<< IN1901 - Microcontroller Based Application Development Project >>

PROJECT PROPOSAL REPORT

Level 01

<< Automatic Cable Coiling & Wire Winding Machine >>

Examiner <Mr. B. H. Sudantha> < >

Submitted by:

Thilshath S.M.	**224195D**
Balasuriya P.B.G.A.V.K.K.	224244E
Afzal M.Z.M.	224232P
Kahingala K.J.T.	224099L
Bushra M.B.F.	224236G

Bachelor of Information Technology
Faculty of Information Technology
University of Moratuwa

Table of Contents

1. Introduction

Cable coiling and wire winding are fundamental processes in various industries, traditionally handled manually. The labor-intensive and time-consuming nature of these tasks poses challenges such as human errors, inconsistent coiling tension, and reduced efficiency. To overcome these issues, the proposal is to design and develop an Automatic Cable Coiling &Wire Winding Machine, leveraging microcontroller technology.

1.1 Problem in Brief

Manual cable coiling and wire winding processes suffer from human errors, variations in coiling tension, and time inefficiencies. These challenges lead to increased production costs, decreased quality control, and operational inefficiencies. The Automatic Cable Coiling &Wire Winding Machine aims to address these issues by providing a precise, efficient, and automated solution.

1.2 Significance of Study

The significance section underscores the importance of the study by highlighting the positive impact the proposed machine could have on industry practices. Reduced human errors, consistent coiling tension, and improved operational efficiency are positioned as key benefits. The study not only addresses current challenges but also contributes to increased productivity, cost-effectiveness, and workplace safety.

1.3 Aim and Objectives

- **Aim:**

The primary goal of the project is to design and construct an Automatic Cable Coiling &Wire Winding Machine. This machine is envisioned to offer a solution that is not only precise and efficient but also fully automated. The aim is to significantly enhance the cable and wire coiling process, moving away from manual methods prone to errors and inefficiencies.

- **Objectives:**

1. **Versatility:**
    - Explanation: The machine should be versatile enough to handle various sizes and types of wires and cables. This adaptability is crucial because different industries may require coiling solutions for a wide range of materials. The machine's design should allow for easy adjustments to accommodate these variations.
    - Importance: Versatility ensures that the machine can cater to the diverse needs of different industries, making it a valuable asset across various applications.

2. **Sensor Integration:**
    - Explanation: Implementation of sensors and control mechanisms is essential for accurate measurement during the coiling process. Tension, speed, and length are critical parameters that must be precisely monitored and controlled for optimal coiling outcomes.
    - Importance: Sensors enhance the precision of the coiling process, ensuring uniformity and preventing variations in tension or length. This level of control contributes to the overall quality of the coiled products.

3. **Safety Features:**

    - Explanation: Safety is a paramount consideration in any industrial setting. Developing safety features involves incorporating mechanisms that protect operators from potential hazards during the machine's operation.
    - Importance: Ensuring operator safety not only complies with industry standards but also creates a secure working environment. It minimizes the risk of accidents and contributes to the overall efficiency and reliability of the machine.

4. **Optimization:**

    - Explanation: Optimization of the coiling process focuses on improving productivity and cost-effectiveness through automation. This includes streamlining operations, reducing waste, and enhancing overall efficiency.
    - Importance: Optimization ensures that the machine operates at peak efficiency, minimizing resource consumption and maximizing output. This objective aligns with the broader goal of creating a machine that not only automates but also enhances the cable coiling process.

These objectives collectively guide the development process, providing a clear roadmap for creating an Automatic Cable Coiling/Wire Winding Machine that is not only technically sophisticated but also aligns with the practical needs and challenges faced in various industries.

2. Literature Study

The literature study is a critical phase in the research and development process, aimed at gaining a deep understanding of the existing knowledge, technologies, and challenges associated with cable coiling and wire winding.

- **Research and Technologies:**
  - Existing Practices: Investigate how cable coiling and wire winding are currently performed in industries. Understand the manual methods, tools, and equipment commonly used.
  - Technological Landscape: Explore any existing automated solutions or technologies utilized in cable coiling. Identify the strengths and weaknesses of these technologies.

- **Challenges Faced by Industries:**
  - Human Errors: Examine how manual processes contribute to human errors in cable coiling. Understand the impact of inaccuracies on the quality and efficiency of the coiling process.
  - Inconsistent Tension: Analyze how variations in tension during manual winding affect the final product. Explore the consequences of inconsistent tension on cable integrity.

- **Current Trends:**
  - Automation Trends: Identify any emerging trends in automation within the cable and wire manufacturing industry. Explore how automation is being integrated to improve efficiency and reduce errors.

- Smart Manufacturing: Investigate the adoption of smart manufacturing practices and how they relate to cable coiling. This could involve the use of IoT devices, sensors, and data analytics.

➢ **Advancements in Automated Solutions:**

- Technological Advancements: Explore recent technological advancements that have contributed to the field of cable coiling automation. This could include developments in sensor technology, control systems, and robotics.
- Case Studies: Examine specific case studies or projects where automated solutions have been successfully implemented. Understand the outcomes, benefits, and challenges faced during implementation.

➢ **Insights for the Design Process:**

- Identify Gaps: Determine any gaps or limitations in existing technologies that the proposed Automatic Cable Coiling/Wire Winding Machine can address.
- Best Practices: Extract best practices and lessons learned from existing literature that can guide the design and development of the proposed solution.
- Benchmarking: Benchmark the proposed solution against existing technologies to ensure it offers a competitive edge in terms of efficiency, versatility, and safety.

By conducting a comprehensive literature study, the research team can leverage existing knowledge, learn from past experiences, and ensure that the proposed Automatic Cable Coiling/Wire Winding Machine aligns with the latest industry trends and technological advancements. This phase is crucial for informed decision-making and designing a solution that truly addresses the identified challenges in cable coiling.

3. Proposed Solution

The proposed solution introduces the Automatic Cable Coiling &Wire Winding Machine as an innovative response to the challenges of manual winding. By automating the coiling process and incorporating sensors, precise control systems, and safety features, the solution aims to ensure uniform coiling, increase efficiency, and prioritize operator safety.

3.1 Features of the Proposed Solution

- Versatility:

The machine accommodates various wire/cable sizes and types, providing flexibility for different industry applications.

- Sensor Integration:

Incorporates sensors for accurate tension, speed, and length measurement, ensuring precise control during the coiling process.

- Safety Features:

Implements safety mechanisms to prevent accidents and prioritize the well-being of operators.

- Microcontroller-based Control System:

Utilizes a microcontroller for precise and automated control of the coiling process.

These features collectively contribute to the effectiveness and efficiency of the proposed solution

3.2 Components required for the proposed solution

Here the required resources for the solution design were mentioned.

1. Load cell : Measures the weight of the coiled cable, contributing to derive the current length of the coiled cable.
2. Tension Sensor: Monitors and controls the tension in the cable during the winding process. it ensures that the cable is not slipping on pulley.
3. Counter Sensor: The pulley rotates, carrying the magnetic nobs past the sensor. The sensor reacts to the rising magnetic field by generating a voltage pulse. We can derive the length from pulse counting.
4. Nema 23 stepper Motor: Drives the winding mechanism, providing controlled and automated coiling.
5. Servo Motor : It is used to cut the wire after finishing the measurement.
6. 16*4 LCD Display: Offers a user interface for real-time monitoring and feedback.
7. Keypad 4*4: Allows operators to input commands and set parameters for the coiling process
8. Speaker : To announce alerts or information {Ex:- Change the wire role(if length is not enough), process finished, and etc}

These components work together to create a sophisticated and efficient Automatic Cable Coiling &Wire Winding Machine.

3.3.Nature of the Solution

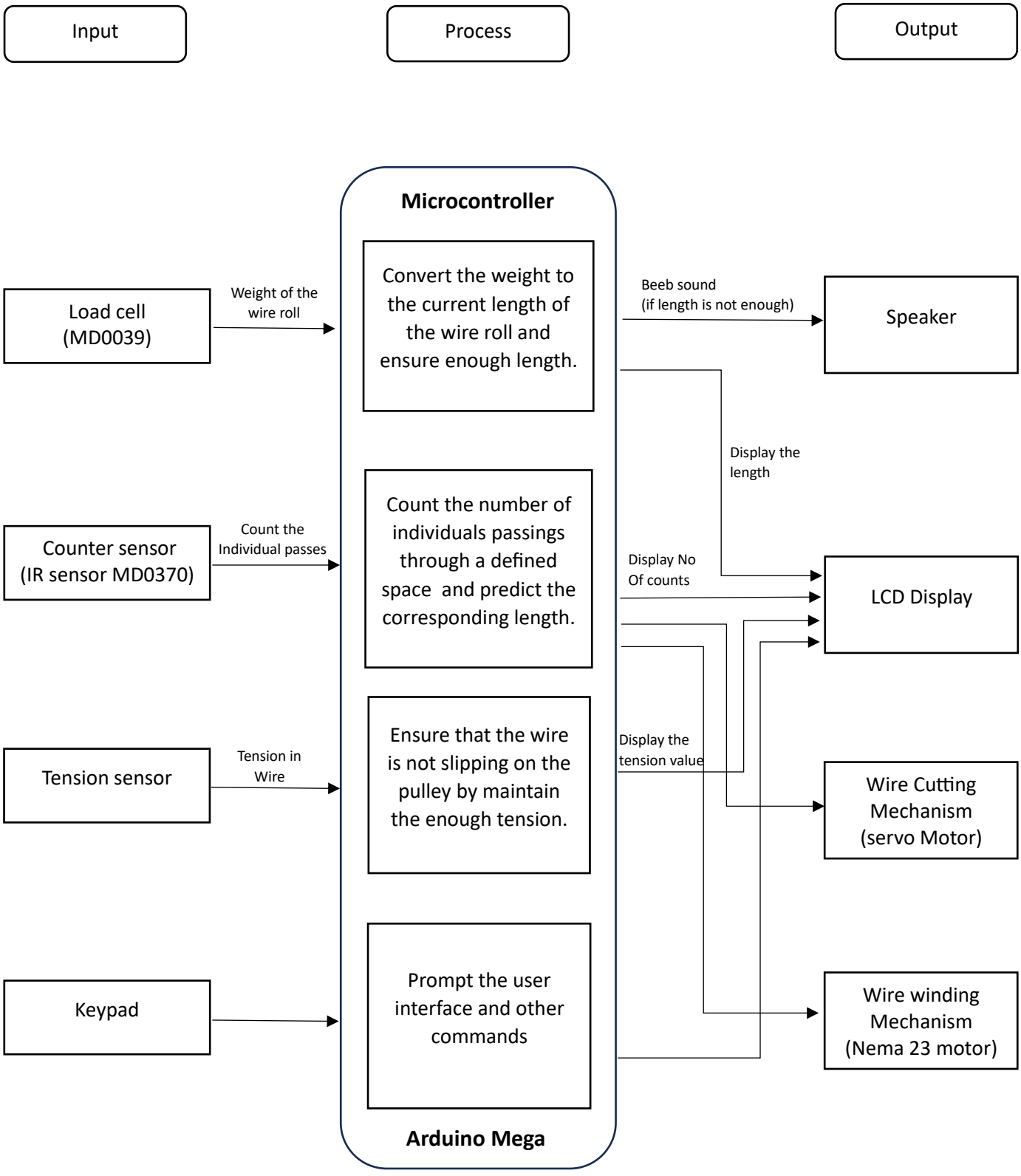
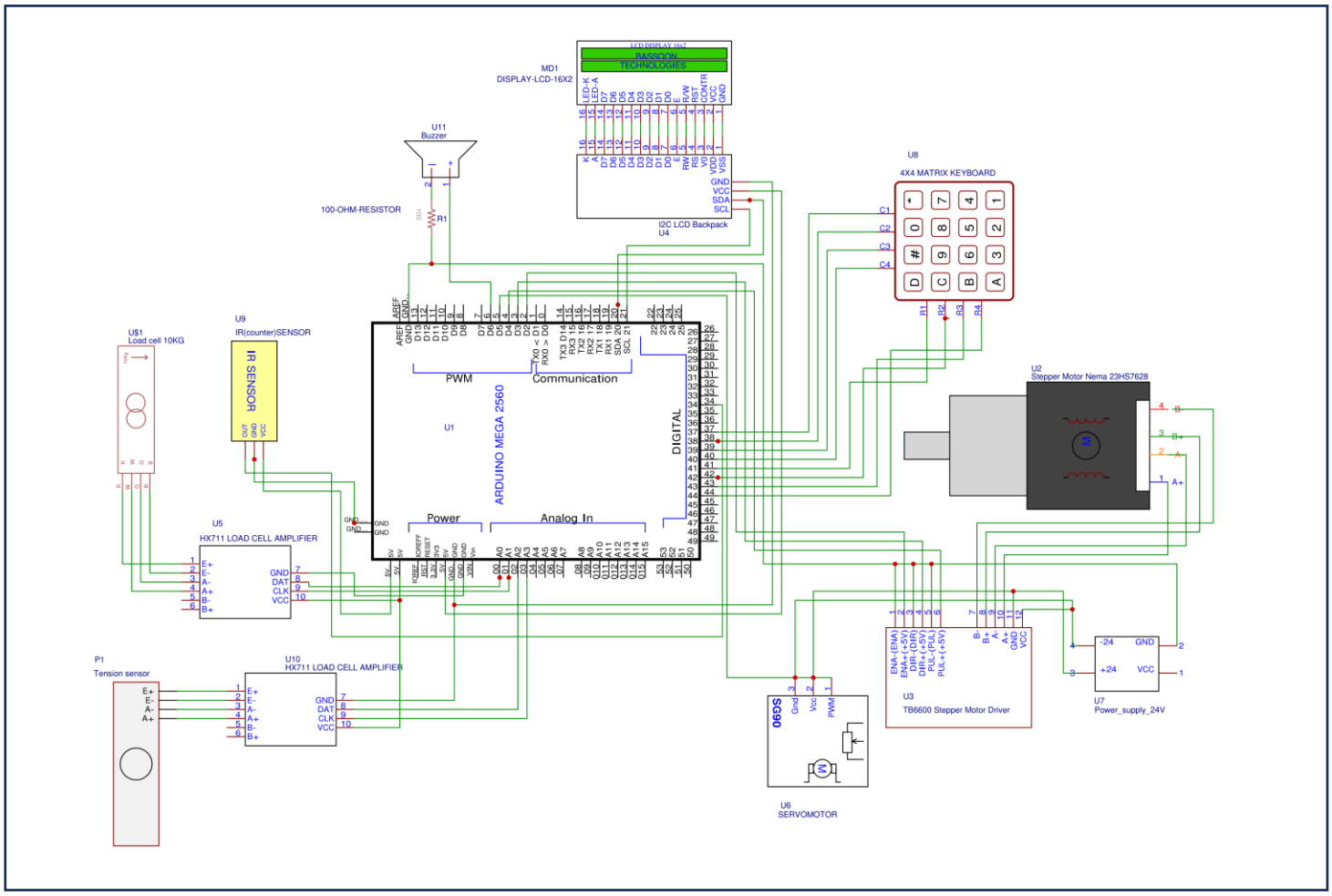


Figure 01 :Block diagram of the input , process, and output



3.4 Solution Design

3.5 Resources

Here we include the required resources for the solution design with the budget allocation for those items

Component	Unit Price (LKR)	Unit	Total Price
Nema 23 stepper Motor(MT0270)	8900.00	1	8900.00
Motor Driver module (TB6600)	1150.00	1	1150.00
Servo Motor(RB0178)	6400.00	1	6400.00
Load cell(10kg)	420.00	2	840.00
HX711 /Load cell amplifier breakout board.	170.00	1	170.00
Counter Sensor - (IR sensor)	150.00	1	150.00
16 Key 4x4 Membrane switch keypad (MD0062)	150.00	1	150.00
16x2 LCD Display(DM 0002)	380.00	1	380.00
Arduino Mega 2560(CH340)	5800.00	1	5800.00
Tactile push buttons	8.00	2	16.00
STANLEY 84 - 214 -22 5.25" 130 mm Wire Stripper Ideal for Cutting (wire cutter)	1000.00	1	1000.00
PCB Design	1100.00	1	1100.00
Plastic Belt Pulley wheel	20.00	5	100.00
Total			**= 26156.00**

3.6 Workload matrix

Table 02: Workload matrix

Registration Number	Assigned Responsibilities
224195D	Making the Tension sensor User Interface
224244E	Counter sensor PCB design
224232P	Loadcell (weight sensor) Making the wire roll container
224236G	Cutting Mechanism(Using servo motor)
224099L	Winding Mechanism (Using Nema 23 stepper Motor) Buzzer alert system

4. References

1) https://youtu.be/GBbT6FhckXM?si=2b0o0CCleGefbD0r – to make the mechanical part

2) https://youtu.be/q1EAGI2PFsQ?si=hVQiwEkYK6ajEirE - for cutting mechanism

3) https://nevonprojects.com/industrial-manufacturing-projects/ - for case studies

4) https://www.instructables.com/Automatic-Wire-Cutter-and-Stripper/ - for additional information / what type of wire should use

5) https://youtu.be/q1EAGI2PFsQ?si=LGauHgw-Bp8P52mL – Making the V cutter

6) https://youtu.be/EirQf0B01ss?si=F_ToG1fTMe0ztalC – Making tension sensor our selves