Automatic Coil Winding Machine

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Abstract: In this project of "Automatic Coil Winding Machine" Our proposed model is made for minimizing the work for manually operated coil winding machine. This work will provide Low operational cost, low electrical energy consumption, accuracy to the system. Without human error the quality of product is better and The cost of production will decrease. Nowadays fast growing industries requires an automated machine instead of manually operated machines. Highly advance automation is uneconomical for small scale industries. We have designed machine for Automatic coil winding for low cost and high Accuracy than manually operated machines. Today's fast growing industries requires an automated machine instead of manually operated machines. Highly advance automation is very costly for small scale industries. We have designed machine for Automatic coil winding for low cost and high Accuracy with small space required for assembling .

INTRODUCTION

Introduction:

Today's entire world is rapidly switching to advanced technology like Automation. It is a process in which all the process is done by using different instruments means minimum man power is involved. Therefore manmade errors are reduced in this process and hence the system gainshigh accuracy. All the long lasting processes included in the conventional processes are eliminated in automation process. So time required for getting result is reduced in automation technique. Automation gives effective work with less time.

Nowadays, automation rapidly spreads all the sectors such as Agricultural, Industrial, Educational and Robotics etc. Design of Automatic coil Winding Machine is one of the rightest ways to manufacture coil winding for all type of motors and pumps. It is an upgrade version of existing manual coil winding machine. The issues in present version of coil winding machine such as maximum tension in coil while winding, wastage of insulation material in existing controlling mechanism has been overcome in this proposeddesign of coil winding machine. That can be achieved by the use of modern electronic circuits like Arduino with monitoring devices. Coil Winding machines are used to wind coils for transformer, stators of motor.

To wind a coil using manual coil winding machine will be inappropriate and wastage of time. Various Automated coil winding machines are available in the market to overcome the drawbacks present in manual winding machine. The machines present in the market are complicated and costly and requires large space. So, in this project these drawbacks of automated machine are overcome. Therefore, manufacturing of coil winding machine will be done in this project which is controlled by two Gear-Motors using Arduino program. This machine is in low cost, easy to operate and build in a small scale size for small workshops .

History:

With the development of electrical industry, the demand of the coil for winding increases, and there are more and more varieties. From the large power transformer, generator windings to charging with miniature coil, energy-saving lamps and lanterns with coil, and all kinds of electrical equipment with the coil. It is widely used for every aspect of human life, so winding machine manufacturing industry has brought new opportunities for development.

With application of all kinds of winding machine, there are the earliest manual winding, mechanical automatic winding machine and electromechanical integration control forms of winding machine. In recent years, domestic winding machine manufacturing level and the introduction of horizontal winding machine manufacturing has developed fully automatic, multi-function, efficient automated production capacity. It realizes process automatically from the coil production launch, feeder, end winding into the coil winding and logoff.

At the county level of institutional form, it is different according to the coil winding core. At the same time, they developed a shuttle winding machine to adapt to the ring or other enclosed iron core or the coil winding demand of skeleton. In a word, coil winding machine as production equipment has become more popular and the function is becoming more and more comprehensive.

Objectives :

- To make inexpensive automation machine.
- To maintain high efficiency of the system. .
- To . ensure the appropriate method to wind a coil.
- High accuracy.
- Optimized system.
- Minimum maintenance cost.
- The machine should be worldwide applicable to all gauges of wires.

STUDY OF EXISTING SYSTEM

The latest advancements in automated coil winding machines have introduced highly advanced transformer winding machines that operate with intricate mechanisms. These high-end machines are primarily utilized for high-power and high-capacity transformers. However, when it comes to winding small-scale transformers, such as those used in the electronics industry with 1 ampere or 2 amperes, the process remains complex and unsuitable for undergraduate students to fully engage with, as it often necessitates delicate adjustments.

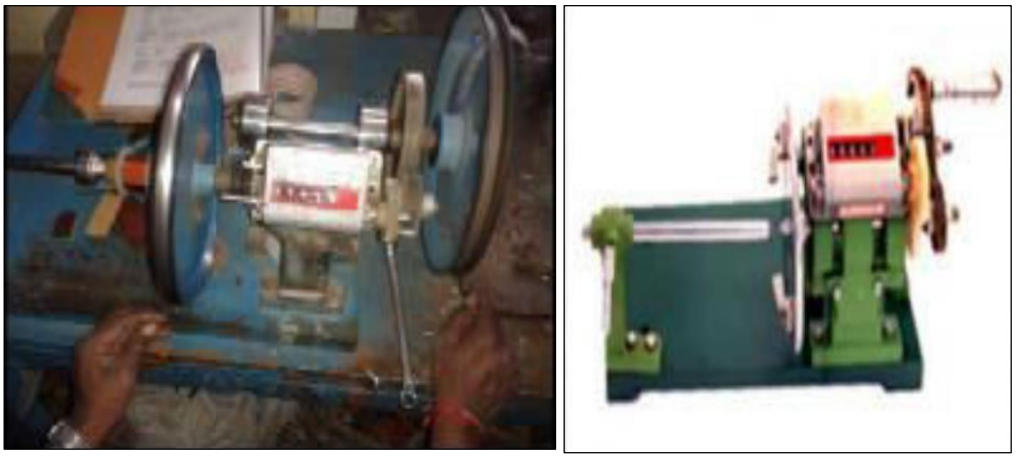
In order to tackle this challenge, we present a solution in the form of a system characterized by a simple design and user-friendly control interface, specifically tailored for undergraduate students. The primary objective of this system is to facilitate a comprehensive understanding of the transformer manufacturing process, as well as the multitude of factors that come into play. By actively engaging with this system, students will have the opportunity to acquire hands-on experience and develop a deeper understanding of the subject matter. Our system is designed to empower students with practical knowledge and foster a solid foundation in transformer production..

Our proposed system is an advancement built upon the prior work of some authors, as previously presented in recent years. Through conducting a survey, we have obtained valuable insights into the functionality and limitations of existing systems. These insights have enabled us to refine and enhance the existing systems.

The initial system, referenced as [1], employed two stepper motors - one for lateral movement and the other for rotational movement. The rotational movement was measured using step calculations to determine the rotations of the bobbin. However, this approach necessitated complex programming.This paper gives us the detailed information about the existing manual and semiautomatic coil winding machines.

Complete manual winding machine (Existing)

In this particular method of transformer winding manufacturing, the entire winding process is carried out manually by skilled workers. The process involves manually rotating the shaft, on which the bobbin is mounted, using a paddle assembly. This



manual rotation is illustrated in Figure 1..

Figure. Complete Manual winding machines

Semi automatic winding machine (Existing):

The development of an advanced version of the winding machine was driven by the need to eliminate the laborious manual paddling process. Around 1965, a new machine was introduced in France, which gained widespread acceptance worldwide. This machine, with some subsequent modifications, continues to be utilized today.

Figure. Existing Semi-automatic winding machine

As depicted in the figure, the winding process still heavily relies on skilled labor, as the operator must simultaneously manage four distinct tasks. Firstly, they need to control the speed of the induction motor. Secondly, they are responsible for providing horizontal motion back and forth to ensure uniform winding. Additionally, the operator must set the appropriate tension in the wire, taking into consideration the speed of the induction motor. Furthermore, they must monitor the counter to keep track of the number of turns completed and the remaining turns. It is also crucial for the operator to ensure that the number of turns per layer does not exceed the predetermined value for the specific wire gauge being used. Since this value varies depending on the wire gauge, the entire process becomes cumbersome and time-consuming.

Advanced Semi automatic winding machine (Existing)

This is more advanced method of semi-automatic transformer winding machine as it provides horizontal to & from motion automatically. But the main drawback of this machine is that it can only be used for manufacturing LV transformers & there also

for specific range of bobbin size. The advanced automatic transformer winding machine fails to provide automatic paper isolation as per requirement. The main drawback of this machine is that it is very costly & it cannot be used for manufacturing of HV transformers.

Figure. Advanced semi-automatic winding machine

PROPOSED SYSTEM

Coil winding machines have extensive applications in winding coils for transformers, motor stators, and chokes. Manual coil winding can be inconvenient and time-consuming. To address this, the market offers various automated coil winding machines that aim to overcome the limitations of manual winding. However, these machines are often bulky, complex, and expensive. To overcome these drawbacks, this project focuses on developing a coil winding machine that utilizes two gear motors controlled by an Arduino program. This machine offers several advantages: it is cost-effective, user-friendly, and designed on a smaller scale.

In this project, Arduino programming is employed for automation purposes. Gear motors play a crucial role in rotating the threaded shafts on which the bobbins and armature are mounted. The entire assembly comprises three shafts used to mount the wire drum, bobbin, and armature respectively. The tension required during winding is maintained by the bobbin. The wire is wound onto the armature through the bobbin, which draws wire from the wire drum. The Arduino board effectively controls the coil feed, ensuring precise and controlled winding. This project aims to provide an affordable and user-friendly solution by utilizing Arduino automation and gear motors for rotation, allowing for efficient coil winding with a smaller machine footprint.

3D Hardware Model

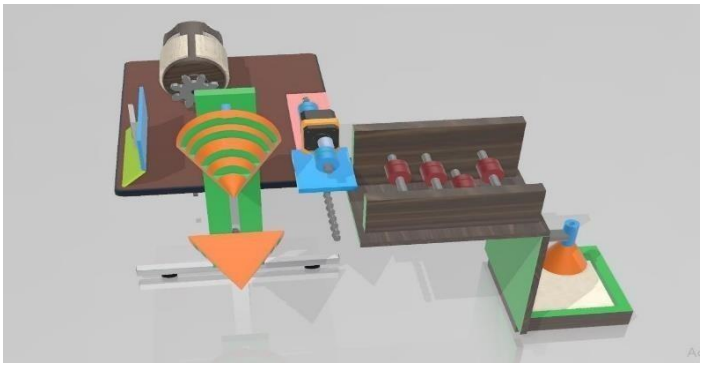


Fig. 3D model of project

Actual Model:

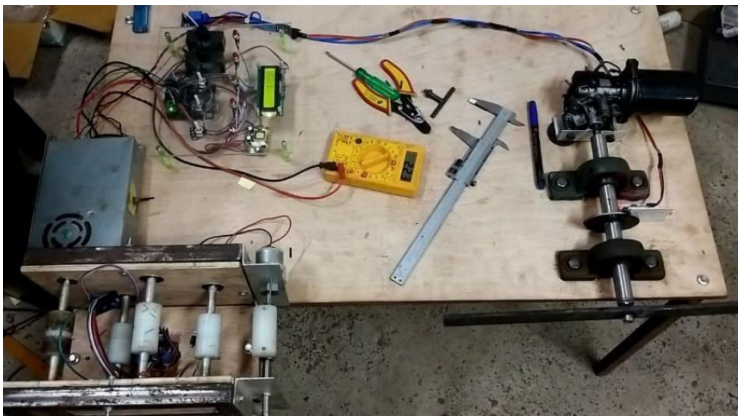


Fig. Assembly of Machine

Block Diagram:

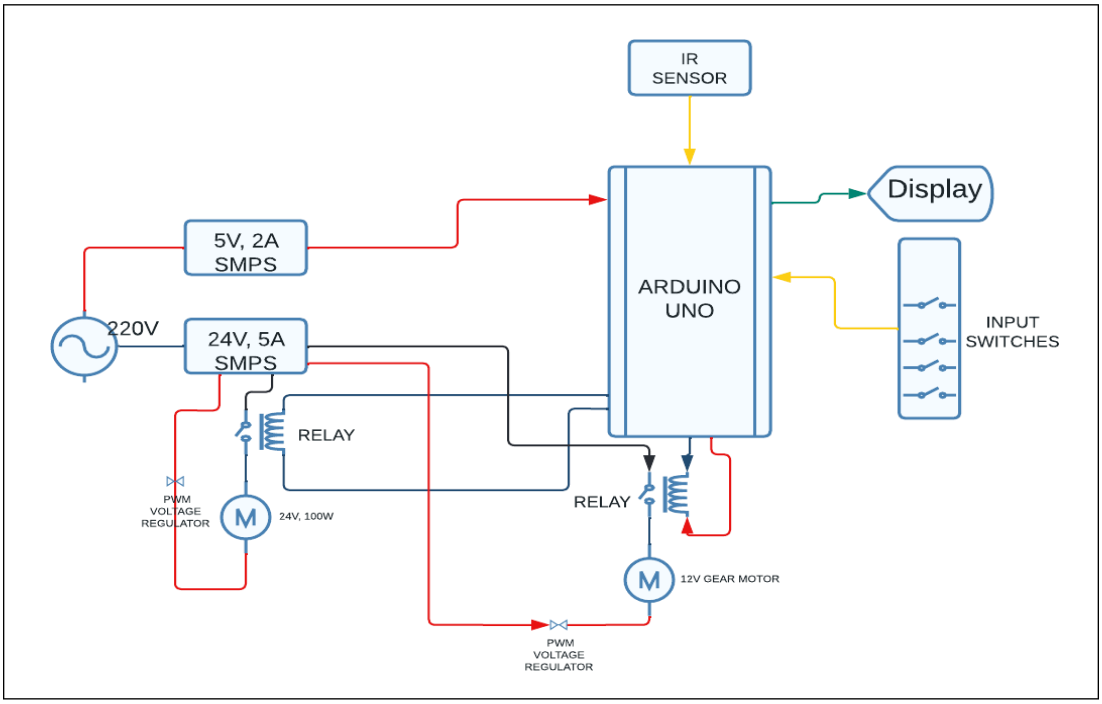


Fig. Block Diagram Of Automatic Winding Machine

As shown in above block diagram, 220v power supply given to both of SMPS (Switch mode power supply). For main motor 24V, 5A SMPS is used and for the Arduino Uno controller 5V, 2A SMPS is used. Here 24V, 100W motor is connected to the main former and 12V gear motor is connected to the transverse control mechanism .

As shown in below block diagram power supply given to controller Arduino nano ATmega328p. Push-buttons is use as input to controller. Depending input controller will give PWM signal to motor driver L298N, which drives dc motor in such way that we get desired output. The input count and output results will display on LCD display connected to Arduino Nano respectively

CONCLUSION

The previous method of manual coil winding was laborious and time-consuming, resulting in low winding accuracy and uneven spacing between consecutive windings. On the other hand, the currently used automatic winding machines in the industry are complex, bulky, and expensive. To address these challenges, the main objective of this project was to develop a low-cost and compact automatic coil winding machine.During the literature survey, a gap was identified, leading to the formulation of the problem statement. Industrial coil winding machines typically utilize PLC (Programmable Logic Controller), which requires complex and lengthy programming. In contrast, this project employs Nano Arduino, which offers simpler programming and is cost-effective.

Achieving proper wire tensioning was a complicated task, particularly because the coil drum needed to move along with the slider. By utilizing a stepper motor for the rotation of the threaded shaft, precise winding and equal spacing between consecutive windings could be achieved, even with varying wire diameters.The objective of compactness was successfully achieved through proper design considerations and the use of adequately thick parts, resulting in a compact and efficient coil winding machine.

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