget Allocation

Item	Cost
Arduino Mega board	5800
Viper motors	4600
LCD display	310
Wires	1250
I2C module	450
BTS7960 motor driver	1600
keypad	450
Water level sensor	110
Heart rate sensor	850
IR sensor	250
DS18B20 temperature sensor	130
Gt2 belt and 2 pulleys	600
typing chain and 2 cog wheels	500
Solder wire	450
4 Relays	720
Multibond	300
bearing	2000
4 DC fans	2000
Buck converter XL4015	420
2 Peltier modules	3000
Buzzer	150
Silicon glue	500
iron	2800
Wood board	2000
nails	850
Power unit 12V/20A	2700
PCB	2700
Capacitors/Pin headers/Terminals... etc.	650
Thermal paste	200
Plug point+wire	570
cloth	700
bulbs	200
Sanding papers	300
Others	3500
Total	**39860**

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