FOOT RELAXING MACHINE

IN1901-Microcontroller Based Application Development Project

IT - Group No 12

INTRODUCTION

This foot relaxing machine can reduce,

- **Numbness in legs**
- **Coldness of the legs**
- **Stress and monotonous**

Identify,

- **Heart rate**

PROBLEM IN BRIEF

- **Working in AC may cause numbness in the legs , and feel too cold.**
- **Sitting for a long time period may result in poor blood circulation.**
- **High workload leads to stress**

SOLUTION

- **Switch on the heating fans when the room temperature goes down**
- **Using a pulse sensor measure the pulse rate**
- **Having proper therapy releases stress and reduces numbness.**

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

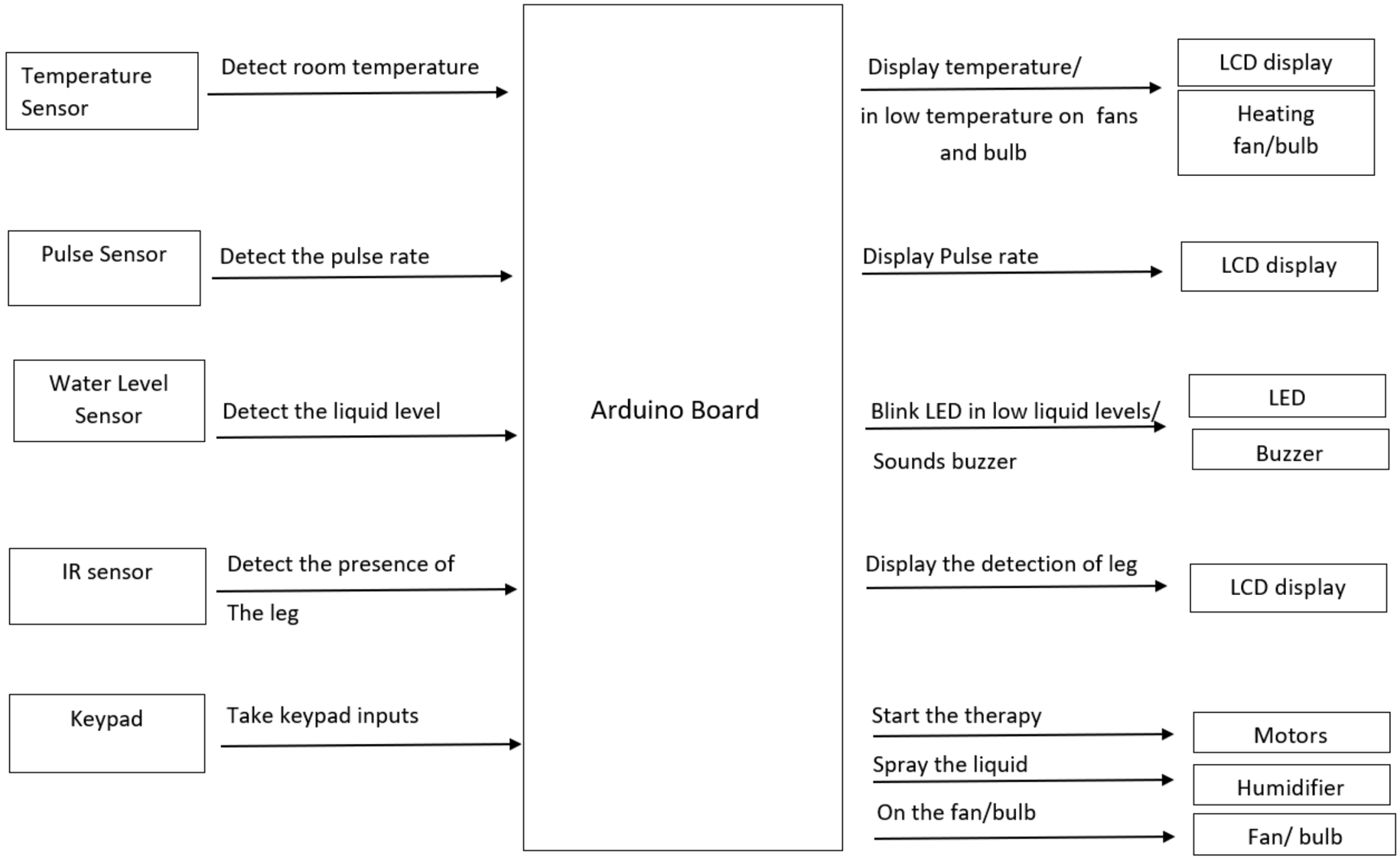
2) Numbness Reduction

3) Heart rate Monitoring

4) Customizable Therapy

5) Ease of Use

SOLUTION (Block Diagram)



TESTING & IMPLEMENTATION

INDIVIDUAL CONTRIBUTION

OUR TEAM

Member 01
A.R.S. Prathibhani
(The Leader)

Member 02
D.T.A. Wijesekara

Member 03
W.S.C.Y. Indunilperuma

Member 04
H.S. Muthumala

Member 05
A.S.S. Sewwandi

214157F - A.R.S. PRATHIBHANI

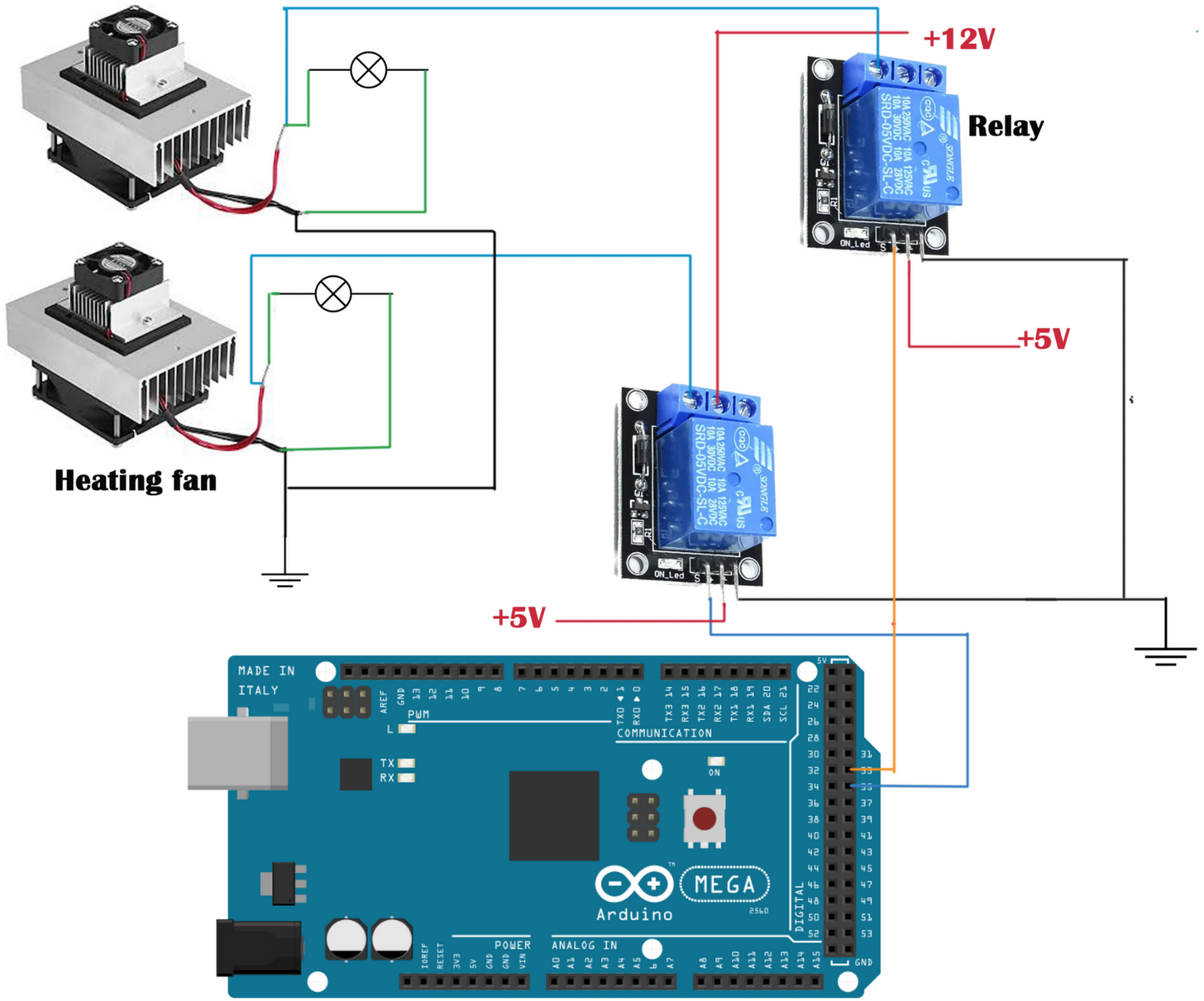
- Code integration
- Heating fan with peltier module
- PCB design

HEATING FAN
(PELTIER MODULE - TEC1-12706)

- Used to reduce coldness of feet

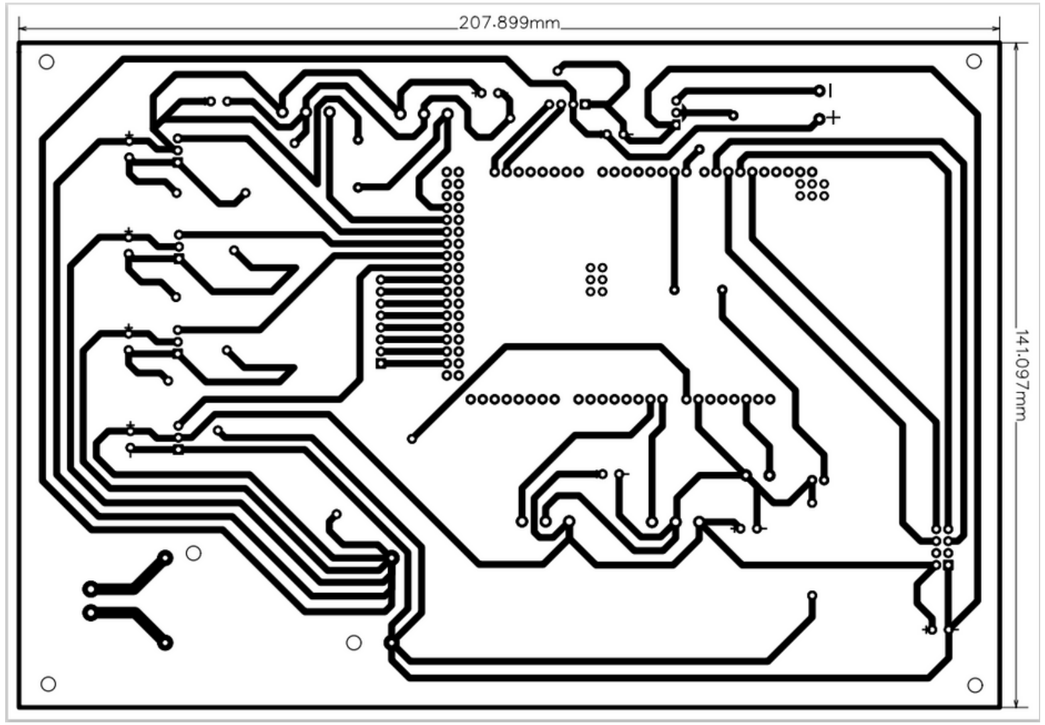
Hot Side Temperature (° C)	25° C	50° C
Qmax (Watts)	50	57
Delta Tmax (° C)	66	75
Imax (Amps)	6.4	6.4
Vmax (Volts)	14.4	16.4
Module Resistance (Ohms)	1.98	2.30

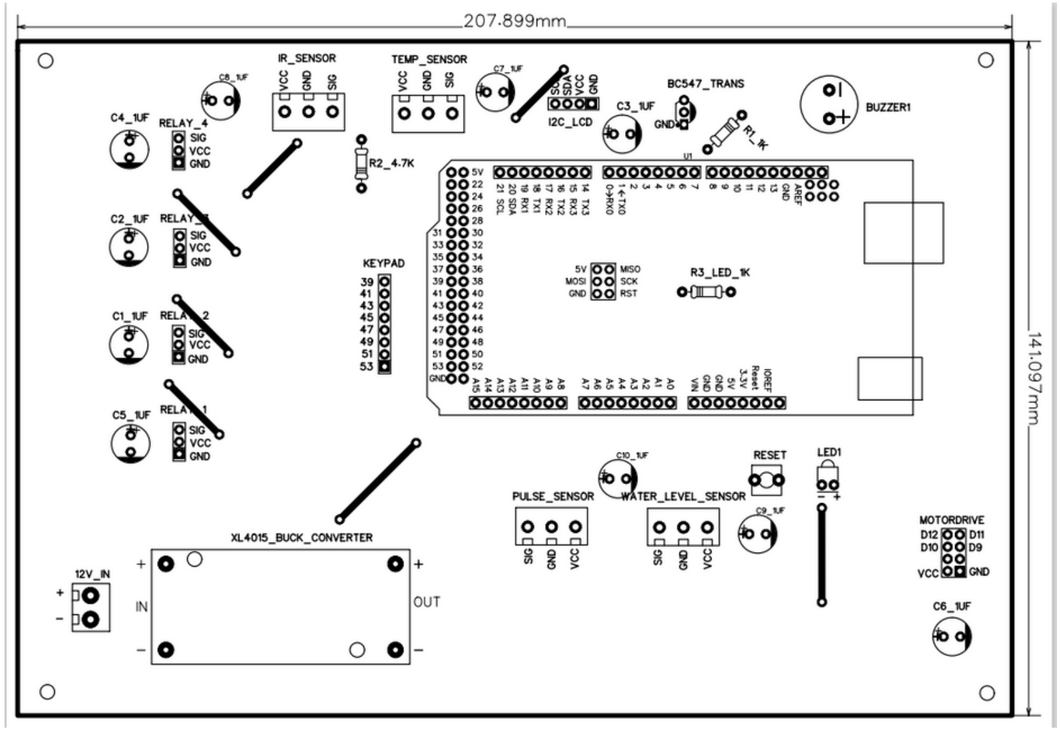
CIRCUIT DIAGRAM



PCB DESIGN

- Software Used - EasyEDA
- Single layer Design





214040P- D.T.A.WIJESEKARA

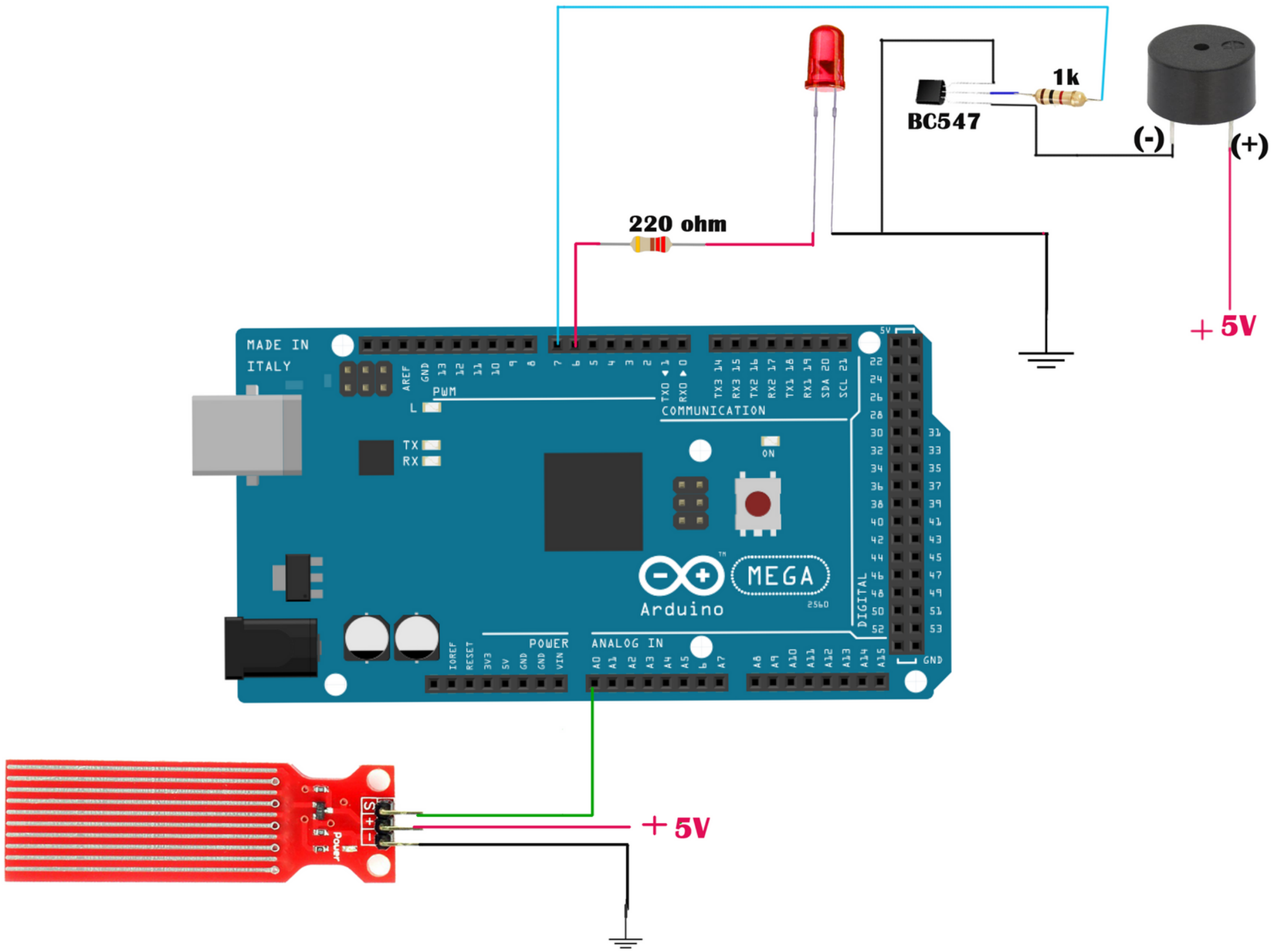
- Study and implement the process of **water level sensor**
- Study and implement the process of **wiper motors**
- Design the structure

WATER LEVEL SENSOR (SE045)

- Used to measure the muscle relaxing liquid level

  - Working Voltage : DC 3-5V.
  - Working Current : <20mA.
  - Operating temperature: 10~30 Celsius.
  - Sensor Type : Analog.
  - Detection Area : 40 mm x 16 mm.
  - Size : 65 mm x 20 mm x 8 mm.
  - Humidity: 10% -90% non-condensing.

CIRCUIT DIAGRAM



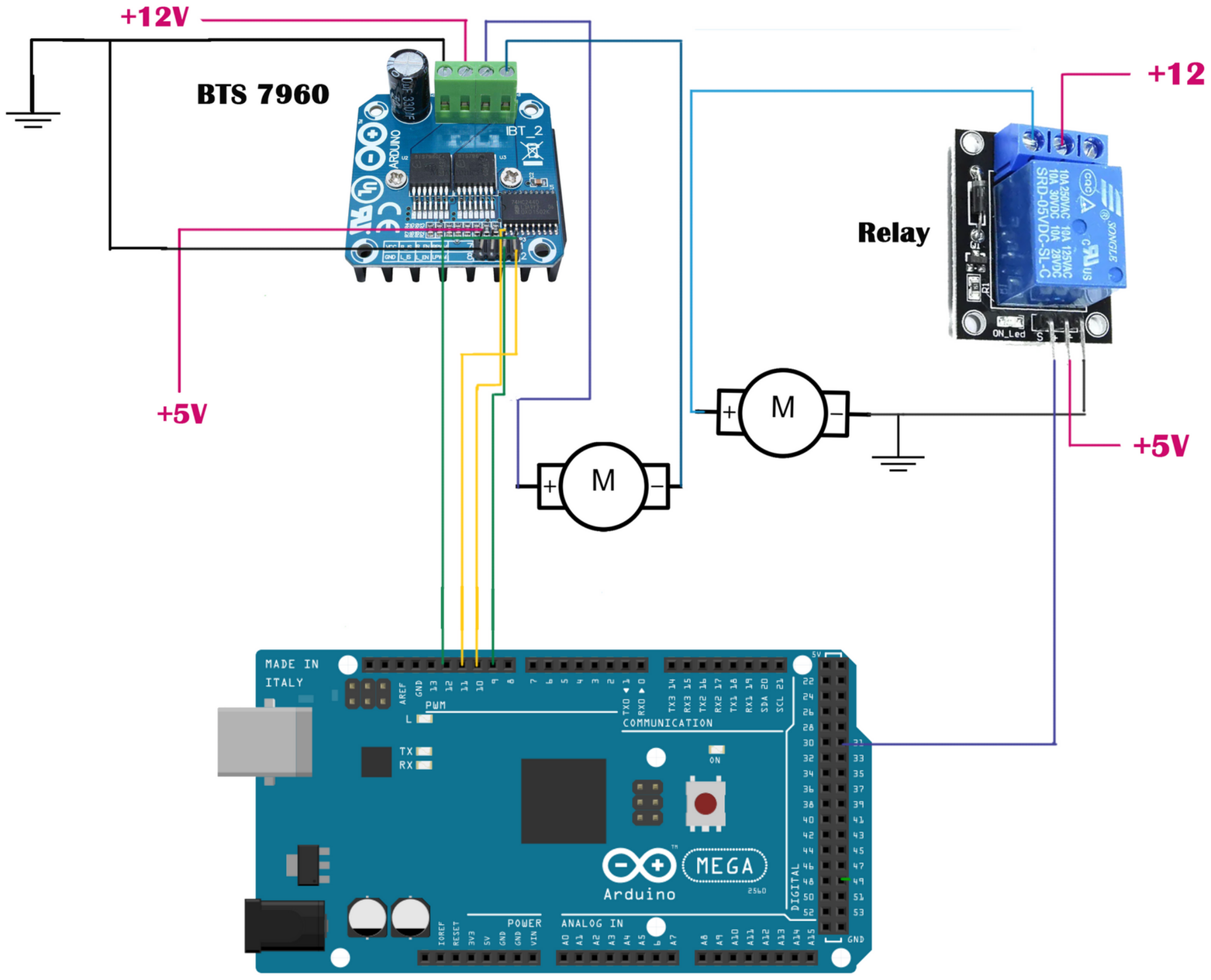
CODE

```
#define WaterLevelSensorPin A0
#define WaterLevelLedpin 6

int wlevel = 0;

void setup() {
pinMode(WaterLevelLedpin,OUTPUT);
}

void loop() {
 wlevel = readWaterLevelSensor();
  if(wlevel<500){
    digitalWrite(WaterLevelLedpin,HIGH);
  }else{
    digitalWrite(WaterLevelLedpin,LOW);
   }
}
int readWaterLevelSensor() {
 wlevel = analogRead(WaterLevelSensorPin); // Read the analog value form sensor
 return wlevel;      // send current reading
}
```

MOTORS

- Used to implement the relaxing process
- Used BTS7960 motor driver
- 2 vehicle wiper motors are used

CIRCUIT DIAGRAM



CODE

```
#define motor 31   //define pin to relay of motor

int r_en = 10;
int l_en = 9;
//Use PWM pins
int r_pwm = 11;
int l_pwm = 12;
int pwm=200;

boolean motorOn = false;
int massageDuration;
unsigned long massageStartTime = 0;

void setup() {
pinMode(motor,OUTPUT);

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

}
void loop() {
 if(motorOn){
 if(millis()-massageStartTime>=(massageDuration*60000)){
 digitalWrite(motor,LOW);
 stopMassage();
 }
 int leftTime = massageDuration- ((millis()-massageStartTime)/60000);
 //display left time
 }
 char key = userKeypad.getKey();
  if(key=='A'){
   if(motorOn){
    digitalWrite(motor,LOW);
    stopMassage();
   }else{
    massageStartTime=functionalKeyA();
   }
  }
}
void stopMassage(){
 digitalWrite(r_en, LOW);
 digitalWrite(l_en, LOW);
 motorOn=false;
}
void startMassage(){
 digitalWrite(r_en, HIGH);
 digitalWrite(l_en, HIGH);
 //RPM in forward and backward
 analogWrite(r_pwm, 0);
 analogWrite(l_pwm, pwm);
 motorOn=true;
}
```

214153N-W.S.C.Y. INDUNILPERUMA

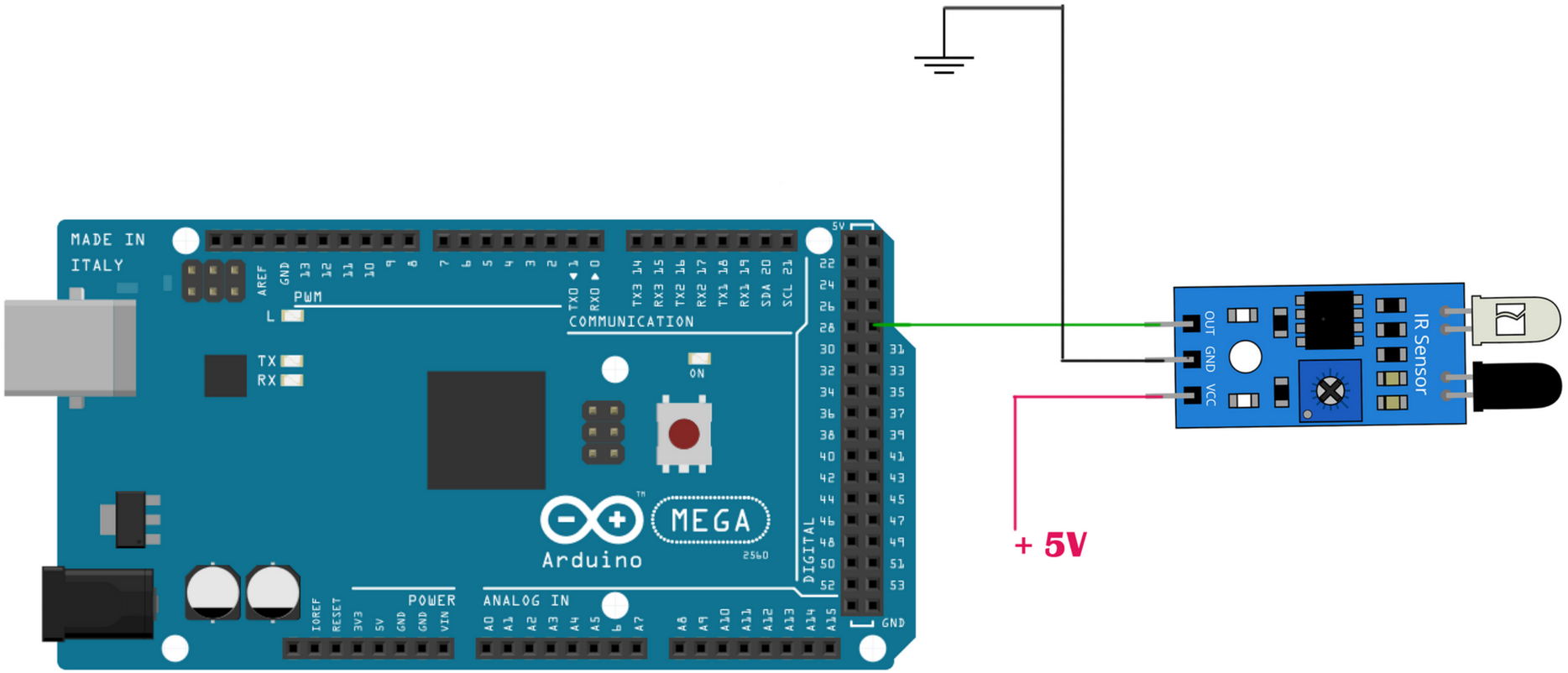
- Study and implement the process of **IR sensor**
- Study the mechanism and structure
- Design the structure

IR SENSOR (FC-51)

- Used to detect the presence of the leg

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

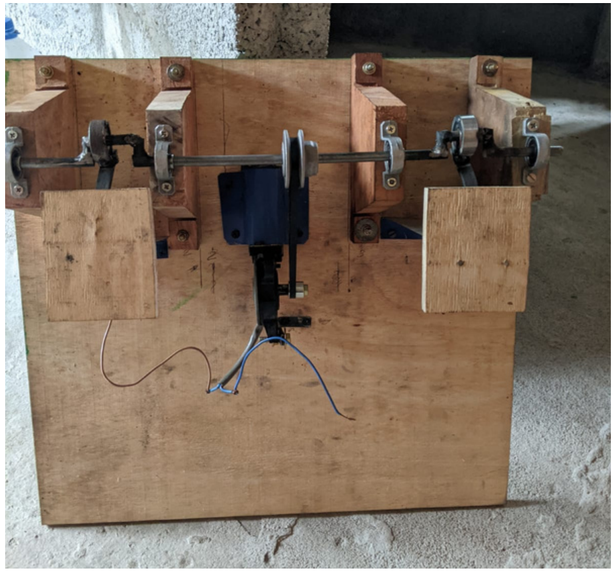
CIRCUIT DIAGRAM

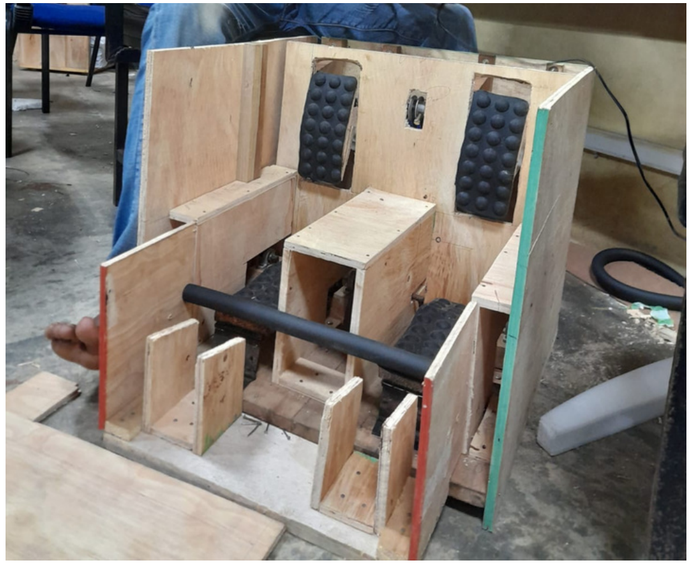


CODE

```
#define irSensorPin 29

boolean legDetected = false;
unsigned long legRemovedTime=0;

void setup() {
 pinMode(irSensorPin, INPUT);

}

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

  }
  // all process is happen inside this scope
}else {
 if (legDetected) {
 legRemovedTime = millis();
 legDetected = false;
 lcd.clear();
 lcd.print("Place Leg on");
 lcd.setCursor(0, 1);
 lcd.print("the Machine");

 }
 }

}
```

MECHANISM





214191D-A.S.S.SEWWANDI

- Study and implement the process of P**ulse sensor**
- Study and make the U**ltrasonic mist maker**

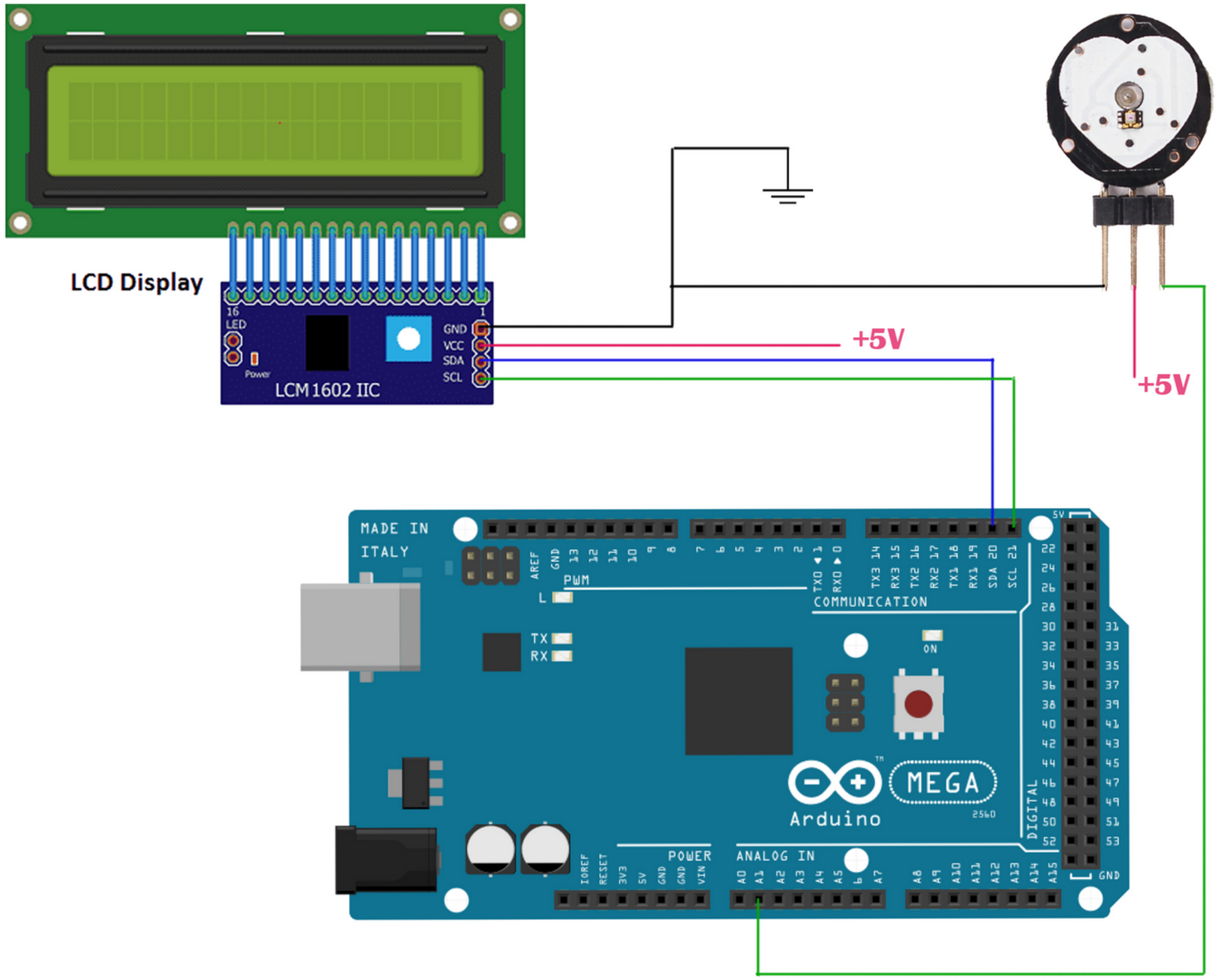
PULSE SENSOR (HW-827)

214191D- A.S.S. SEWWANDI

- Used to monitor the pulse rate

maximum current	100mA
Heartbeat deduction output	LED
VCC	+5v DC (high-quality regulation)
Light source	660nm super Red LED

CIRCUIT DIAGRAM



CODE

```
int const PULSE_SENSOR_PIN = A1;
int Signal;
int bpm;
int Threshold = 700;


void loop() {
  readPulse();
}
void readPulse()
{
 Signal = analogRead(PULSE_SENSOR_PIN);

 if(Signal>Threshold){
  bpm = 60000/Signal;
   Serial.println(bpm);
   //lcd.display(bpm);
   delay(1000);
 }
}
```

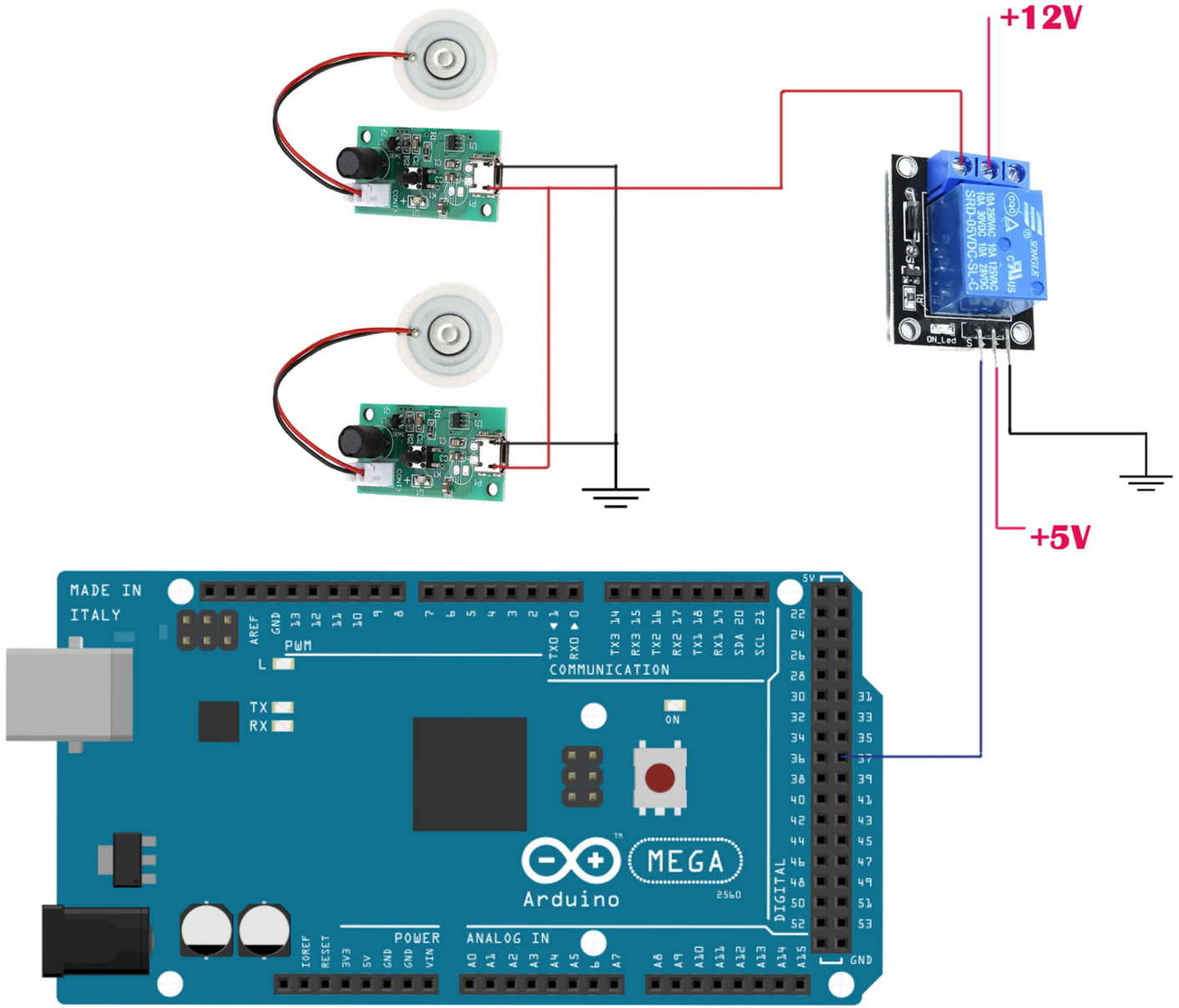
ULTRASONIC MIST MAKER

214191D- A.S.S. SEWWANDI

- Used to spray the pain relief liquid

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

CIRCUIT DIAGRAM



214136P-H.S.MUTHUMALA

- Study and implement the process of **Temperature sensor** (DS18B20)
- Study the LCD display and keypad

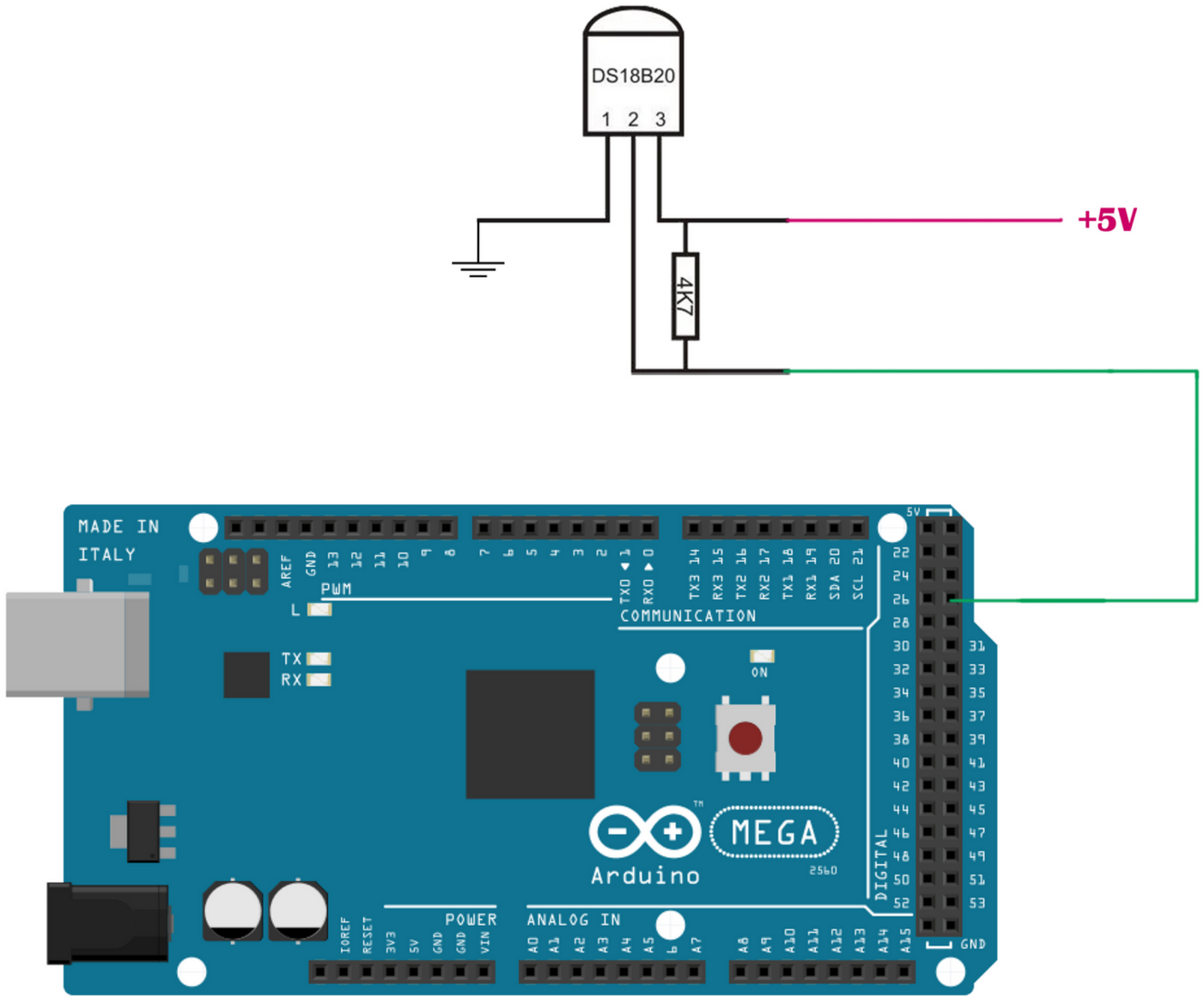
TEMPERATURE SENSOR

(DS18B20-TO 92)

- Used to measure the room temperature

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

CIRCUIT DIAGRAM



CODE

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

#define ONE_WIRE_BUS 27 // temperature sensor pin 27
OneWire oneWire(ONE_WIRE_BUS);
DallasTemperature sensors(&oneWire); // Pass oneWire reference to DallasTemperature
library


void setup() {
 sensors.begin(); // Start up the DallasTemperature library
}

void loop() {
 int temperature = getTemperature();
 displayTemperature(temperature);

  if(temperature<=20){
    //heating fan on

  }else if(temperature>40){
    //heating fan off
  }
}
```

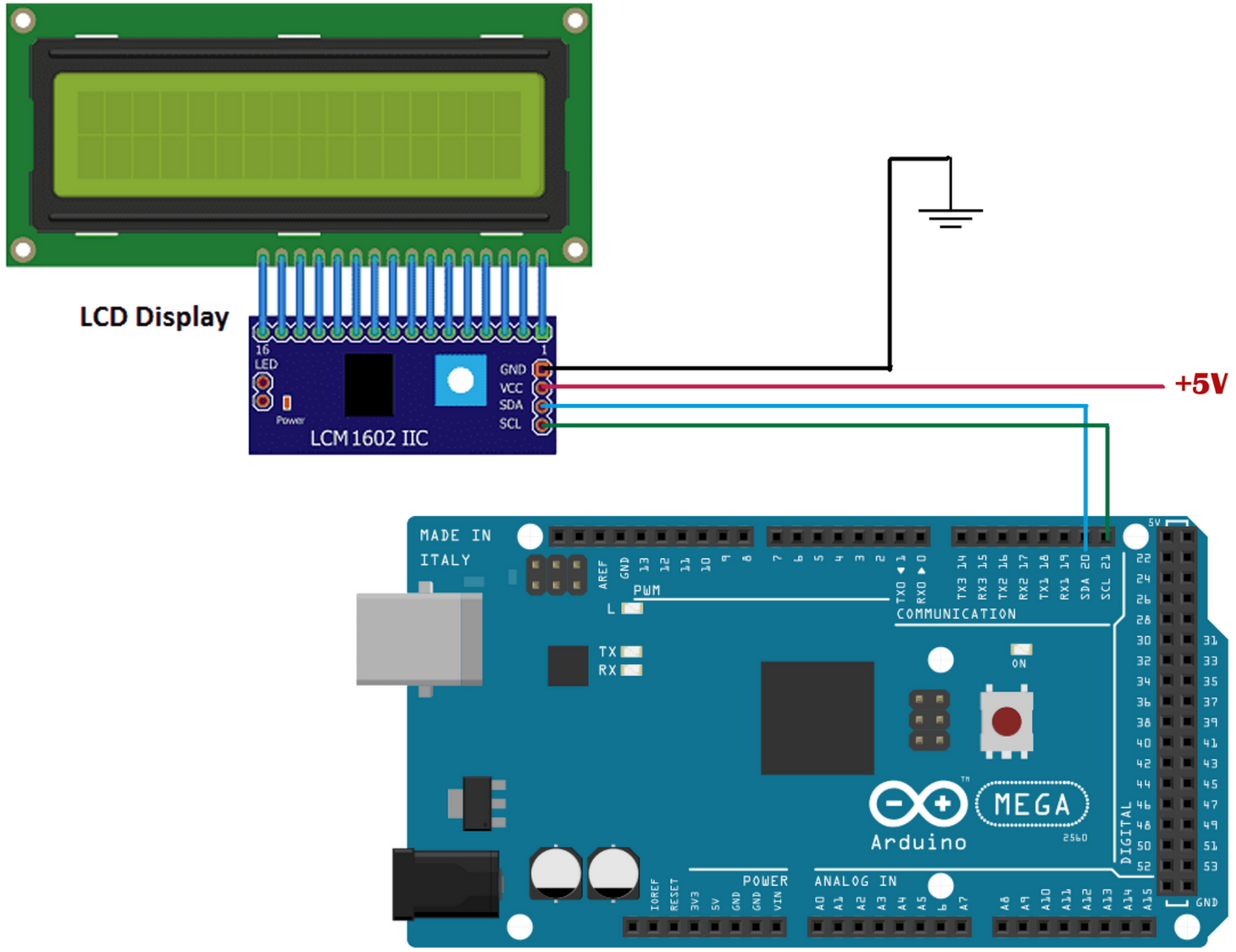
```
int getTemperature(){
 sensors.requestTemperatures(); // Send the command to get
temperatures
 int temperatureC = sensors.getTempCByIndex(0); // Read the
temperature in Celsius
 delay(500);
 return temperatureC;
}

void displayTemperature(int temperature) {
 //display temperature
}
```

LCD DISPLAY + I2C

214136P- H.S.MUTHUMALA

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

CIRCUIT DIAGRAM

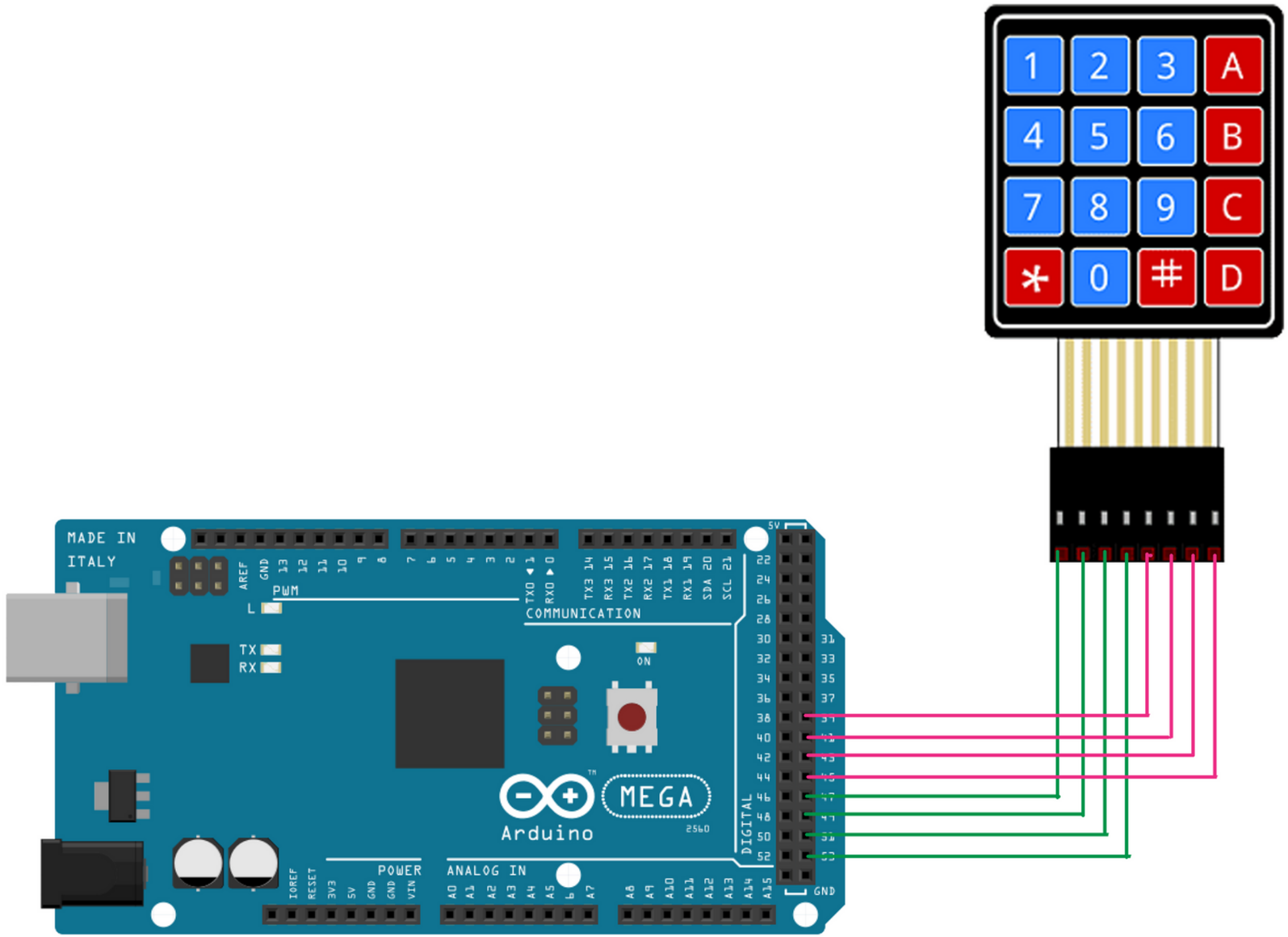


4*4 KEY PAD

214136P- H.S.MUTHUMALA

- Used to take user inputs

CIRCUIT DIAGRAM



CODE

```
#include <Keypad.h>
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 loop(){
 char key = userKeypad.getKey();

if(key=='A'){
  //massager on/off
}
if(key=='B'){
  //heating fan on/off
}
if(key=='C'){
  // spray on/off
}
if(key=='D'){
  //measure pulse
}
```

CODE

```
#include <LiquidCrystal_I2C_Hangul.h>

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

void setup(){
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");
}
```

Budget Estimation

Amount	Qty	Total
LCD Display	1	310
Wires	10	1250
i2c module	1	450
BTS7960 motor driver	1	1600
keypad	1	450
water level sensor	1	110
heart rate sensor	1	850
Gt2 belt and 2 pullys	1	600
typing chain and 2 cog wheels	1	500
Viper Motor	2	4600
solder wire	5	450
IR sensor	1	250
Relay	4	720
multibond	1	300
Arduino Mega	1	5800
bearing	14	2000
ds18b20	1	130
Dc Fan	4	2000
buckconverter XL4015 2A	1	420
peltier	2	1500
LED	1	10
Buzzer	1	150
silicon gum	1	500
iron	1	800
wood board		2000
nails		850
power unit 12V/20A	1	2700
PCB	1	2700
capacitors/ pin headers/ terminals....		650
thermal paste	1	200
plug point+wire		570
cloth		700
cap+ wires		310
bulb	2	200
paint	1	400
sanding paper	2	300
Others		2500
	Sum	39878

Q & A

THANK YOU