

# **WinderX**

**Microcontroller Based Hardware  
Development Project – Level 01  
Group Number 15 (IT)**

# IT Group Number 15

**Thilshath S.M.**

**224195D**

**Group Leader**

**Balasuriya  
P.B.G.A.V.K.K.**

**224244E**

**Group Member**

**Bushra M.B.F.**

**224236G**

**Group Member**

**Kahingala K.J.T.**

**224099L**

**Group Member**

# OVERVIEW

Hardware Project - IT Group 15

- |           |                    |           |                         |
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Automatic wire winding and  
wire cutting machine



# INTRODUCTION

01

Traditional wire cutting and winding processes are usually done manually. This method is time-consuming and prone to human errors. Our project aims to design and develop an automatic wire winding and cutting machine using Arduino technology. This innovative machine significantly reduces time consumption.



# PROBLEM DEFINITION

02

Measuring wire length manually takes a significant amount of time. The length of the wire in a roll may not be as expected, and this can only be determined after manual measurement. Manual measurement is prone to human errors, leading to inconsistencies and inefficiencies.



03

# PROPOSED SOLUTION

To address the mentioned challenges, we decided to innovate and develop an automated machine that eliminates these problems.



To create this automated machine, we utilized components such as Weight sensor, Tension sensor, IR sensor, NEMA Stepper motors and Buzzers. These components work together to enhance the machine's efficiency to reduces human errors and decreases time complexity.

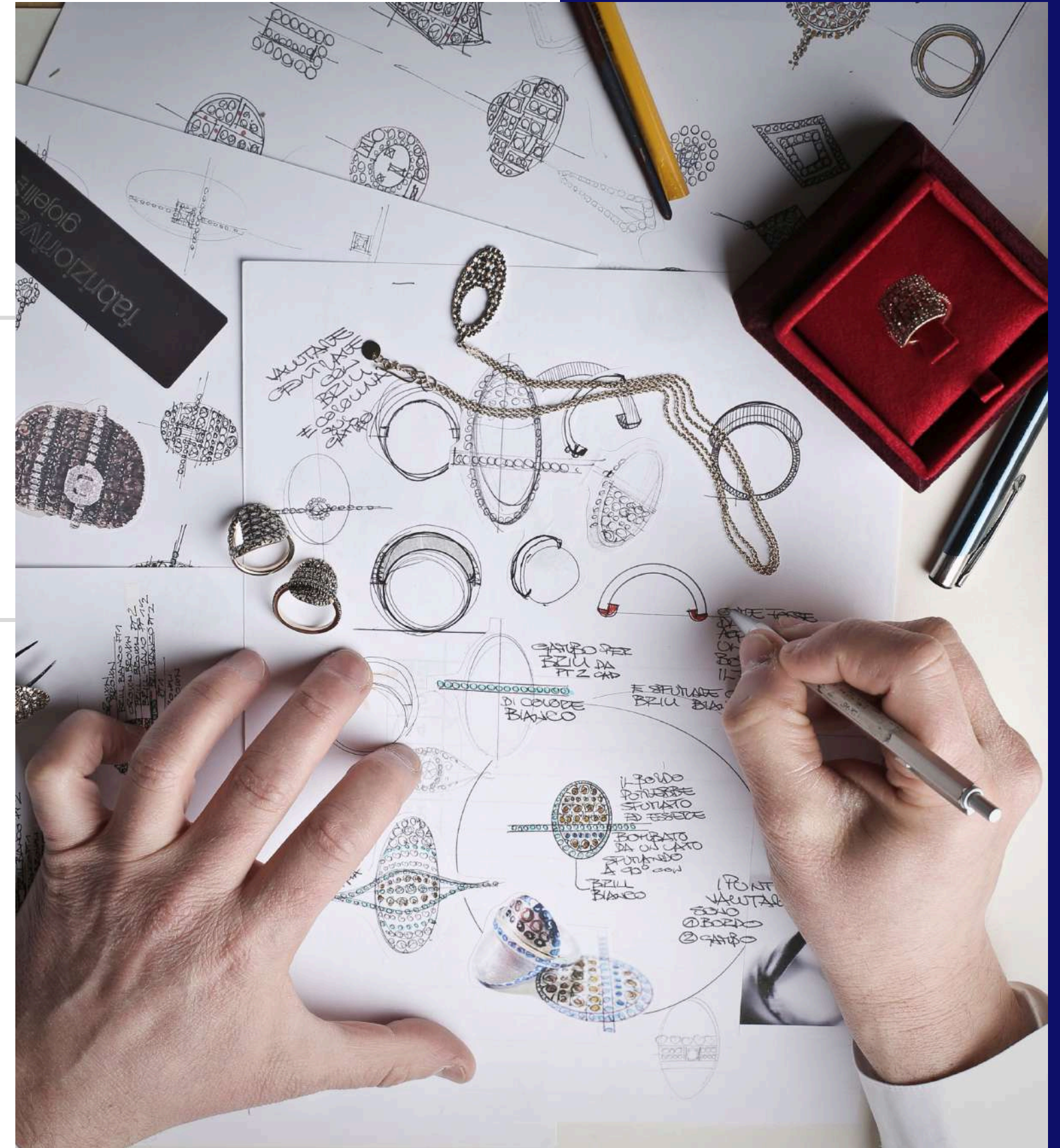


# PROJECT AIM

04

## Automated wire winding and cutting machine

The aim of this project is to create an automated cable coiling and cutting machine using Arduino. This machine will reduce human errors and save time in the wire winding process. It will use sensors and motors to measure wire length, maintain tension, and cut the wire accurately, improving efficiency and reliability





# OBJECTIVES

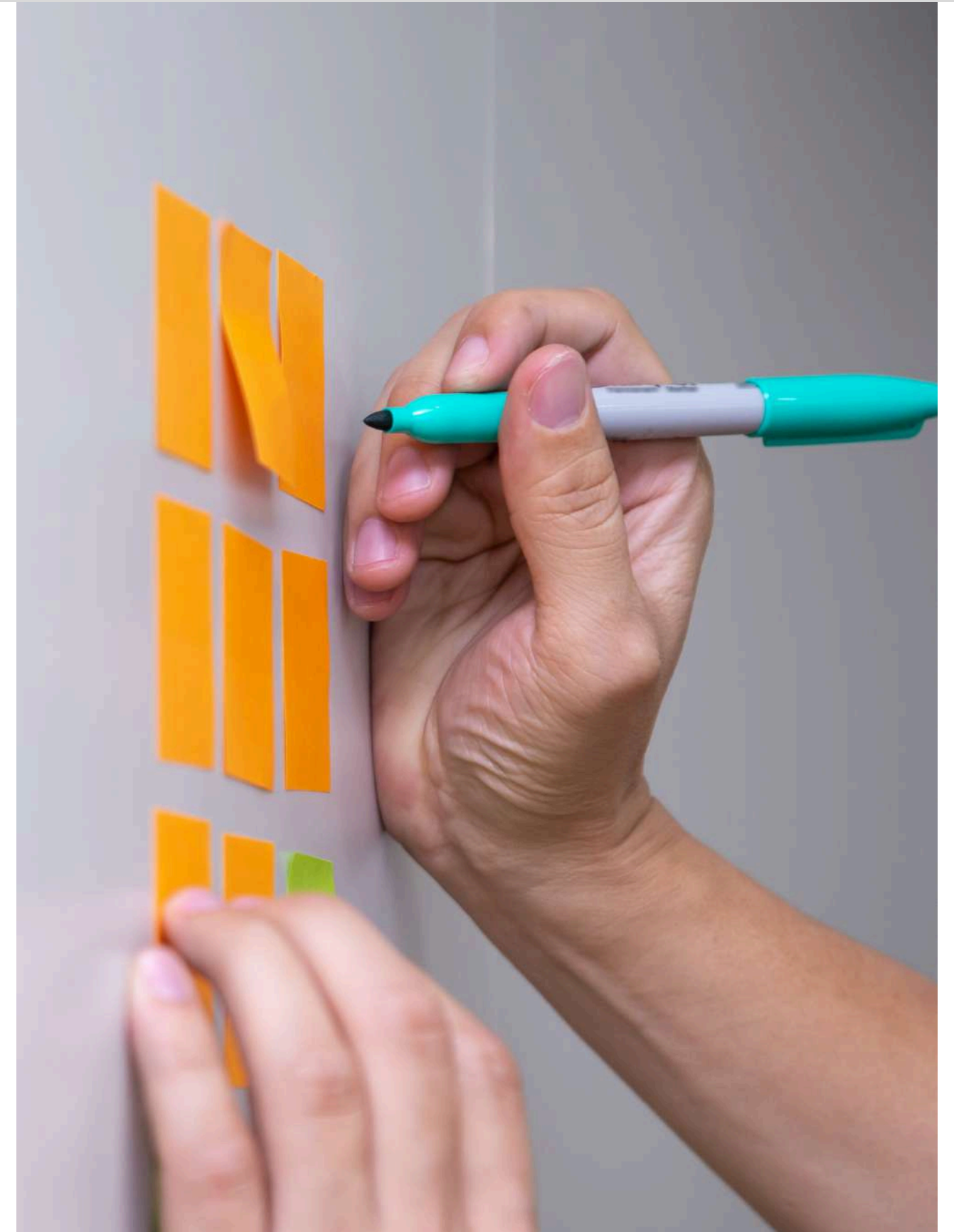
04

Decrease the time required for wire winding and cutting, increasing overall productivity.

Develop a simple user interface for easy operation and input of required information.

Automatically winds wire, reducing the need for manual labor.

Minimize Human Errors.





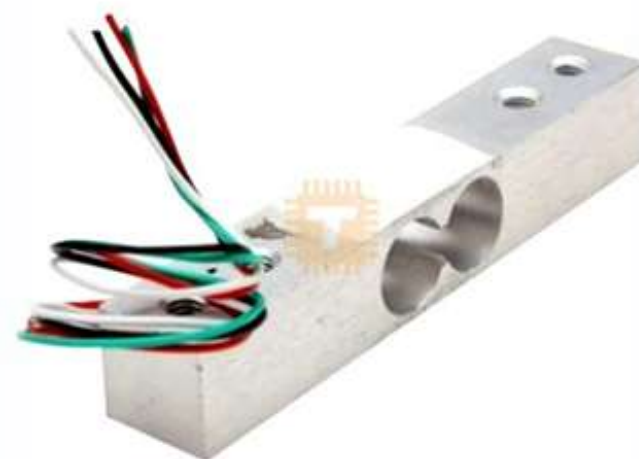
## 05



## LOAD CELL



# 4\*4 MATRIX KEYPAD





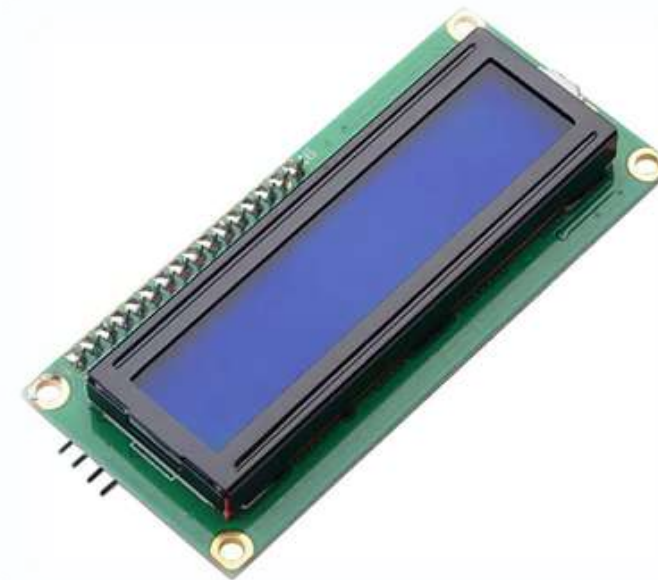
# COMPONENTS USED <sup>05</sup>



**NEMA STEPPER  
MOTOR**



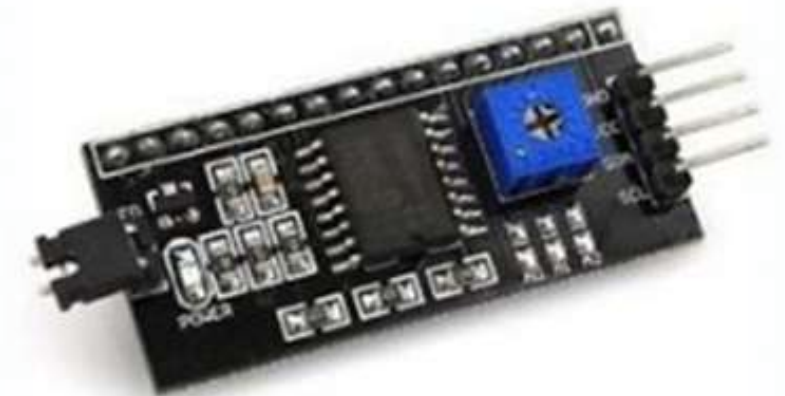
**LCD DISPLAY**



**NEMA STEPPER  
MOTOR DRIVER**



**I2C MODULE  
(LCD ADAPTER)**





# COMPONENTS USED <sup>05</sup>



**PIEZO  
BUZZER**



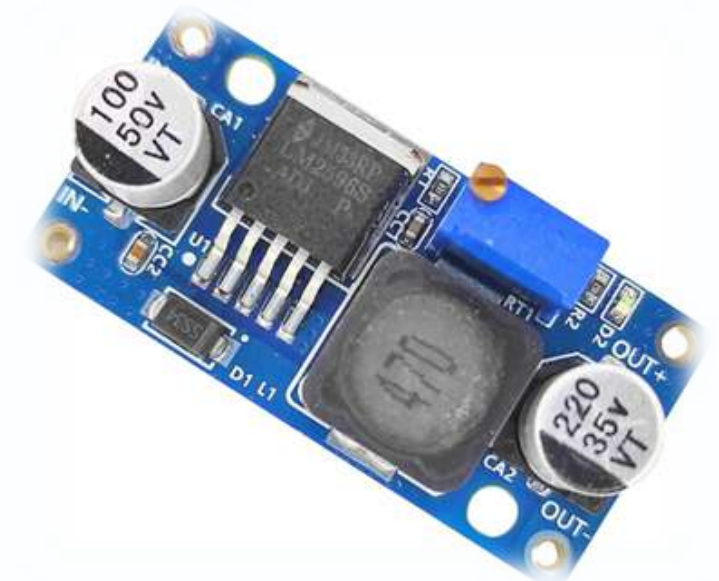
**POWER  
SUPPLY**



**1R SENSOR**



**STEP-DOWN  
CONVERTER**



# COMPONENTS USED <sup>05</sup>



**RESISTOR  
(220 OHM)**



**RESET  
BUTTON**



**PULLEYS**

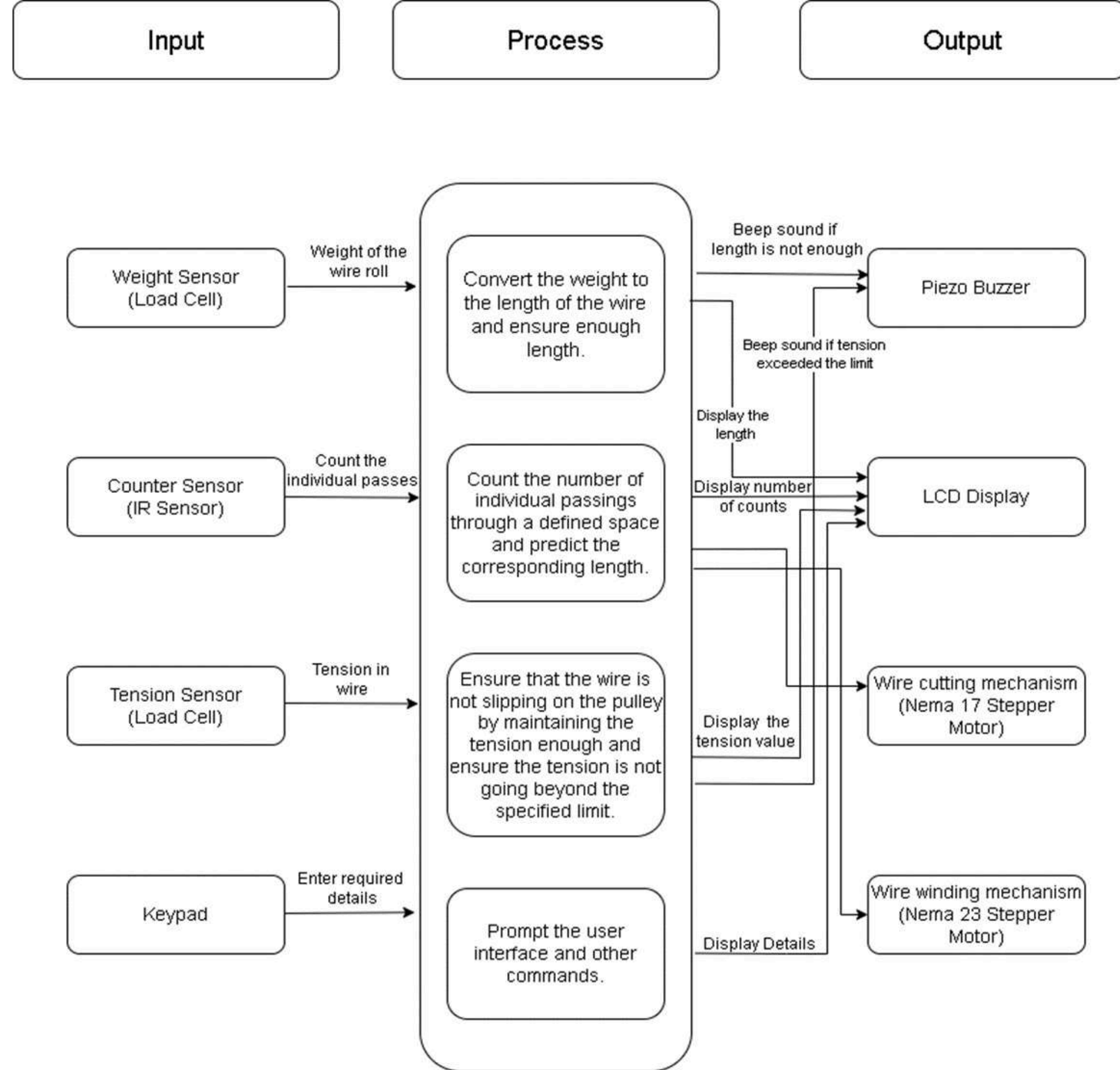


**WIRE  
CUTTER**

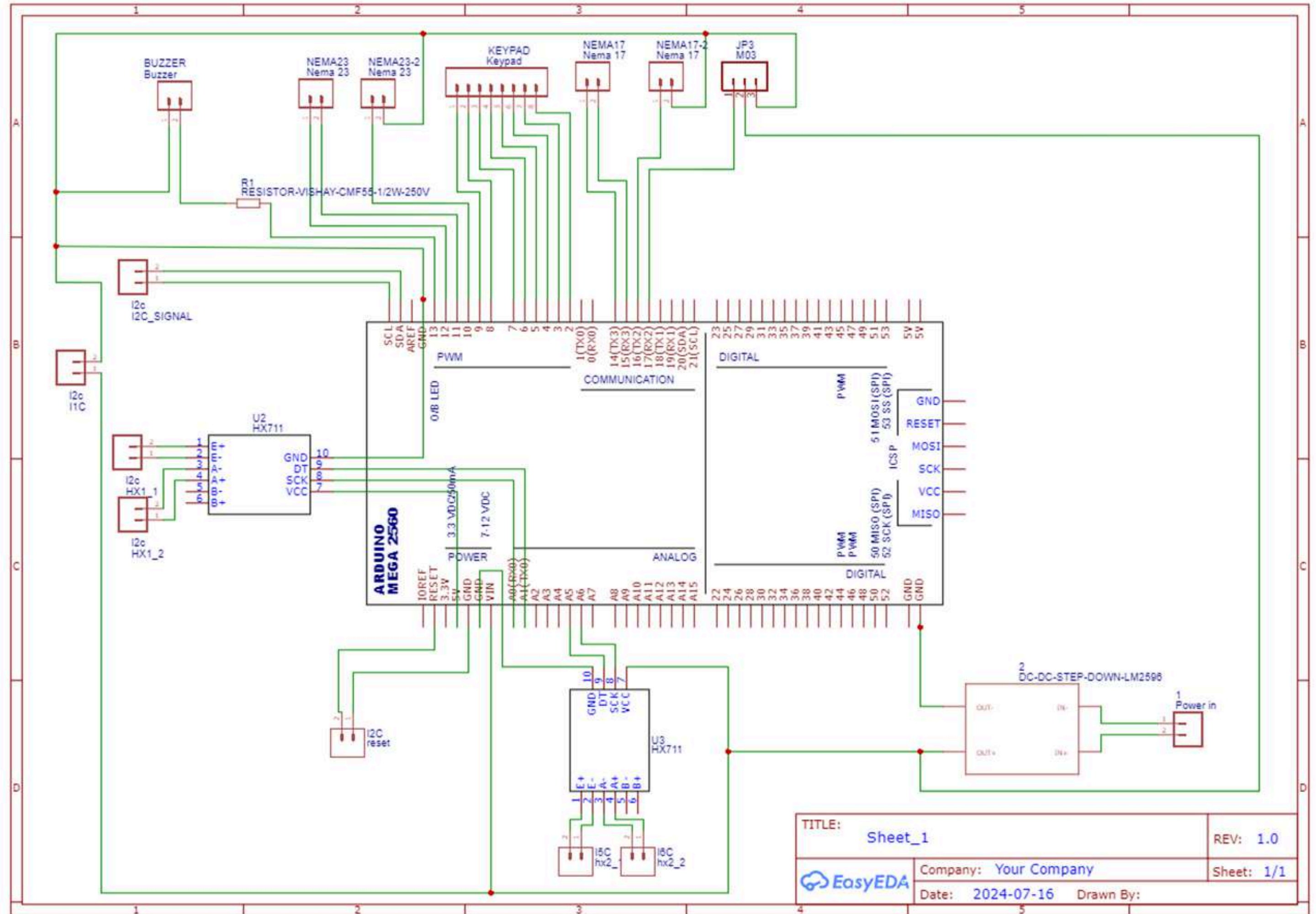




# BLOCK DIAGRAM

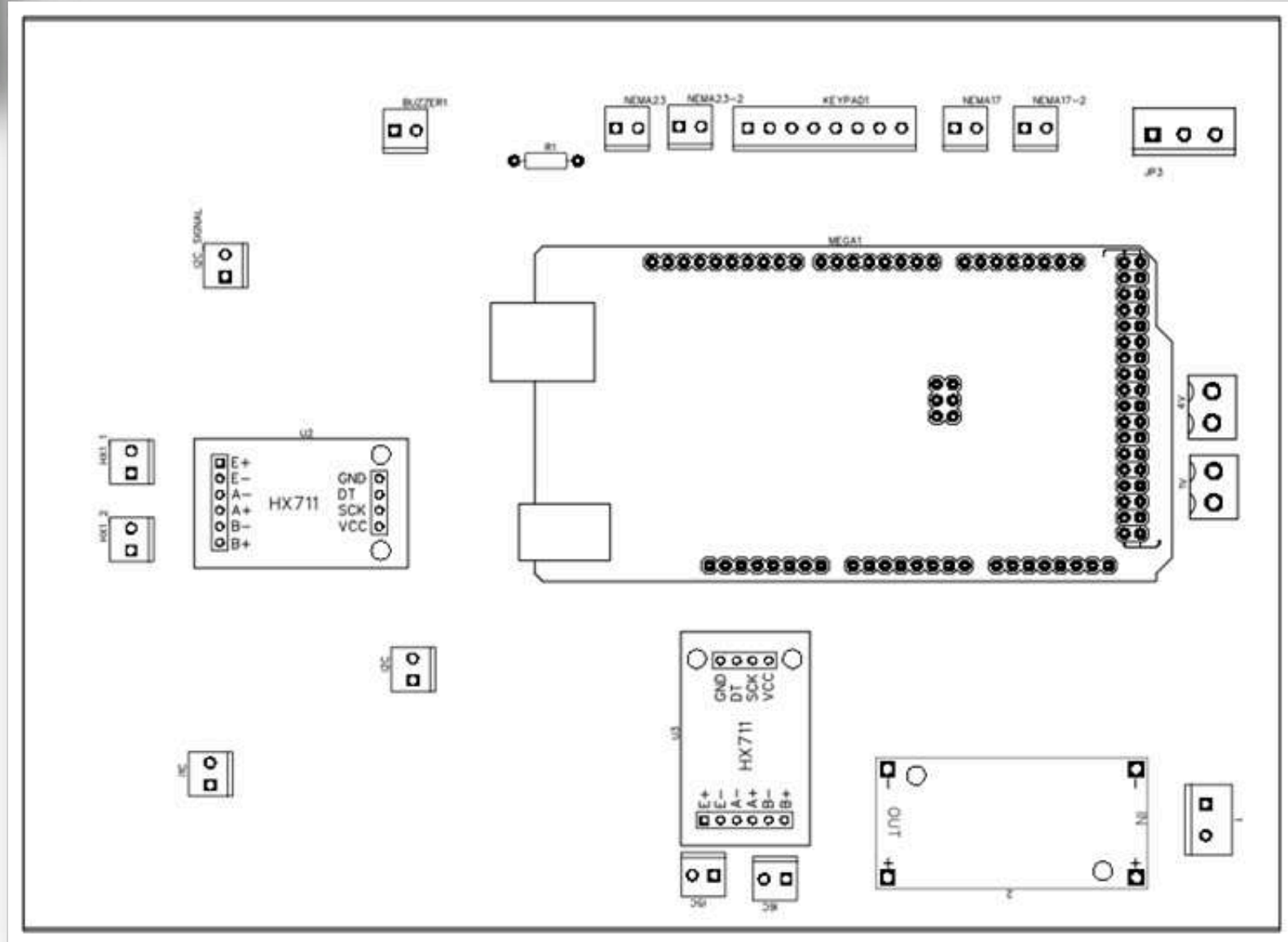
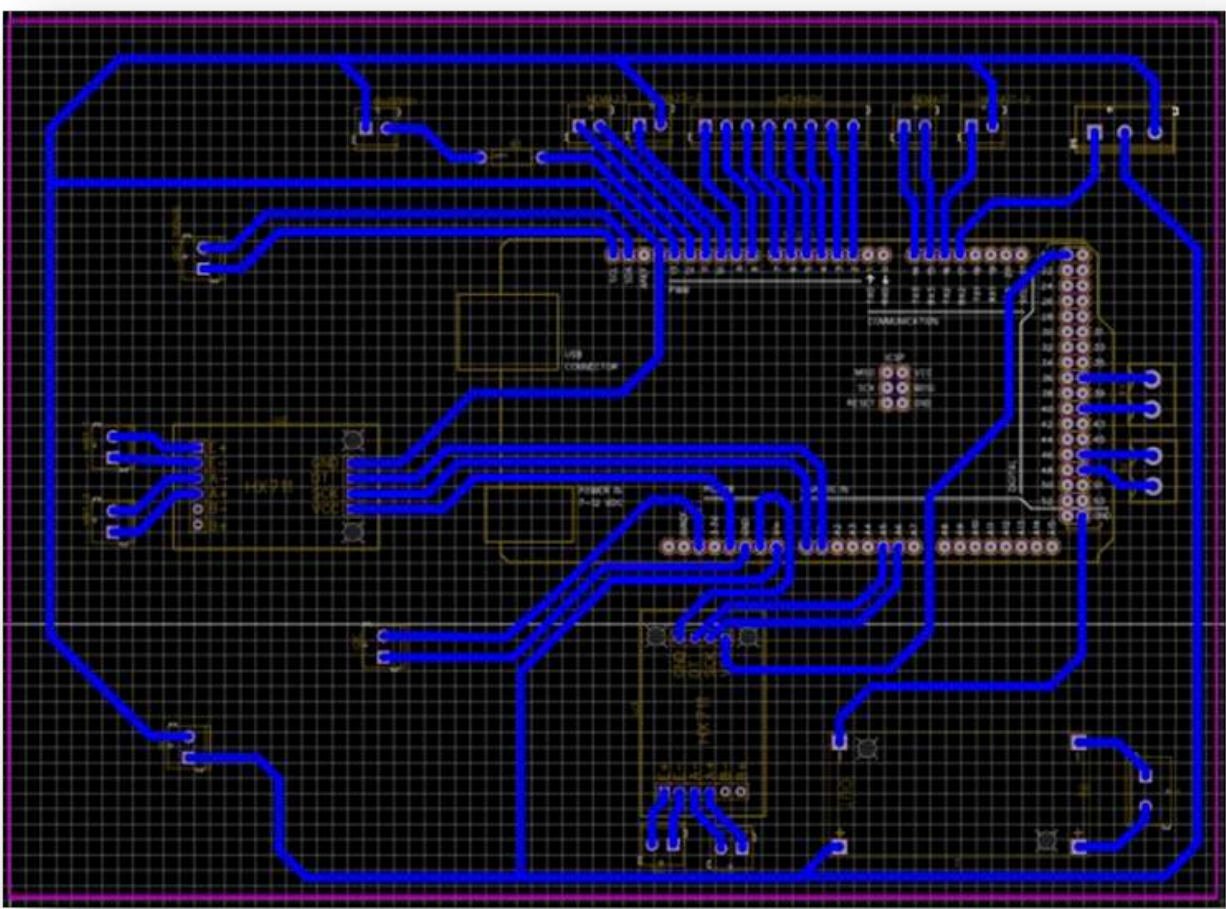


## SCHEMATIC DIAGRAM





# PCB DESIGN



# OPERATION PROCEDURE

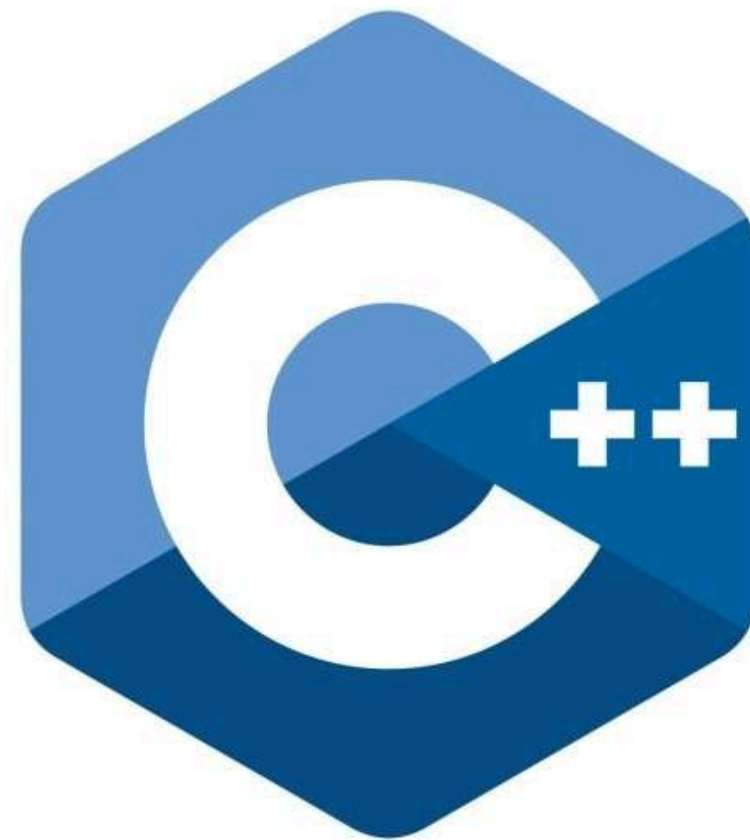
- Place the wire roll on the weight sensor to ensure that it contains a sufficient amount of wire for your needs.
- If the wire length is insufficient, the buzzer will sound an alert to indicate the shortage.
- Pass the wire through the tension sensor and secure it to the winding mechanism.
- Enter the required details, such as the desired wire length, through the keypad.
- The machine will begin winding the wire automatically based on the entered specifications.
- If the wire tension exceeds the specified limit, the buzzer will sound an alert to indicate the issue



# OPERATION PROCEDURE

- Once the winding process is complete, the system will prompt you to confirm whether additional length is needed.
- This process can be repeated as necessary to ensure the required wire length is achieved.
- After confirming that the desired wire length has been wound, the machine will automatically execute the cutting process.
- Once the cutting process is finished, remove the wound wire from the system and wire is now ready to be handed over to the customer.

# TECHNOLOGIES & METHODOLOGIES





# INDIVIDUAL CONTRIBUTION



SOURCE CODE : IT GROUP 15 CODE

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# THILSHATH S.M. (224195D)

- Responsibilities

- Based on a load cell and load cell amplifier, design a weight sensor and program it to the Arduino board.
- Based on a load cell and load cell amplifier, design a tension sensor and program it to the Arduino board.
- Study the piezo buzzer and program it to the Arduino board.

- Components

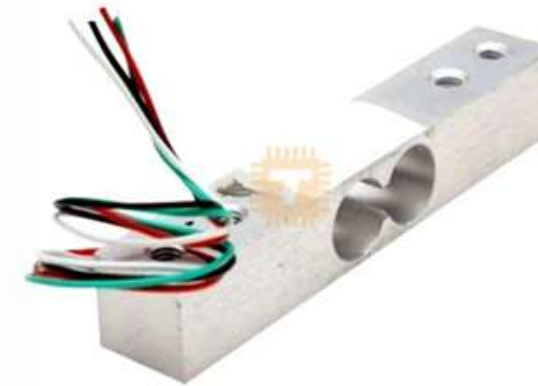
- 10Kg Load Cell and HX711 Module.
- Piezo Buzzer.

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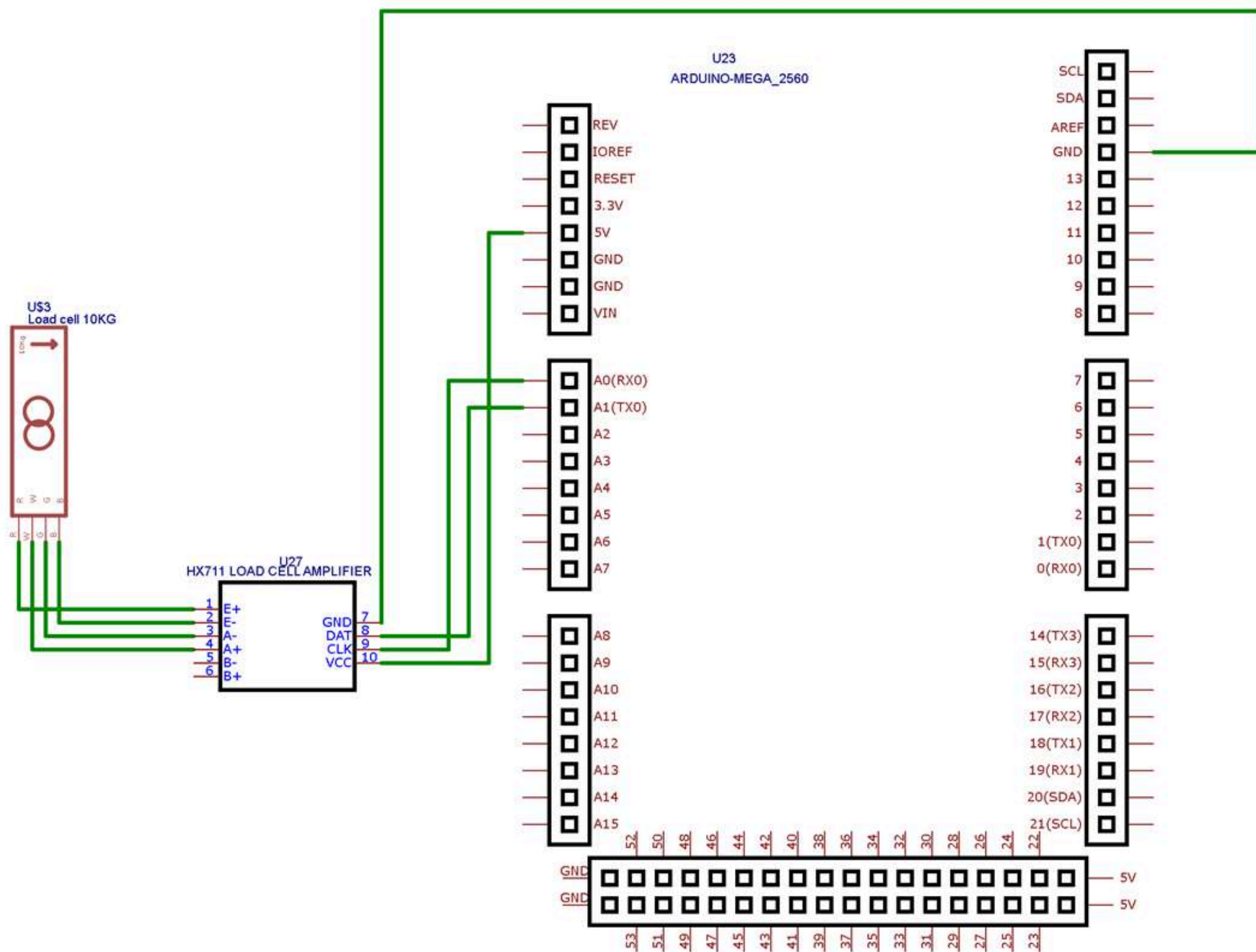


# Weight Sensor

- Designed using a 10Kg load cell and HX711 module.
- The length of the wire will be calculated to ensure whether the length of the wire is sufficient (According to weight/meter).
- Supply voltage: 5V
- Supply Current:



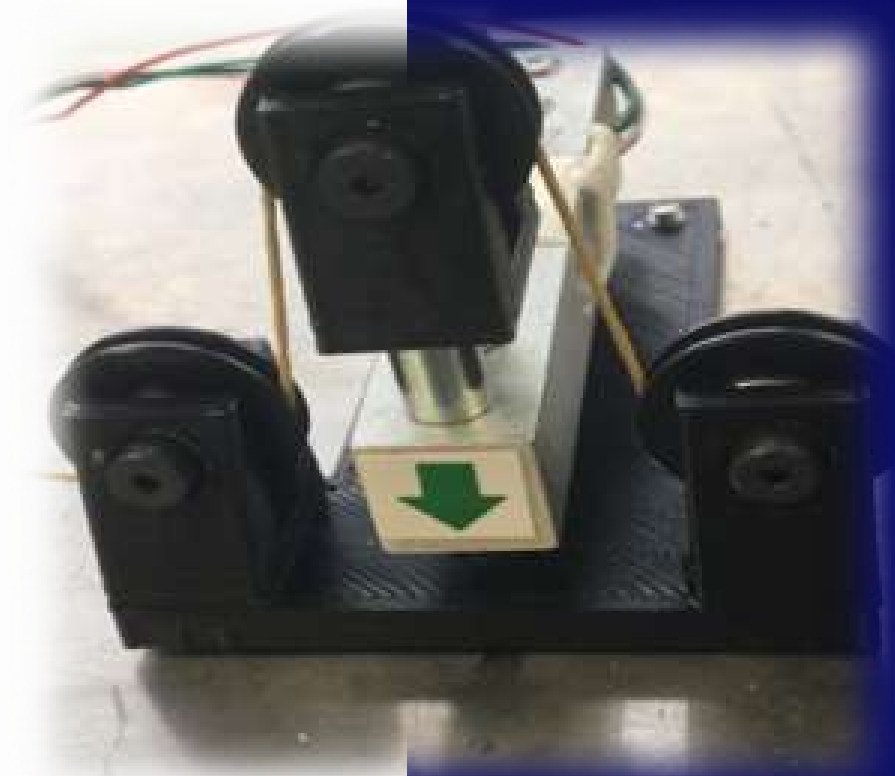
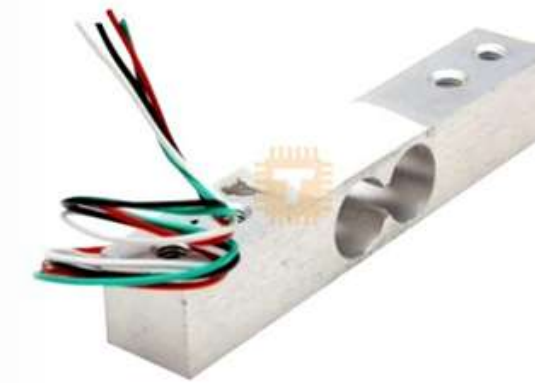
# SCHEMATIC DIAGRAM



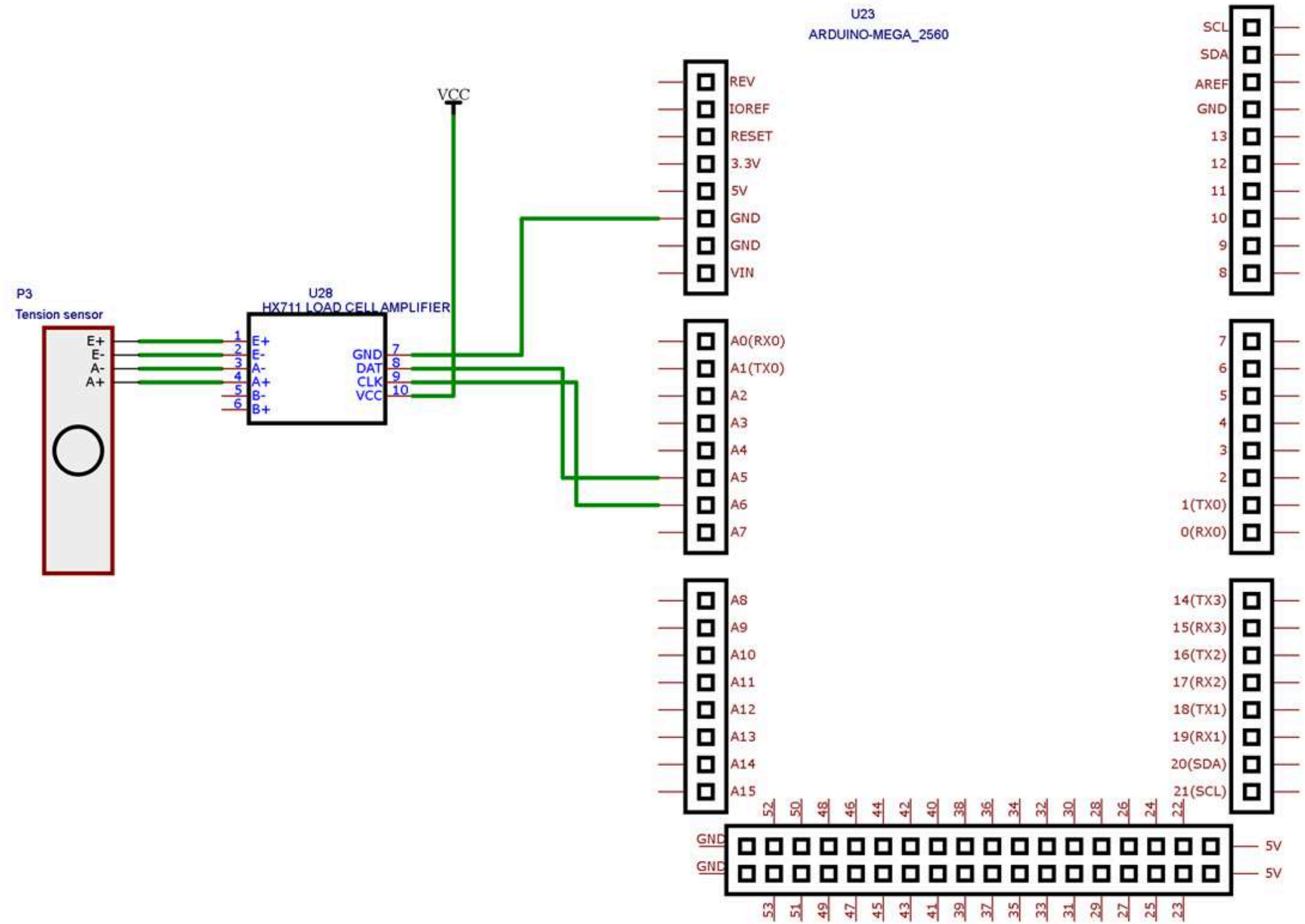


# Tension Sensor

- Designed using a load cell and HX711 module.
- Ensures that the tension in the wire does not exceed the specified limit. This prevents wire breakage due to excessive tension caused by (finish).
- Supply voltage: 5V
- Supply Current:



# SCHEMATIC DIAGRAM



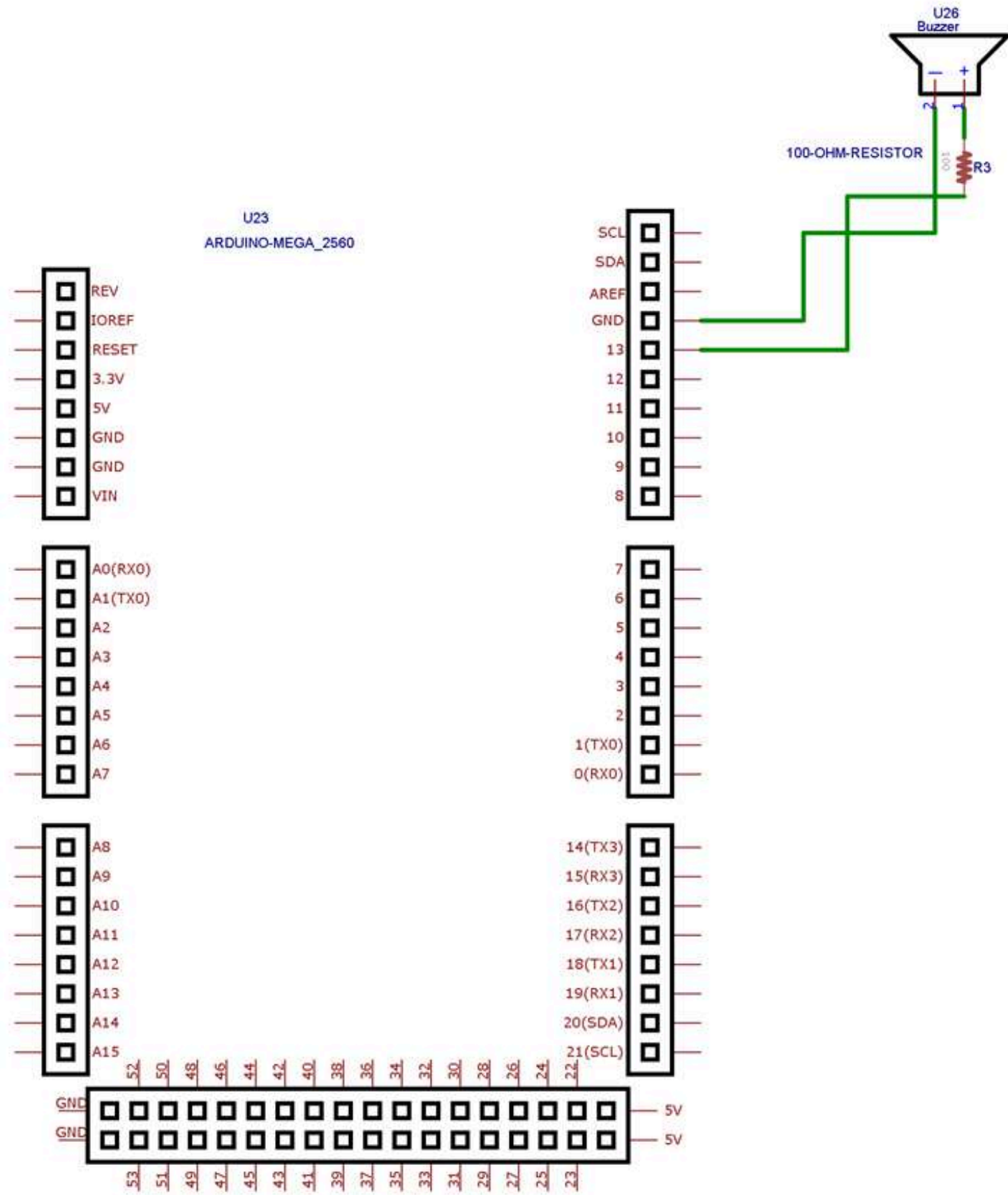


# Piezoelectric Buzzer

- In the weight sensor, a buzzer is used to alert if the wire length is insufficient.
- In the tension sensor, a buzzer is used to alert if the wire tension exceeds the limit.
- Supply voltage: 5V
- Supply Current:



# SCHEMATIC DIAGRAM





# **BALASURIYA P.B.G.A.V.K.K. (224244E)**

- Responsibilities

- Based on the NEMA stepper motor and stepper motor driver, design the winding part of the machine and program it using the Arduino board.
- Design the PCB.

- Components

- NEMA 23 Motor and Driver.

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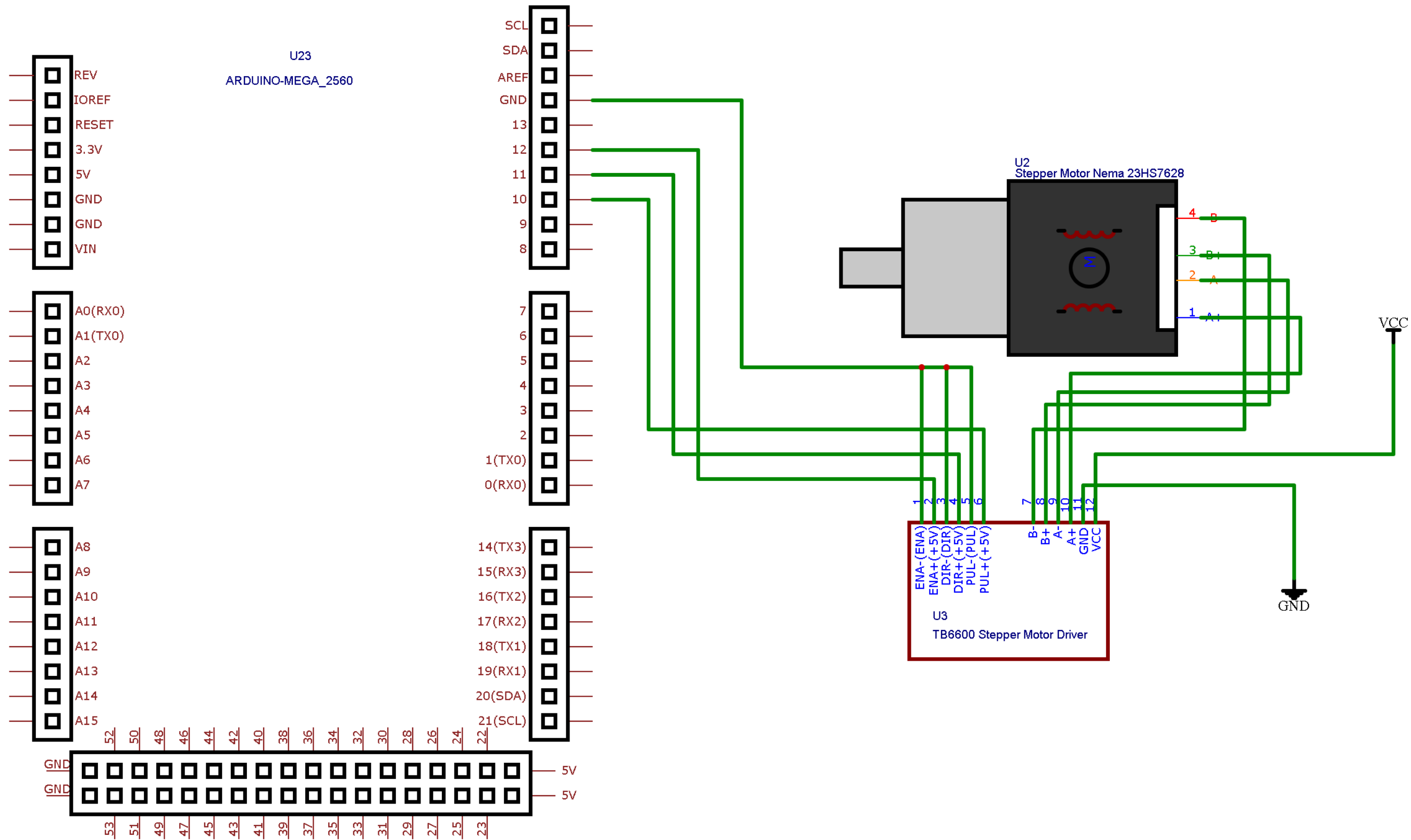
# NEMA 23 Stepper Motor and Stepper Motor Driver

- NEMA 23 motor and stepper driver have been used for the winding mechanism.
- Supply voltage for Driver: 220V
- Supply Current for Motor: 3A
- Step Angle:  $1.8^{\circ}$
- Steps/Revolution: 200



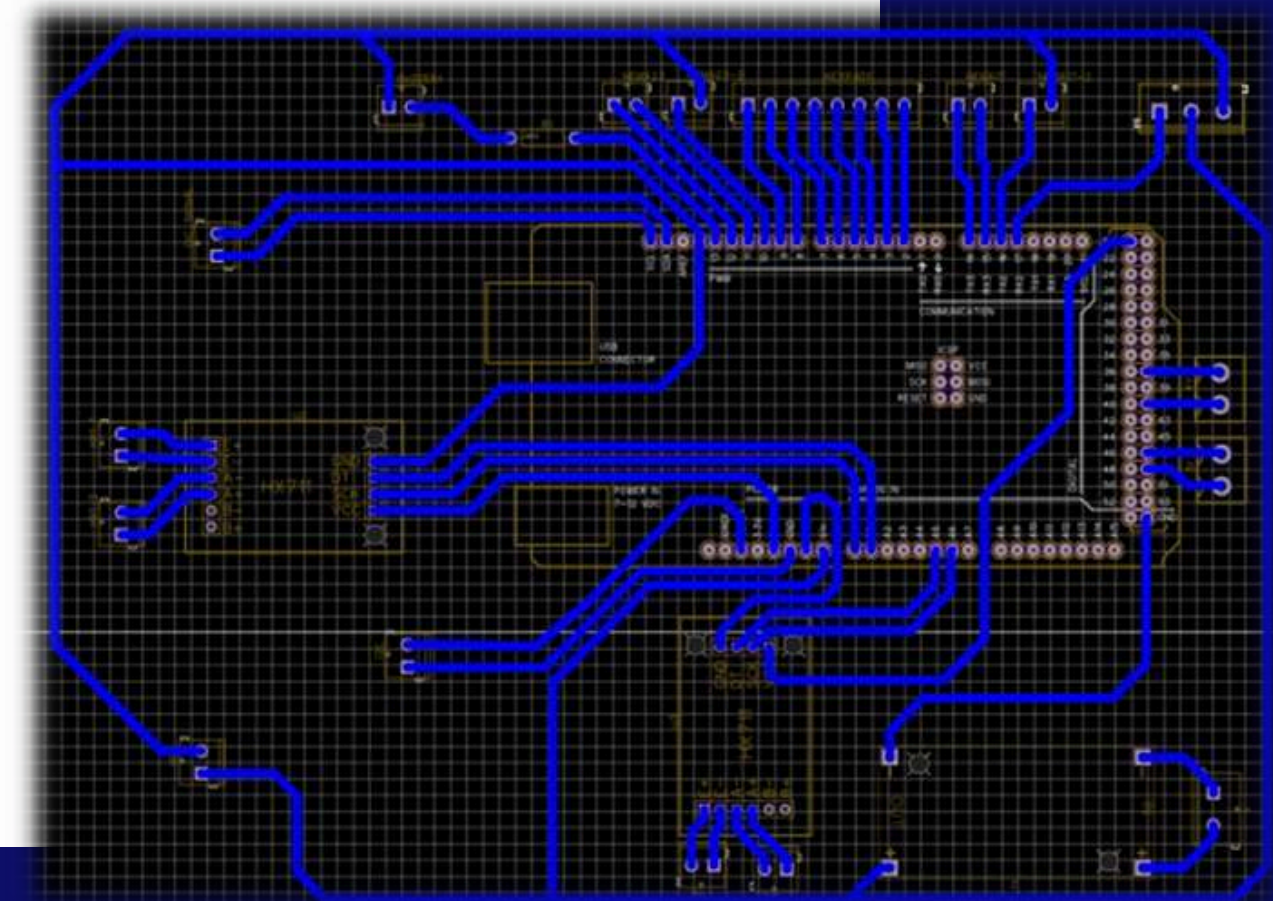
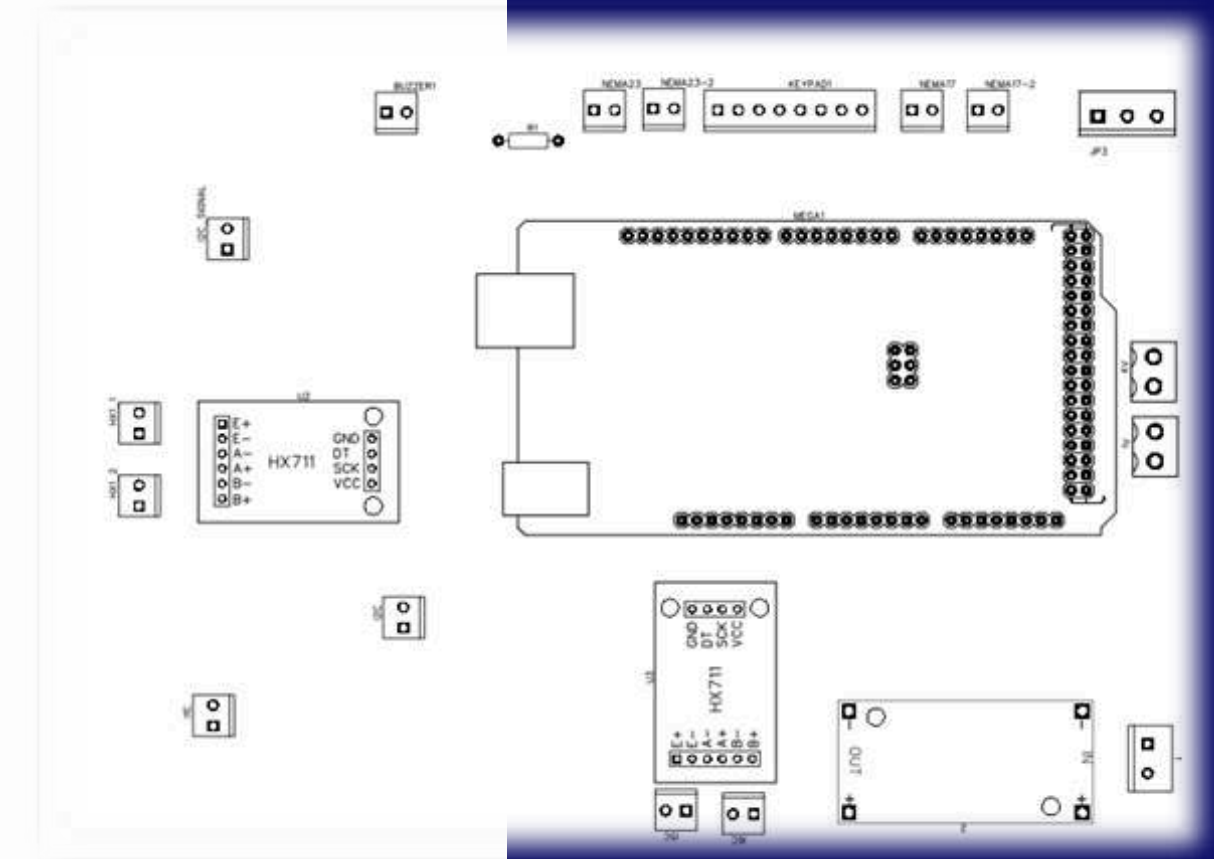


# SCHEMATIC DIAGRAM



# PCB DESIGN

- Software used to design the PCB: EasyEDA
- Single layer design.





# **BUSHRA M.B.F. (224236G)**

- Responsibilities

- Design the cutting part of the machine using a NEMA stepper motor and stepper motor driver, and program it to the Arduino board
- Study the membrane switch keypad and program it on the Arduino board.

- Components

- NEMA 23 Motor and Driver.
- 4\*4 Matrix Keypad.

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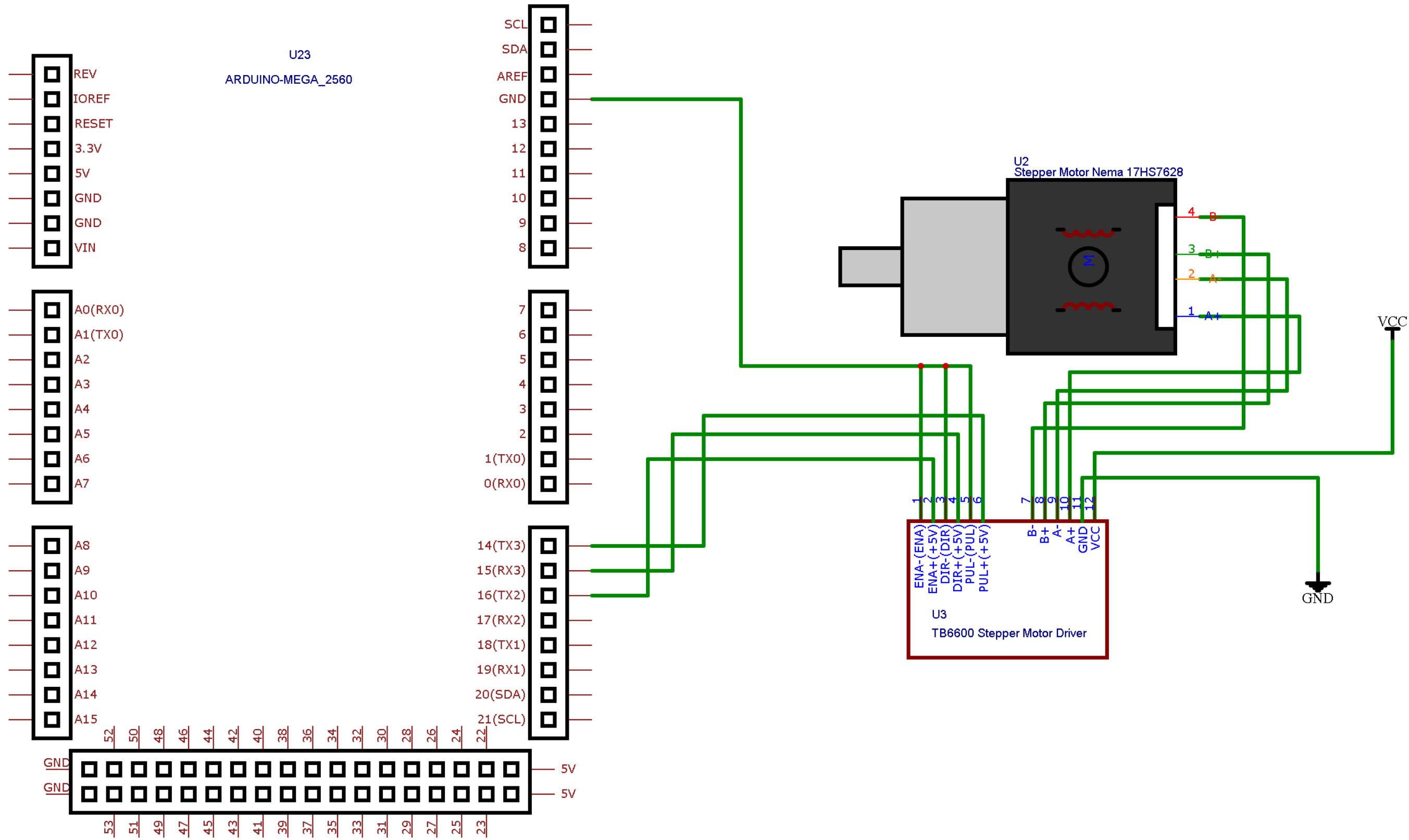
# NEMA 17 Stepper Motor and Stepper Motor Driver

- NEMA 17 motor and stepper driver have been used for the cutting mechanism.
- Supply voltage for Driver: 220V
- Supply Current for Motor: 2A
- Step Angle:  $1.8^{\circ}$
- Steps/Revolution: 200





# SCHEMATIC DIAGRAM

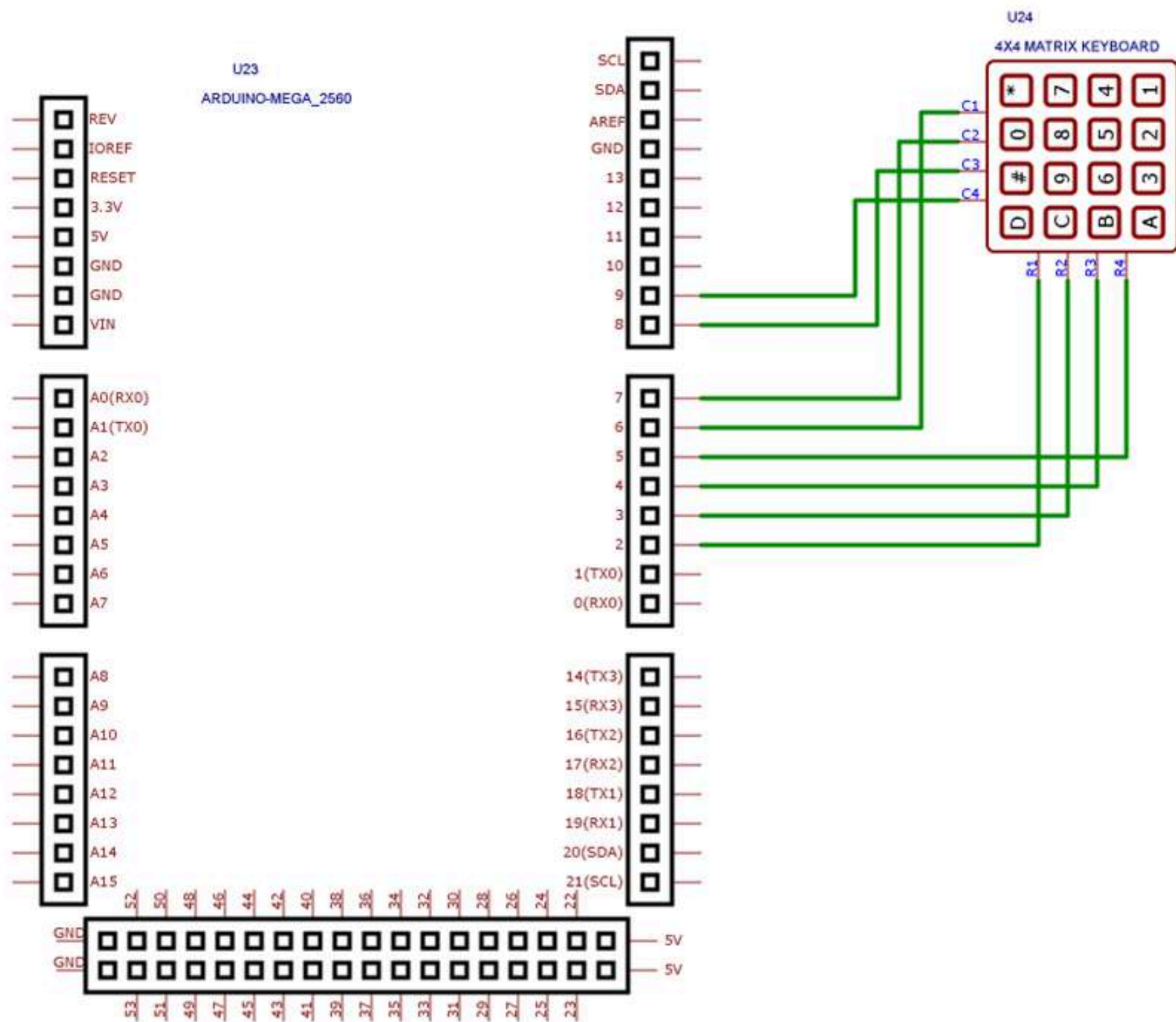


## 4\*4 Matrix Keypad

- The keypad is used to gather information from the user, such as wire type and wire length.
- Supply voltage: 5V
- Supply Current:



# SCHEMATIC DIAGRAM





# **KAHINGALA K.J.T.(224099L)**

- Responsibilities

- Study the IR sensor and program it on the Arduino board.
- Study the LCD display, display adapter and program them using the Arduino board.

- Components

- IR Sensor.
- LCD Display, Display Adapter.

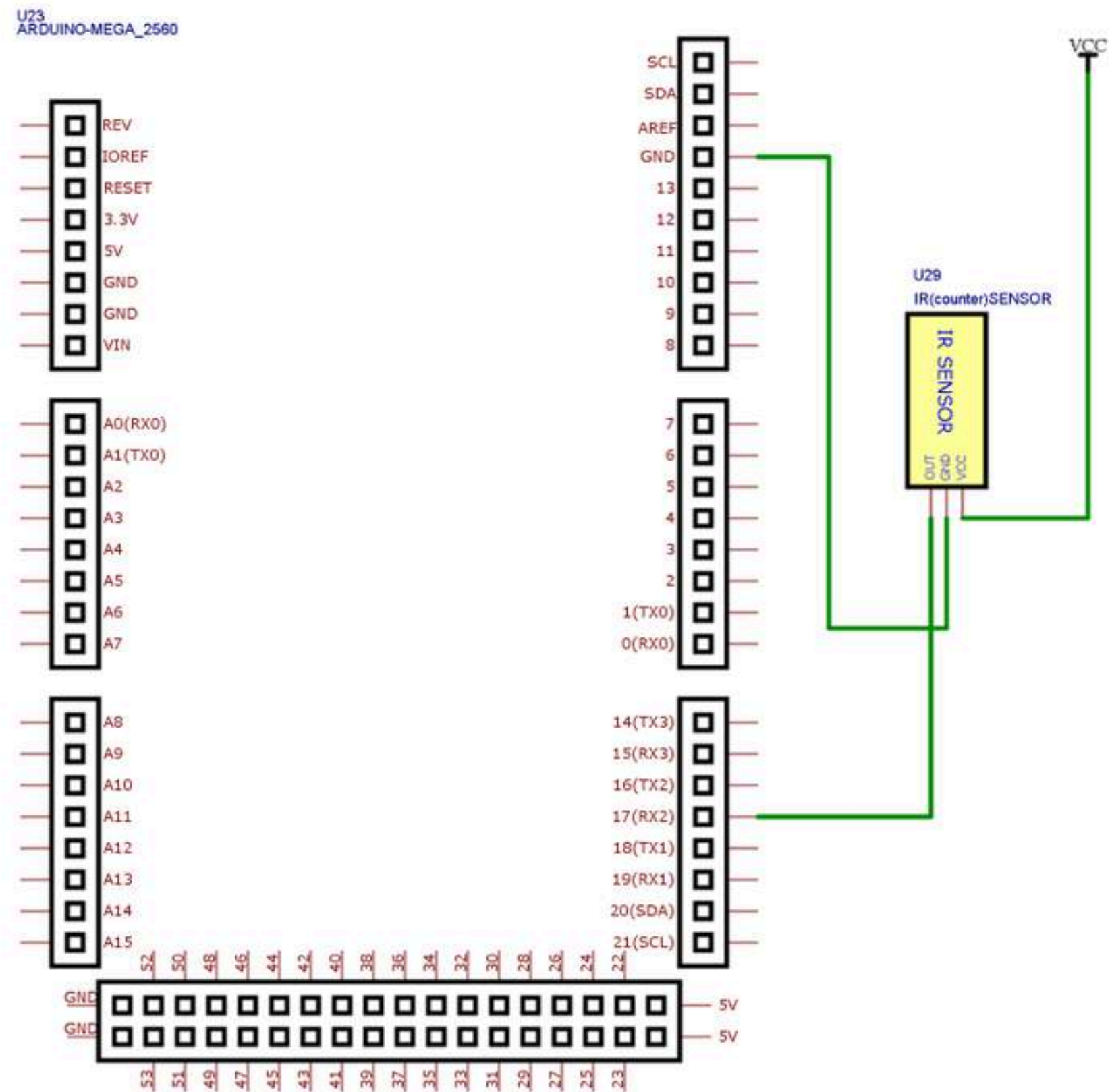
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# Infrared(IR) Sensor

- The IR sensor is used in the winding mechanism. By detecting the number of times the obstacle passes through the sensor, it calculates the length of wire that has been wound.
- Supply voltage: 5V
- Supply Current:



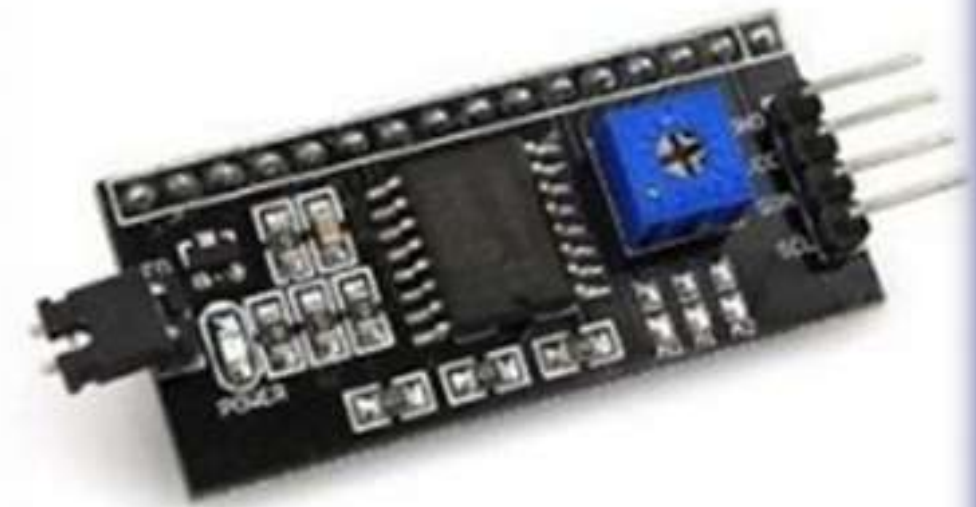
# Schematic Diagram



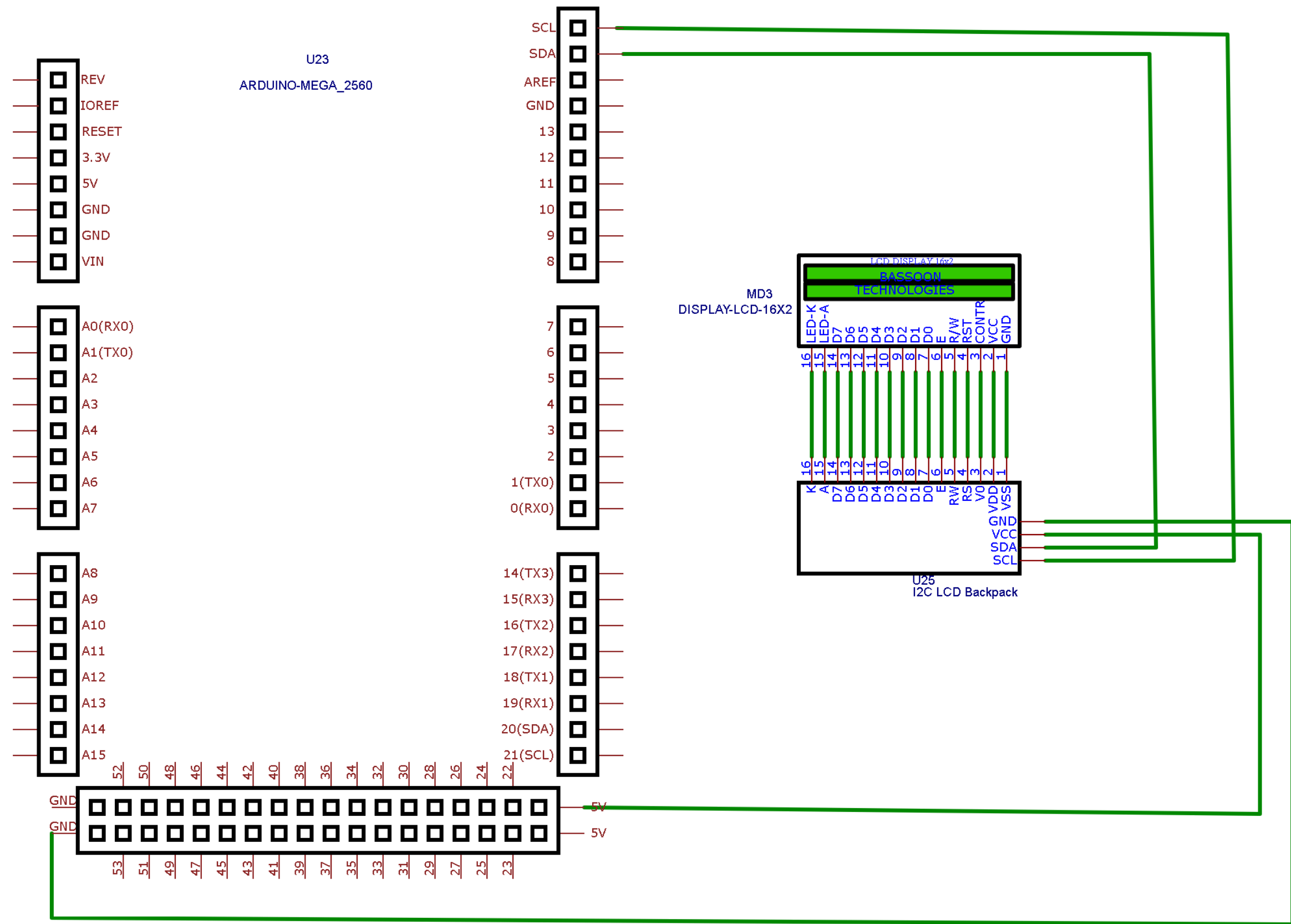


# LCD Display with I2C Adapter

- An LCD display, display adapter are used to display data, such as the progression statements.
- Supply voltage: 5V
- Supply Current:



# SCHEMATIC DIAGRAM



# PROJECT COST

Components	Quantity	Price
Arduino Mega 2560	1	4475
Arduino Cable	2	170
NEMA 23 Stepper Motor	1	3060
NEMA 17 Stepper Motor	1	1890
Stepper Motor Driver	2	2600



Components	Quantity	Price
10Kg Load Cell	2	600
Load Cell Amplifier	2	440
Keypad	1	130
LCD Display	1	325
I2C Module	1	250
IR Sensor	1	100

Components	Quantity	Price
Capasitor	5	50
Piezo Buzzer	2	80
IC Regulator	1	30
Power Supply	1	3000
Power Supply Cable	1	120
Hall Effect Sensor	1	120

Components	Quantity	Price
Wire Cutter	1	600
Jumper Wire		515
Bread Board	2	450
Closed Timing Belt	1	375
GTS Pulley	1	1000
Pulley Teeth Aluminium	1	625



Components	Quantity	Price
Plug	1	550
Wood		1500
Transport		2500
Miscellaneous		6000
Total Cost		28495

# DEMONSTRATION<sup>13</sup>

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# QUESTION & ANSWER



**THANK YOU!**

