Automatic Wire Cutting Machine

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ABSTRACT

The optimization of industrial processes through automation is essential for enhancing productivity and reducing operational expenses. Wire cutting and stripping, a fundamental operation across various industrial scales, is a prime candidate for such improvements. This project addresses the shortcomings of manual systems by designing and implementing an automated wire-cutting and stripping machine. Utilizing Fusion 360 for precise design and incorporating automation via an Arduino Uno microcontroller, the system achieves superior accuracy, reliability, and material efficiency. The adoption of automation not only reduces time and labor costs but also ensures consistent output by eliminating human error. Constructed using affordable components, the machine's design and fabrication make it accessible and practical for industries of all sizes. This automated solution showcases the potential for enhancing industrial operations through reliable, cost-effective, and technologically advanced methods.

Keywords: Arduino uno, Stepper Servomotor

INTRODUCTION

The Automatic Wire Cutting Machine is an advanced automation tool designed to enhance the precision, speed, and efficiency of wire cutting processes. In traditional manufacturing, wire cutting is performed manually, leading to challenges such as inconsistent wire lengths, human error, and time inefficiency. With the adoption of automation, machines integrated with components such as microcontrollers, sensors, and actuators can cut wires with high accuracy and speed, significantly reducing the dependence on manual labor while increasing production output. These machines are capable of handling a variety of wire types, including copper, aluminum, and insulated wires, and tailoring them to specific lengths for diverse applications. Industries such as electronics, automotive, robotics, and electrical equipment manufacturing rely on wire-cutting machines to streamline their production workflows, ensuring consistency and efficiency.

addressing manual cutting limitations, an Automatic Wire Cutting Machine, which is a sophisticated device that improves the process of cutting wires in manufacturing, plays a critical role in modernizing manufacturing processes and supporting high-volume, high-precision production demands. Unlike traditional manual wire cutting, which can be inaccurate and slow, this machine uses advanced technology to cut the wires quickly and precisely. It can work with different types of wires and cut them to exact lengths. The key benefits of the machine include the following. 1. Increased accuracy 2. Faster cutting speed 3. Reduced human error 4. Higher production output 5. Ability to handle various wire types This technology is particularly useful in the electronics, automotive, robotics, and electrical equipment manufacturing industries. This helps these industries produce wires more efficiently and consistently, especially when large quantities of precisely cut wires are required. By automating the wire cutting process, manufacturers can modernize their operations, reduce reliance on manual labor, and improve the overall production quality and speed.

RELATED WORK

Sammed Narendra Patil, Sourabh Karyappa, Suraj Rajendra Patil, Shubham Deepak Patil et.al, This research explores the creation and implementation of a machine that automatically cuts wire, specifically designed for use in small-scale industrial settings. The primary objectives are to enhance productivity by mechanizing the wire-cutting operation, minimizing human intervention, enhancing accuracy, and reducing processing time. The study emphasizes the economic viability of such machinery and its capacity to boost output in small manufacturing facilities.[**1].**

Ms. Poonam Mane1,Ms. Shalaka Mali2, Ms. Pooja Korade3 and Mr. Suhas Katkar4 et.al, This study examines the development of a machine that automatically cuts wire, aiming to enhance industrial wire-cutting operations. The device employs

microcontroller-based automation to achieve high accuracy, decrease human involvement, reduce errors, and boost overall efficiency. As a result, it provides a cost-efficient and effective solution for various industrial uses.[**2].**

Dr.S.Saraswat1, Rahul Singh2, Rohan Agarwal2, Shubha Patel2 and Tanmay Jha2et al This research outlines the development and construction of a machine that automatically cuts wire, utilizing Fusion 360 for computer-aided design and Arduino for controlling automation. This study focuses on creating an economical and effective method to streamline wire cutting, enhance accuracy, and reduce manual labor. This research underscores the combination of design software and programming tools to boost productivity and flexibility in industrial settings.[**3].**

Abhishek Diwanji*1, Tejaswini Naktode*2, Bhagyashri Donadkar*3, Prasanna Titarmare*4, Ashish Polke*5, Prasanna Pothi*6 et al
The paper,
"Automatic Cable Cutting Machine - An Overview" provides a comprehensive review of the design, development, and applications of an automatic cable cutting machine.
It discusses the technology behind automation in cable-cutting processes, focusing on its efficiency, precision, and cost-effectiveness. This study highlights the use of automation to reduce manual labor, increase productivity, and minimize errors in industrial settings, thereby offering a more reliable solution for cable processing. This study emphasizes the potential of such systems to optimize manufacturing operations across various sectors.[**4].**

Yevgeny Rapoport (Dec2012) et al The paper "Design of an Automatic Machine for Stripping and Bending Insulated Electrical Wire". by Yevgeny Rapoport (December 2012) focuses on the design of an automated system specifically for stripping and bending insulated electrical wires
This study presents a machine that automates these tasks, which are traditionally performed manually, to enhance precision, reduce labor, and increase overall production efficiency. The design involves sophisticated mechanisms that allow for the accurate stripping of insulation and controlled bending of wires, thereby improving the productivity and quality of wire processing. This study highlights the potential benefits of machines in industries that require high-volume wire manipulation.[**5]**

BLOCK DIAGRAM OF SYSTEM

The diagram illustrates the basic setup of automatic wire-cutting machine using an Arduino Nano as the central controller.

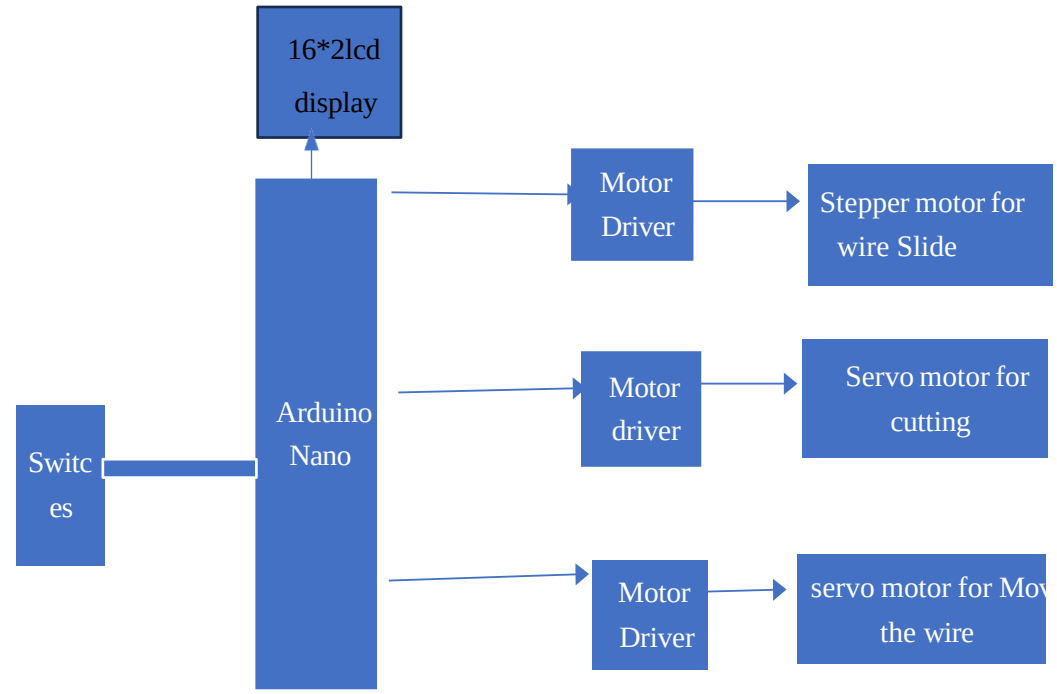

Figure 1: *Block Diagram of System.*

1. Arduino Nano: Acts are the main controllers for managing the entire system, processing input signals, and controlling the motors via motor drivers.

2. 16x2 LCD Display: It is used to display relevant information, such as the system status, wire length, and cutting count.

3. Switches: Allow user interaction to input settings such as wire length, number of cuts, or start/stop operations.

4. Motor Drivers: The interface between the Arduino Nano and the motors enables proper power supply and control of motor functions.

5. Stepper Motor for Wire Sliding. The precise movement of the wire was handled to ensure accurate length measurement before cutting.

6. Servo Motor for Cutting. The cutting mechanism was controlled to cut the wire to the desired length.

7. Servo Motor for Moving the Wire Assists in feeding or repositioning the wire during the operation. This system integrates multiple components to efficiently automate the wire- cutting process, offering precision and ease of use.

FLOW CHART OF SYSTEM

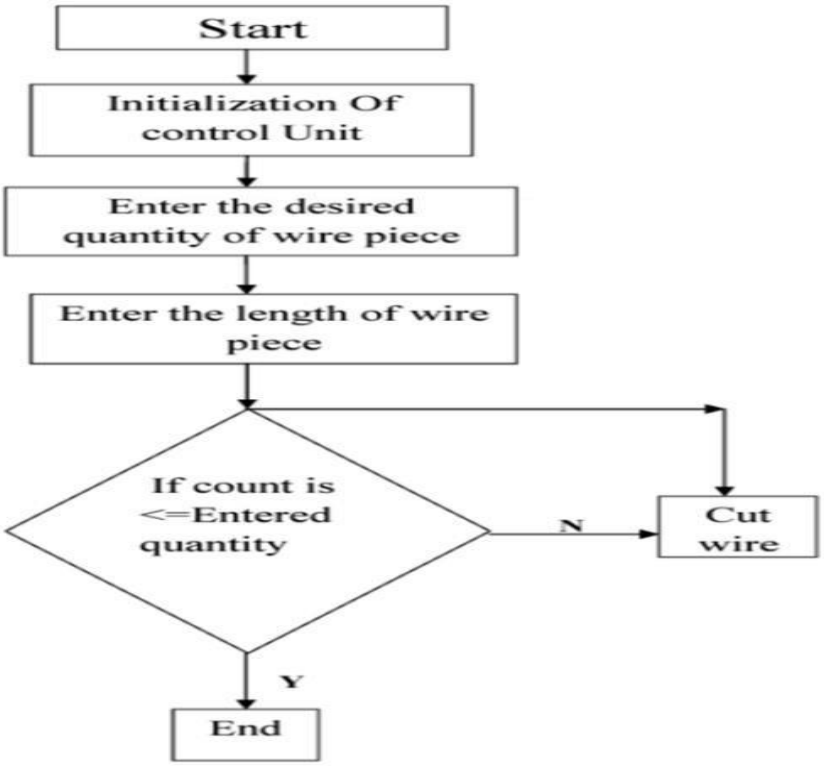

Figure 2: *Flow chart of the system.*

The diagram illustrates the sequential operation of an automated wire-cutting control system designed to produce a user-specified number of wire segments at a given length. The process begins with system initialization, ensuring all components are ready for operation. Users then input two key parameters: the desired quantity of wire pieces and their intended length. These inputs guide the system's operation, accommodating various production needs. The control unit then enters a decision-making loop, assessing whether the current number of cut wire pieces meets or falls below the specified quantity. If so, the cutting mechanism is triggered to produce another wire segment of the predetermined length. This cycle repeats until the target quantity is reached, at which point the operation terminates. This automated approach ensures accuracy, efficiency, and uniformity, making it particularly beneficial for industries that require standardized wire segments, such as electronics, construction, and automotive manufacturing. By reducing manual intervention and incorporating flexibility and scalability, the system improves productivity and dependability in manufacturing processes.

SOFTWARE RESULT

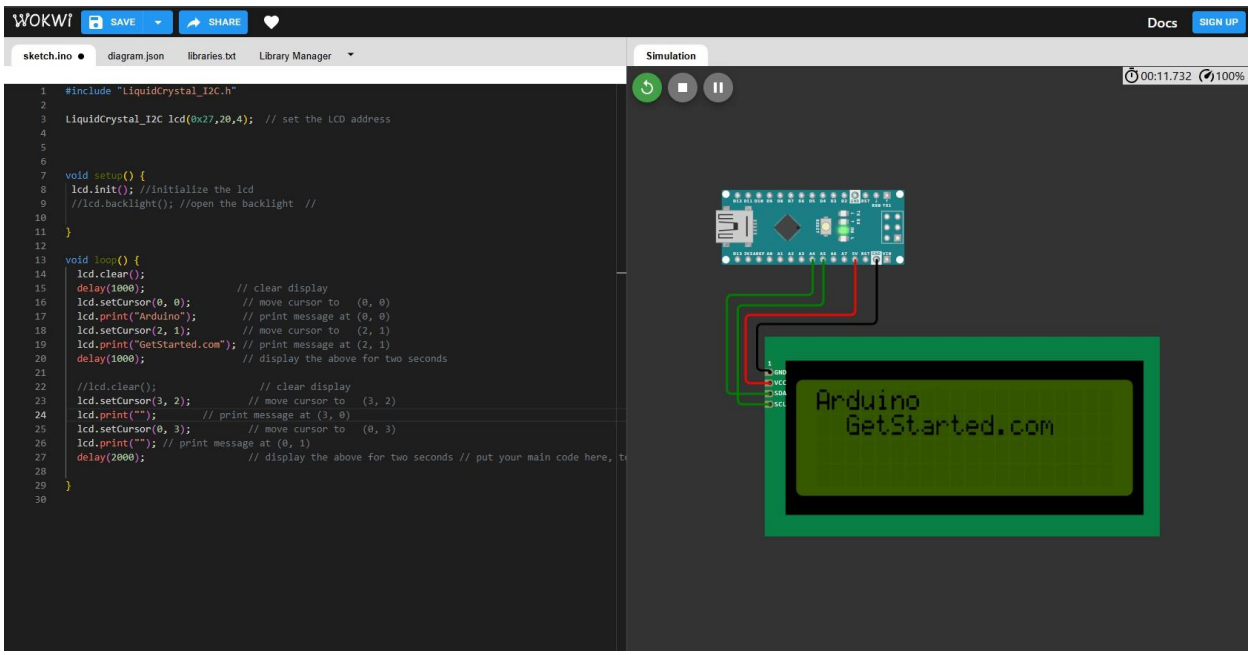

Figure 3: *Software Result.*

Fig. 3 shows the Arduino setup with an I2C LCD display. The code initializes the LCD, sets the cursor position, and prints "Arduino" and "GetStarted.com" on the screen. The wiring connects the LCD to the Arduino using I2C communication (SCL, SDA, VCC, and GND).

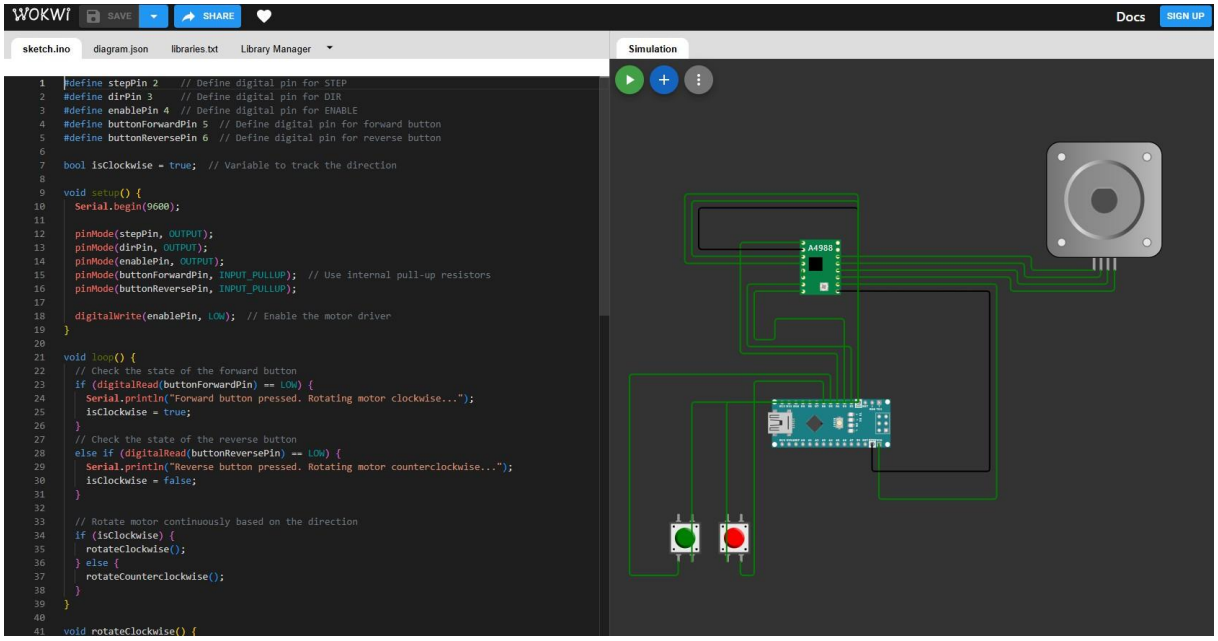

Figure 4: *Software result of LCD interfacing with PIC.*

Fig.4 This setup controls the stepper motor using an A4988 driver and two buttons. Green button:
Make the motor rotate clockwise,
Red button: Makes the motor rotate counterclockwise.
Arduino monitors the button presses and rotates the motor in the selected direction.

CONCLUSION

Automatic wire-cutting machines have become indispensable in modern industries because they offer unparalleled precision, efficiency, and scalability. By reducing manual labor, minimizing errors, and adapting to diverse operational needs, they align perfectly with the demands of today's fast-paced technology-driven world. Their integration into production processes ensures higher productivity, consistent quality, and long-term cost-effectiveness, making them a vital asset for industries aiming to remain competitive and innovative.

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