

## Automatic Cable Cutter and Roller with Arduino

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DOI: <https://doi.org/10.30880/peat.2022.03.02.039>

Received 27 January 2022; Accepted 07 November 2022; Available online 10 December 2022

**Abstract:** When it comes to the installation of any electrical or electronic device, then cables and wiring form “nerves” to carry electric currents or pulses. During the wiring installation, process of cable cutting and winding is a basic thing that happens throughout the work. A project such as "Automatic Cable Cutter and Roller with Arduino", provides convenience method to users in doing work and also can save working time. This project was equipped with two combined circuits that can work at the same time. Arduino is a mainstay component to supervise and control the entire cutter circuit. The cutting circuit part uses 2 power supplies. The first power supply is for Arduino Nano which is 5V. The second power supply is 12V and connected to the motor driver as a stepper motor power supply. The use of 2 stepper motors is intended as a feeder and cutter. The feeder motor work as the cable supplier to the cutter motor. This circuit runs after length and cable quantity was set. Next is the roller & puller circuit. This circuit was supplied with 12V. The usage of a power window motor is very useful with high traction and moderate movement. The circuit work as a tool to wind and pull the cable in case it gets stuck on something during wiring. In conclusion, the prototype "Automatic Cable Cutter and Roller with Arduino" can provide convenience method in electrical and electronic wiring work.

**Keywords:** Cable Cutter and Roller, Electrical and Electronic Wiring Work, Arduino Automatic System

### 1. Introduction

Electrical wiring is a basic thing to be emphasized. Various methods need to be done in completing wiring or soldering. While doing wiring, cable cutting is one of the processes during cable installation. Cable pieces are made after the measurements are made. However, there was more wastage of cables once they were installed. This is because, the wiring often cuts beyond measure to ensure no extension cables due to short cables. To resolve this issue, studies have been conducted on various platforms. The study made, found that most of electrician now only use a manual system to cut the cable. Most wireman

(PW4) use “shell” branded cable cutters. This project aims to identify and solve issue. Wire measuring and cutting are labor-intensive process that requires human effort. The proposed study would cut wire automatically. With technology like this, employees can save time and even measurement efficiency.

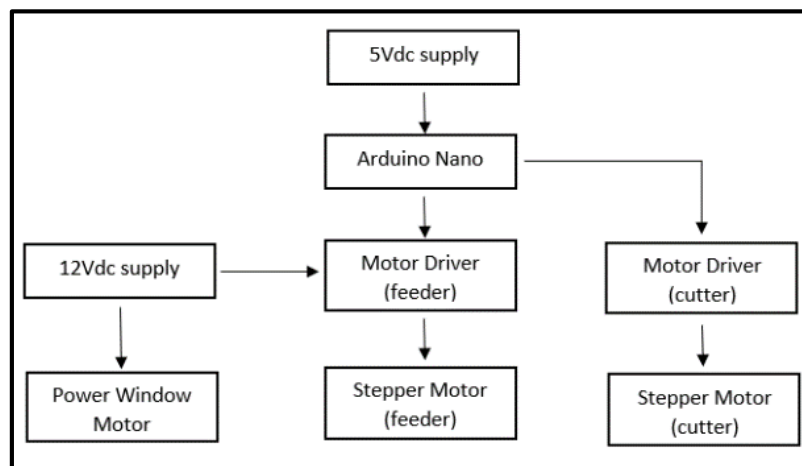
Besides, there were also problems when winding cables that have been used or scattered. In this case, it will take a lot of time for the worker to roll it back. This is because the cable quality is very heavy and hard. Mostly, a coil of cable that was still long and scattered requires 2 people to rewind it. Various platforms have been used to conduct research in order to overcome the problem. This invention was supposed to have a motor. Although wire winders were already on the market. However, most winders were for large cables usage such as underground and overhead cables. This is because, the development of technological inventions in the domestic industry is still needed.

The next project function was pull cables to assist the wireman (PW4) or electrician while working. This was the project special feature. In this section, was referred to the cable puller. The cable puller did not use human energy. This invention made, was to facilitate the electrician when to pull the cable inside the conduit. Generally, electrical wiring project was done in a team. This is because it will be difficult for the wireman to work if working alone. To complete this project, a study was conducted to find out the tools that are often used by local wireman. The study found, the use of “cable puller wire” was always used by the wiremen. Besides, this cable puller mechanism was connected to the automation system.

This current project, called the " Automatic Cable Cutter and Roller with Arduino," using an automation system with the use of an Arduino as a controller to all component movements and signals. This project combined hardware and software in setting the amount of the length and also the quantity output desired cable. The user only needs to press the switch to set the number of cables to be cut and also for the use of cable pullers and winders

## 2. Methodology

A block diagram was used to represent the system structure and involved process flow. Figure 1 illustrates the block diagram for the project.



**Figure 1: The block diagram of the project**

By refer to Figure 1, it can be proved that the whole circuit was used the 12 Vdc from motorcycles battery. The usage of 12 Vdc was very important as the supply for the stepper. The planning was to identify the components needed even the working principles. The Arduino Nano was applied to the circuit. The Arduino was to control the stepper motor movement. Arduino Nano will be injected with 5Vdc. Stepper motor will be used for cable feeder and cable winder. Furthermore, the power window motor would use as the puller and winder. The reason for selecting the power window motor for pulling

and winding was because of high in torque and the normal speed. The motor selection was extremely essential for the appropriateness usage.

2.1 Flowchart

The flow chart in Figure 2 shows the operation of the Automatic Cable Cutter and Roller with Arduino from beginning to end.

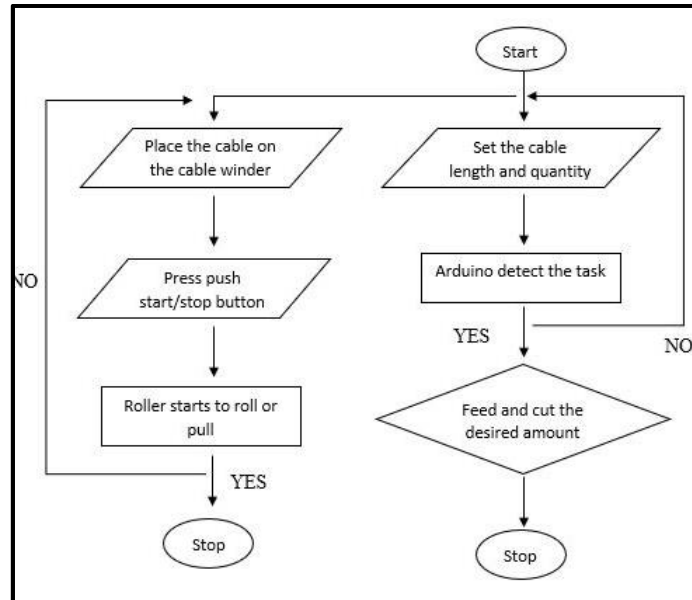


Figure 2: Flowchart of the Automatic Cable Cutter and Roller with Arduino

2.2 Hardware Development

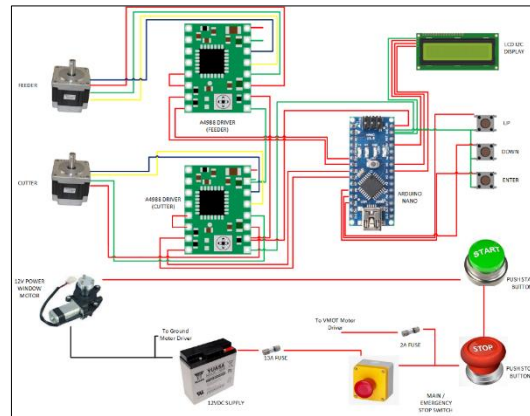
Table 1 shows the list of the component for Automatic Cable Cutter and Roller with Arduino system circuit.

Table 1: List of components

Component	Description	Operating supply
Stepper Motor	NEMA 17HS4401 Bipolar	12 vdc / 1.7 amp
Arduino	Arduino Nano	5V input, 0-5V output
Battery	Motorcycle battery	1.7A rated current, 12 vdc
Liquid Crystal Display (LCD)	2x16 LCD with I2C Module	0.5Watt rated power
Roller and winder motor	Power Window Motor with Coupling (Right)	Rated 10A at 12V
Motor Driver	A4988 Stepper Motor Driver	8vdc to 35vdc / 2 amp

2.3 Circuit Diagram

Figure 3 illustrates the circuit diagram of the project.



**Figure 3: The illustration circuit of the project**

By refer to Figure 3, there were 2 of motor driver used. The motor driver was supplied by 12 vdc from battery. The A4988 is a full-featured micro stepping motor driver with an integrated translator for simple operation[1]. As we can see, the connection every of stepper motor was to the 1B. The pin of 1A, 1B, 2A, and 2B was the connection to the coils of the motor. For the feeder motor’s driver, the connection of step and direction was connected to the pin of Arduino Nano which are D3 and D4. The D3 and D4 were used as input or output pins[2]. The digital pins from D0 to the D13 is act for the high (5v) and low (0v). The reset and sleep pins were looped because of the floating on the breakout (not pulled high or low), it simply by connect this to the SLEEP pin. The pins of VDD and GND were looped to every motor driver. The looped of both wires would be connected to the Vin and Gnd of Arduino Nano. Therefore, the supply amount of VDD was 5v.

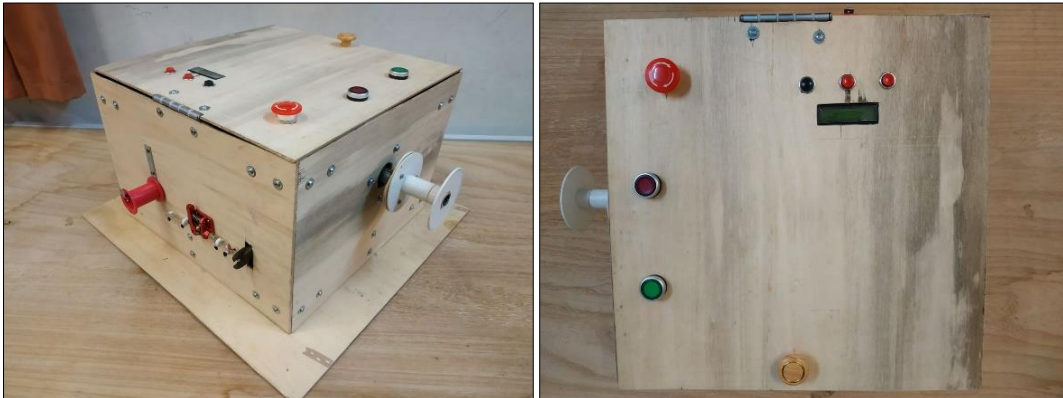
Then, for the cutter motor connection was same to the feeder motor, which used the pins of 1A, 1B, 2A, and 2B. Direction (DIR) and step for this motor driver was connected to the D5 and D6 Arduino pins. For the switching actuator, the pins of D8 to D10 were used for the increase and decrease the amount setting. For the LCD supply, the pin of VCC was connected to the Arduino 5v pins and the ground also must be connected from the Arduino. Both drivers were connected to the battery supply with the 2A fuse as the safety for the stepper motor. The power window was connected directly to the supply and the switch used was the latch push button. The installation of power window circuit was equipped with the 13A fuse as the safety for the circuit. All the connection was equipped with the emergency push button stop. This was the biggest safety for the project circuit.

### 3. Results and Discussion

#### 3.1 Hardware Result

In this chapter, will described how the project outputs details. The prototype result for this project can be referred in Figure 4. Results and discussions are important for good analysis. This is because, the results and discussions will show the changes in terms of costs and components after the successful output of the project objectives. The prototype’s construction was made of 0.4 cm plywood. The plywood strength was enough for the project specifications. The prototype base size was 2 feet each of the sides. For the box of the prototype was 18 inches every of the sides but for the box height was 1 foot only. All the electrical parts included battery is saved inside the prototypes box. There was wood knob on the prototype as the holder to open the project for maintenance. For information, the power supply of Arduino was from an outside source. Observation revealed that several of the push buttons were divided into two groups. The small push button was for the cutting purpose which was included with LCD. There were 3 push buttons that would act as the down, up, and enter. For the next part, the 2 large push buttons were used for the roller and puller. The red was for stop and the green was for start.

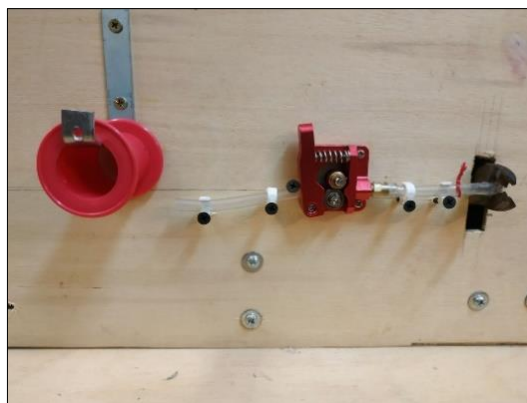
The installation of the emergency button at the middle of the circuit will give the safety and ease to push when in use one of the sides.



**Figure 4: Final Design of the Project**

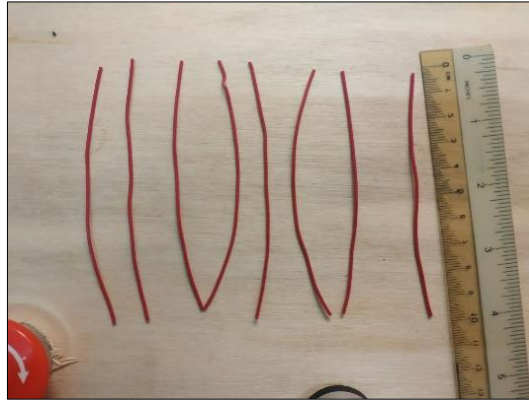
### 3.2 Cutter Result

For the cutter purpose, there were components installed on the plywood as cutting mechanism. The first equipment was plastic cable roller, the second was extruder which acted as cable suction and the last was cable cutter. The cable way-guide was made of 0.5 cm plastic tube. Figure 5 shows the view of the cutter mechanism. The cutter part was calibrated by using the electronic wire as the output sample. The wire has been hung on the roller which attached to the iron hooks. The wire will extract from roller to the cutter mechanism by extruder.



**Figure 5: Cutter mechanism**

The calibration of the mechanism was set by cut the wire with the length of 10 cm and 9 pieces of wire for the quantity setting. By referring to Figure 6 the time taken for the task was 27.44 seconds. This can be the proved of working time saving. The Figures 6 and 7 shows the result of wire output. The cutter efficiency was plus minus of 0.2 cm. The condition of the cable will give the efficiency effect for the cutting mechanism. The next calibration was by set the length of 30 cm and the quantity of 5. By referring to Figure 7 the time taken for the task was only 21.50 seconds.



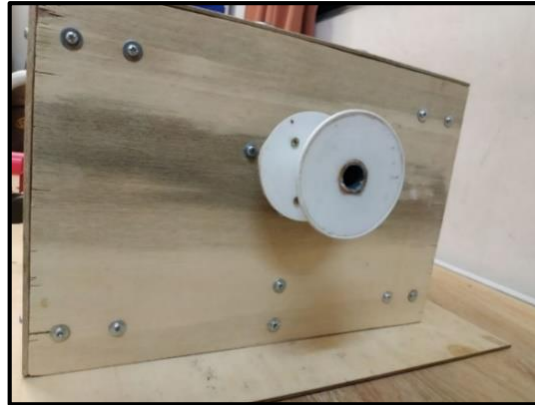
**Figure 6: Result of wire output**



**Figure 7: The result of 30 cm setting .**

### 3.3 Roller & Puller Result

Based on Figure 7, the power window coupling was screwed to the plastic roller. For the roller and puller, the working principle was same among them. The power window motor will turn on and pull the cable if stuck in conduit. The strength of the power window motor was tested by using some packs of water. The water was measured at 500 grams for each of them. By refer to Figure 8, the pressure has been tied on the roller that acted as the cable pressure when pulling and rolling.



**Figure 8: Roller and puller part**



**Figure 9: Roller and puller testing**

Based on Table 2, all the readings have been taken and the total of data was 8. The load tied will increase by 500g. The roller result can be concluded that the roller was able to use in industry. For the puller purpose, the roller can pull the cable if the pressure is below 4 kg. The pull strength was suitable for small scale pressure. When the cable in the conduit, it was recommended not to use the full human strength because the cable have the stretch capacity, where it could be breaking in high pressure.

**Table 2: Roller strength analysis**

Mass	Time (s)	Length of Rope
0.5	8.12	4 feet
1	8.23	4 feet
1.5	8.30	4 feet
2	8.37	4 feet
2.5	8.39	4 feet
3	8.49	4 feet

3.5	8.59	4 feet
4	9.20	4 feet

#### 4. Conclusion

As conclusion, “Automatic Cable Cutter and Roller with Arduino” was successfully built well. This project used 2 DC power supplies and used various components and tools as the main drivers of the process. There are several important components namely as stepper motor, power window motor, motor driver and LCD screen. From the results issued in chapter 4 shows the cutter part can cut the cable well and quickly. From data analysis in previous chapter, it has been shown the results for the cutting part are satisfactory and the cable can be cut according to the predetermined measurements. Besides, the time that has been spent to complete all the cables can outweigh the manpower and also achieve the objectives of the project.

On the pull and roll side, the weight pressure of the water sample that can be lifted on the roller proves that the motor can overcome the cable stuck in the conduit on a small scale successfully. For winding purposes, this project can solve the problem when the motor will always run as long as the switch is not turned off. By using this prototype, all the objectives and goals of the project can be achieved as desired.

##### 4.1 Future Improvement

In the future, the project of “Automatic Cable Cutter and Roller with Arduino” can be improved by upgrading some of the components and coding system. This project can get more interesting when the components and working principle can do above expected thought. Upgrading the power supply is one of the suggestions that will increase the strength of the stepper motor. Stepper motor now is only used for cutting the electronic wire. By upgrading the amount of DC supply even conversion of DC to AC will provide the best outputs. The powerful of the stepper motor will increase the ability and speed of cutting any types of cable. The materials used for the manufacturing of project also must upgrade. The usage of metal or heavy-duty plastic will improved the strength of the prototype cover to manage the pressure of pulling and rolling. As conclusion, this project can be further developed with more functions and robustness.

#### Acknowledgement

The authors would like to thank the Faculty of Engineering Technology, Tun Hussein Onn University of Malaysia for its support.

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