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DESIGN AND FABRICATION OF A DIGITAL TURNS COUNTER FOR AN ARMATURE WINDING MACHINE

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ABSTRACT

In the world of Electronics, motor is a vital device. There are different types of motors which is employed for various applications. Regarding maintenance/ repair of a motor, the coil inside them is of prime importance. Mainly, winding the coil is an activity that needs high efficiency as well as great accuracy. In most workshops, it is being done using a coil winding machine. At my training place there are coil winding machines but they are not very efficient. They do not have the capability to control the number of windings. As such, the number of windings results from the machine are lesser or higher than the exact value. This study was therefore aimed at designing a digital turn's counter to be fixed in winding machines. The main attention is provided to reduce the effort behind manually operated machine and implement the idea of automation in coil winding process at a minimum manufacturing cost in order to increase the productivity of the existing armature coil winding machine. Furthermore, low operational cost low power consumption, accuracy and flexibility to the system will be provided through th design. On the other hand, the quality of the winding as well as the life of the motor can als be improved by this device.

Keywords – ATmega16, Encoder unit, Relay, Turns counting system, Winding machine

1. INTRODUCTION

Sri Lanka Ports Authority (SLPA) is one of the largest service providers in Sri Lanka focusin at all port development efforts and co-ordination and supervision of shipping services[1]. Amon SLPA's repairing and services activities undertaken, the motor repairing plays a vital role. Th service, repair, rewinding and load testing of all types of AC/DC motors are mainly undertake

by the Unity Container Terminal (UCT section) of the SLPA. Even though the UCT section frequently performs rewinding of motor armatures, there is no special method to count the number of turns of the winding. They still use to count the required number of turns manually. The reason is their existing armature coil winding machine does not have an automated counting system even for large motor armature winding.

The manual counting causes huge drawbacks as the chances of happening counting errors is high and it is more time consuming when counting large number of rounds repetitively. Therefore the need of an automated counting system is essential to overcome the existing drawbacks[2].Since the purchasing of an advanced automated machine is very costly this study has been undertaken with the aim of developing a feasible solution for the wind counting problem.

2. EXPERIMENTAL

In this study there are three important steps used to execute the project. They are design, fabrication and installation. Design is the crucial part. In this project, the design has been done using Proteus software. After completing the project drawing, the materials that are suitable to fabricate were selected. On fabrication, it was divided into two sections, which is hardware and software. Arduino program was used in this project as the connector between the hardware and the software.

Figure 1 shows the block diagram of the design and figure 2 is the corresponding circuit diagram.

In the block diagram there are several components. Inputs (the number of required turns would need to wind) are given using keypad to the microcontroller. Keypad input and also the number of turns that system has wound at a moment is displayed by the LCD. Microcontroller reads the input signal from keypad. Then it is compared with the signal from the encoder unit. This process is done by the microcontroller continuously. Encoder unit is obtained current number of rotating rounds from the motor and passed it to the microcontroller. At the moment when the entered value and the encoder unit value become equal, a signal is sent to the relay by microcontroller and motor is turned off by the relay according to the microcontroller signal. Light emitting diode (LED) and buzzer alarm were used to indicate task completion signal for the user. Power is given to the system through the voltage regulator. Regulator converts income voltage to 5V and passes it to the system.

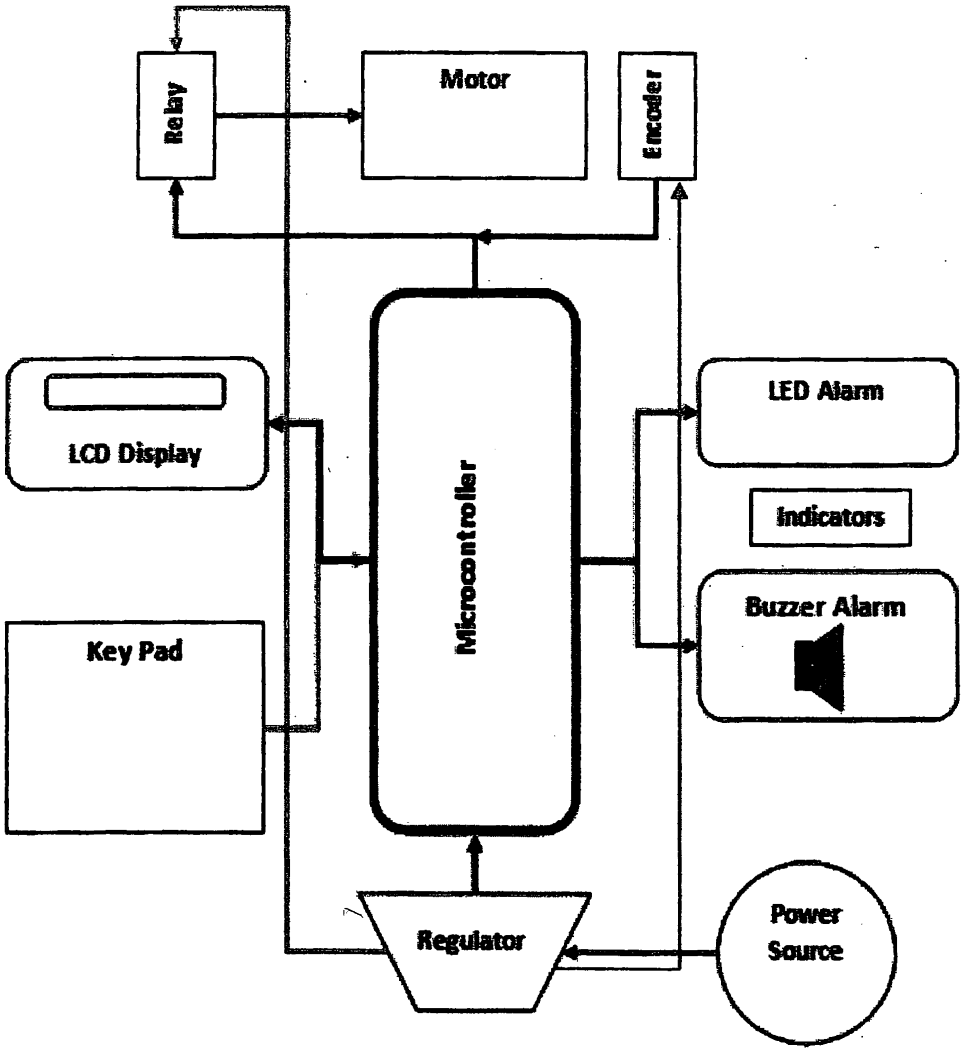

Figure 1: Block diagram of the device

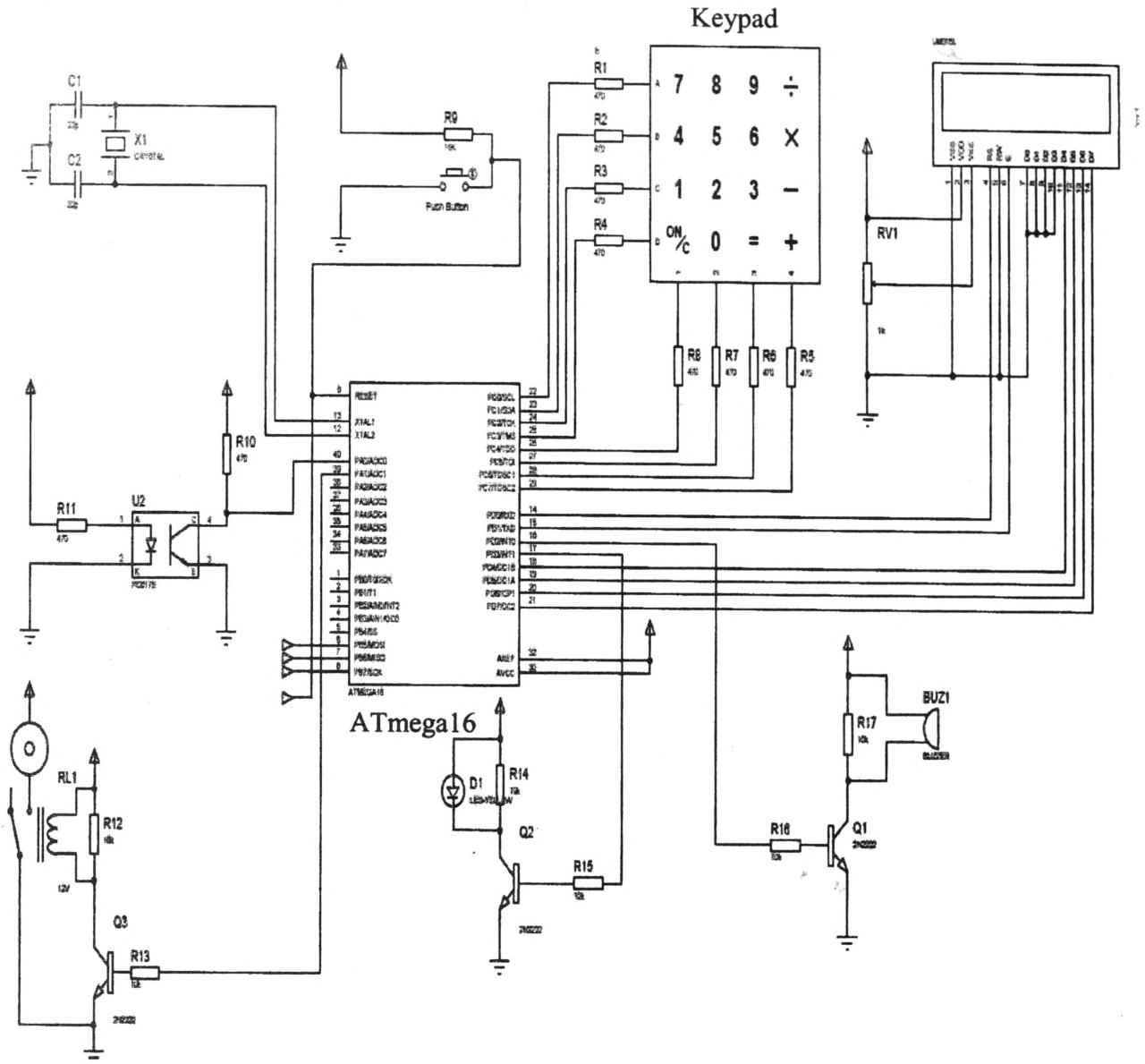

Figure 2: Circuit design of the system

The components in the proposed system are working with the 5V power. Therefore 5V power supply was designed for the proposed system. The power supply was designed using two 100 μF capacitors, two 1 μF capacitors and a 7805 regulator as shown in the following figure 3 to use in the proposed system implementation[3].

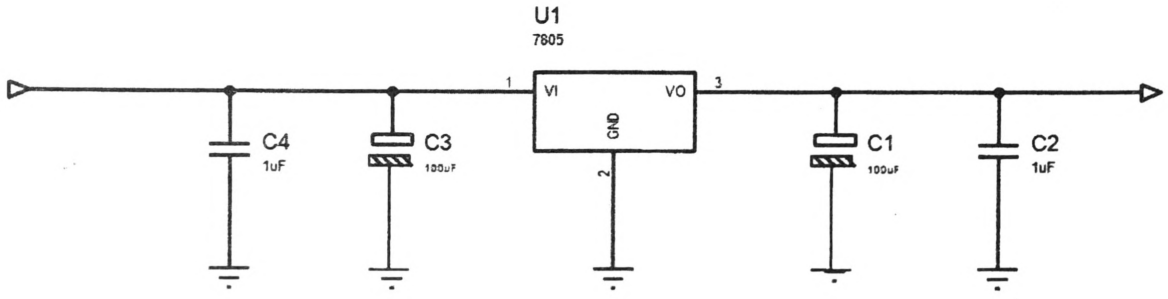

Figure 3: Circuit design of the power supply

Encoder is another important component which is used in this project. Since the encoders are much expensive, an alternative design was done using a discarded CD, an IR diode and an IR receiver. When the CD is rotating a pulse from the two sensors will be created. If the second pulse from the two sensors is created within a programmed time period after the first pulse, then the count will increase. If the second pulse is created more than that of the programmed time period after the first pulse, then the count will decrease[4].

3. RESULTS AND DISCUSSION

According to the figure 2, number of required turns is given to the system using the keypad. Keypad input and also the number of turns that system has wound at a moment is displayed by the LCD. The number of turns that machine motor has rotated is continuously read and the details are simultaneously sent into the microcontroller by the encoder. The code is run by the microcontroller that has already fed to it and according to the program, components in the system are regulated by the microcontroller at the specific conditions given. The encoder output is read continuously by the microcontroller and it is compared with the keypad input. When keypad input and encoder output become equal, the winding machine is automatically turned off by the relay (which acts as an electrical switch). After receiving the signal from microcontroller, an audio indication of the completion of the number of turns is given by the buzzer and in addition a LED is used to indicate the user that the task has completed.

Table 1: Experiment results of the design

Armature Type	No. of Turns Given	No. of Turns counted
Armature 1	25	25
Armature 2	50	50
Armature 3	100	100
Armature 4	175	175
Armature 5	250	250

According to the results mentioned in table 1, data collected from automated method. To check the accuracy of the proposed system five different type armatures were wound using automated system. At each time system is successfully counted number of turns given by user.

4. CONCLUSION

Even though this is a preliminary study, the results show the possibility of fabricating a digital turns counter. The designed system meets the demand of high-speed production using the least mechanism requirements. The system has shown the ability to work effectively avoiding unnecessary wastage of copper and other resources. The system also provides high accuracy and precision in proportion of armature coil winding.

The machine already has a constant speed to wind a turn and it will take considerable time to finish large number of turns. This study only focused on automating the counting process. It was not focused on fabrication of a fast automated machine. This is the main limitation associate with the proposed system. The time taken to finish the turns cannot be changed due to the fact that the speed of the machine cannot be changed. As a further development, it is expected to design a machine which is fully automated for the armature winding purpose for the UCT section of the SLPA to enhance the overall process efficiency.

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