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Development and Designing of Automatic Wire Cutting System using Microcontroller

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Abstract: This paper presented "This paper presents the Development and designing of Automatic wire cutting system based on Microcontroller for industrial Application in real time. The proposed system implements a real time state of art automatic wire cutting system. The system is based on an ARM 7. Preliminary result shows that embed platform are a promising path for the implementation of "Automatic Wire Cutting System" application in real world. In recent years of technology, automation has reduced human efforts and errors to a large extent. The development of automatic wire cutting system will reduce human efforts required to cut the wire in proper length. The time required for cutting different length wires depends on efficiency of workers. Quality depends on accuracy and skill of workers. ARM 7 microcontrollers has been used to control the operation of the system. This system saves time required for cutting the wires. Workers cost is also saved. This system will increase the efficiency of industry by saving time and money. The results are analysed using proteus as well real time experiments.

Keywords: Embedded system; Microcontroller; ARM 7; Automation; Wire cutting

I. INTRODUCTION

In the developing small scale industries, nowadays labor is a major problem. Many a time's situations happen that workers strike for their personal benefits which results in performance degradation and loss in efficiency. As a result the company owners have to bear great loss and hence cannot achieve their desired profit and goals. Automation will solve labor problems and save cost and time, increases accuracy and decreases human errors. After surveying various electrical and electronics industries it can be concluded that, industries have introduced automation in their systems to some extent but for some basic processes which are time consuming like wire cutting, packaging etc. use of human resources is done. If automation is introduced to these basic processes then it will be fruitful regarding the company's development and profit gain as it improves the system in many ways.

In existing system in factory there are workers to take order, implement in workshop and then come cut according to order. The time required for cutting different length wires depends on efficiency of workers. Quality depends on accuracy and skill of worker. Implementation of this system in industry will save time required for cutting the wires. Workers cost is also saved. If direct command to the system is given to cut certain number of wires of desired length then the system will cut the exact number and exact length of wires in small time. This system will increase the efficiency of industry by saving time and money. It is an embedded system. The design of the system consist four subsystems viz. Embedded System, S/W program, Hardware Design and Mechanical Assembly.

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II. RELATED WORKS (TABLE 1)

Sl.no	**Method**	**Description**
1	Development of a Numerically Controlled Hot Wire Foam Cutting Machine for Wing Mould Construction [1]	Proposed a method in which system of a Numerically Controlled Hot Wire Foam Cutting Machine for Wing Mould Construction
2	Tele operaton Setup for Wire-cutting Application in the Field [2]	Design a Setup for Wire- cutting Application in the Field. The setup included single master controller and slave device. The setup was used for carry out wire-cutting experiments with volunteers to determine the quality of the control and ease-of use of the system.
3	Application of Pseudo-Elastic Wire for Hybrid Cutting Robotic Tool [3]	Described the application of Pseudo-Elastic Wire for Hybrid Cutting Robotic Tool.
4	An Autonomous Robot for Casing Cutting in Oil Platform Decommission [4]	This project mainly to describe an autonomous robot for casing cutting in oil Platform Decommission casing.
5	Automated wire cutting and crimping machine with wire color detection system using image processing [5]	Developed automated wire cutting and crimping machine with wire color detection system using image processing and data sequencing. The assembly his off wire harness which conduct the wire segment .The application consists of fully required subsystem. In this system author used image processing Embedded Software, Micro-controller Programming, and hardware design.in this system the main important is detection of wire input location
6	PLC based automatic cutting machine," International Journal of Engineering and Technical Research [6]	Developed PLC based automatic cutting machine .has got faster execution time and is more efficient in working along with safety measure to reject faulty materials and ease in operation. Author explained the application and the importance of the involvement of automation in conventional cutting method. This paper includes the types of cutters, and shop formulas for setting up each operation. Safety plays a critical part in any operation involving power equipment
7	The latest technology of Wire- cut EDM [7]	Presented latest technology of Wire-cut EDM. This paper reviews the effects of various WEDM.

Table 1: An overview of related works.

III. SYSTEM ANALYSIS AND REQUIREMENTS

3.1. Software Requirement

The below listed softwares are used to design our project:

- Proteus VSM
- Keil IDE Software
- Flash Magic Software

3.2. Hardware Requirement

The below listed hardware components are used to design our project:

- ARM 7, LPC2138 Microcontroller
- 5x DC motor 30 RPM
- Motor driver circuit
- Mechanical Base setup

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- Circuit components

3.3. LPC 2138

LPC 2138 (Figure 1) controller is the controller which uses embedded programming language. Figure 3 shows LPC 2138 with GPIO Pin-out Diagram. It consists of 46 GPIO (General Purpose Input-Output) pins which can be used for interfacing LCD, Keypad, Motor drive circuit etc. one D/A converter of 10-bit generating different analog outputs, two 32-bit timers/external events counters, serial interfaces with two 16C550 industrial standard UART are internally and 47 universal I/O interfaces. This chip has high-speed structure and simplified system as ARM. It can complete various control tasks. The author selects it as the control chip of travel control device because of the above- mentioned advantages of LPC2138, especially for its timer/counter, A/D converter of 16 channels with10 bits, D/A converter of 1 channel and 10 bits.

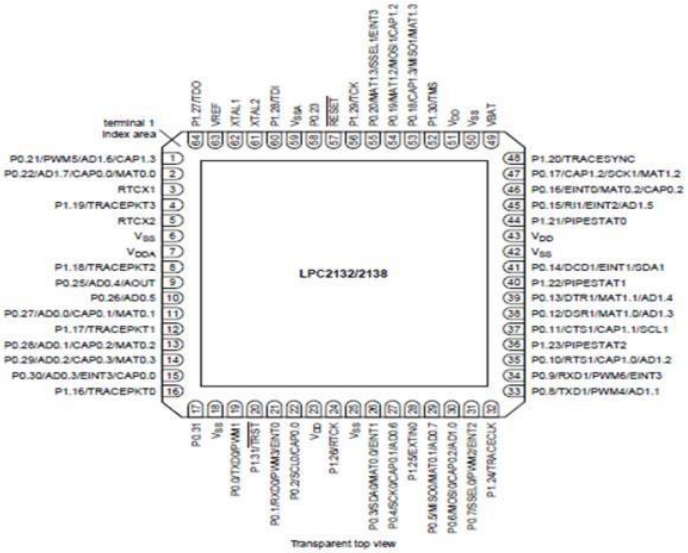

Figure 1: Pin diagram LPC 2138.

Feature of LPC 2138:
• 46GPIO Pins
• Two I2C serial interfaces
• Two SPI serial interfaces
• Three 32 bit timers

Real time clock with optional battery backup:
• CPU clock up to 60 MHz
• 2 programmable timer/counters
• 32 kB in-chip static RAM
• 512 kB in-chip Flash program memory

3.4. DC Motor

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Figure 2: DC motor.

DC Motor supplies electric energy to some circuit components with the appropriate power (Figure 2). It converts one form of electrical energy to another as shown in the (Figure 3).

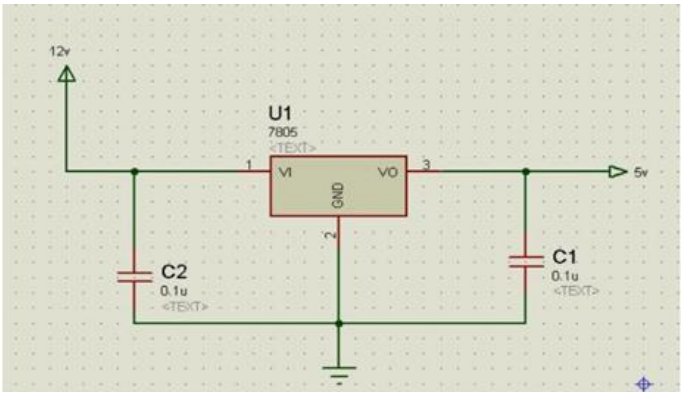

Figure 3: Power supply.

3.5. 9v 500 mA Transformer (230V to 9V) [9-0-9]

Figure 4: Transformer.

Good quality transformer, power supplies for all kinds of project and circuit boards. Step down 230V AC to 9V with a maximum of 500 mAmp current (Figure 4). Generally known as 9-0-9.
Specification:
• Voltage: 2 × 9V
• Current: 1 × 500 mA
• Rated power: 9 VA

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IV. SYSTEM DESIGN AND IMPLEMENTATION

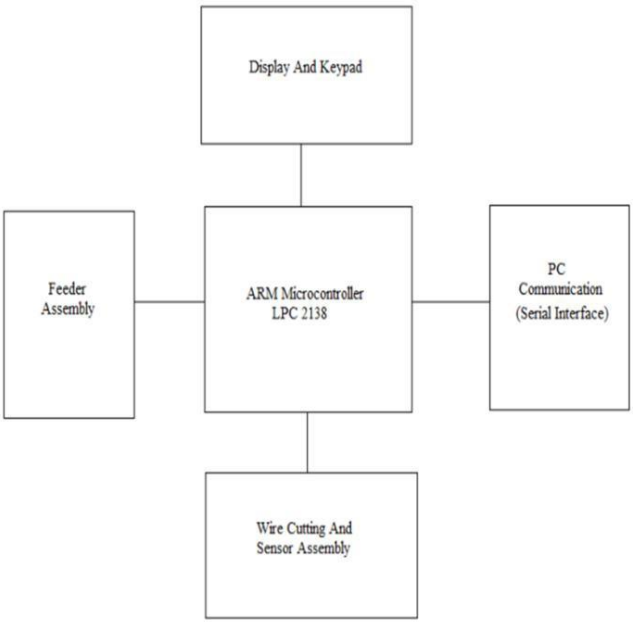

Figure 5: Block diagram of proposed system.

Figure 5 shows block diagram of proposed system. The above figure is the complete block diagram of the system. The main processing unit in the system is the ARM Microcontroller LPC 2138 which processes the inputs and controls various devices connected to it.

The system input is taken from the keypad and also can be taken from the computer; this data is displayed on the LCD display provided on the system. The input taken from the user is the length of wires in centimeter and the required number of wires. The system also checks for the presence of wire or not, if present it continues the process or else stops the system.

When the user presses enter on the keypad, the arm controller gives commands to the relays which drive the DC motors to fetch the wire inside the waveguide. In one rotation of motor the wire moves forward by an exact distance and by this technique the exact length of wire is available for cutting. The cutter which is connected to the low RPM motor is triggered at specific correct intervals to make an exact cut. Also the system displays the count of the wires left for cutting on the display. Thus the requirements of the user are processed and completed at a fast pace, accuracy by using this system.

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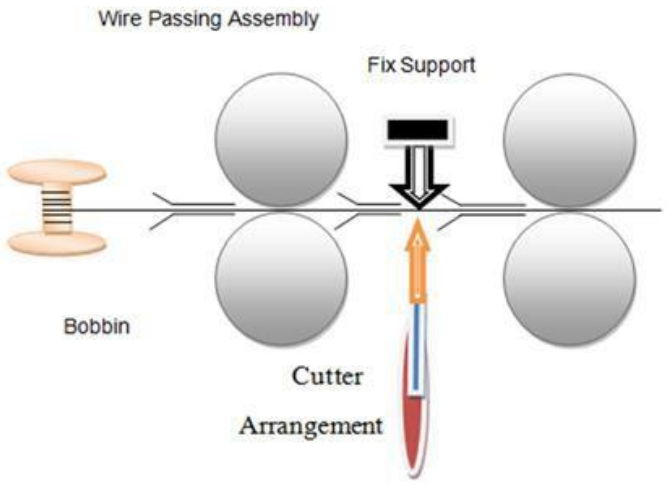

Figure 6: Block diagram of proposed system top view.

Figure 6 shows block diagram of proposed system Top view. It consists of bobbin which is place on bobbin holder assembly. Then wire is passing through the first wire guide channel to drive a wire towards wire cutting section. Roller is use to pass the wire forwards section by rotating clockwise or anticlockwise direction according to the programing. Here four rollers are used to pass the wire to forward sections. The rollers are arranged as show in the block diagram of proposed system top view. The cutter arrangement is placed in between the roller arrangements and wire guide as shown in Figure 2 by using DC motors we can energised blade cutter for cutting the wire [8-10].

V. SYSTEM TESTING AND RESULTS

5.1. Circuit Simulation

Initially the Circuit was Operating with 9V from Dc power supply Transformer. To distribute the voltage to a voltage regulator transistor to feed the microcontroller with 3V to operate and the driver motor circuit got 12V directly from the dc power supply. Source to make the four rollers to move and get 3V from the voltage regulator to make the main circuit to work, also our LCD get 5V source from the voltage regulator to work.

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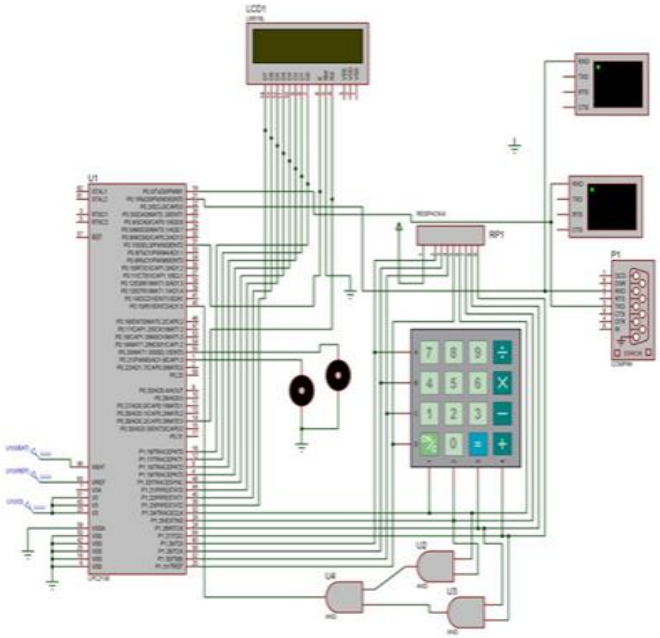

Figure 7: System design using proteus software before pressing keypad input.

5.2. Output and Results

Here we are discussing about the output result.

Figure 7 shows the proteus result of the LPC2138. Figure 7 shows the interfacing and testing of LCD and Keypad with LPC 2138. Keypad is use as input and input is displayed on LCD. This input is given to LPC 2138. The given input and exactly output values as shown in Table 2. The input is given by using keypad as in 'cm'. The actual cutting of wire in 'cm' as shown in output. The testing of wire cutting is done for different values and result is included in Table 2.

Input(cm)	Output(cm)
5	4.5
6	5.7
7	7
8	8
9	9
10	10
11	11
12	12
15	15

Table 2: The result of given input and output values testing.

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Figure 8: Automatic wire cutting system.

Final Setup of Development and designing of Automatic wire cutting system using Microcontroller (Figure 8).

VI. CONCLUSION

This Paper demonstrates low power, low cost embedded system automatic wire cutting system. In this paper, we discuss the design of proposed system for automatic wire cutting system, using ARM LPC 21358 Microcontroller of Atmel as hardware plat from and combine with keypad as input device. LCD and Keypad design is simulated using Proteus simulation tool implemented its hardware on PCB. LCD and Keypad is interfaced with LPC2138.

VII. ACKNOWLEDGEMENT

I take pleasure in presenting my work done in Development and designing of Automatic wire cutting system using Microcontroller. This project is sponsored by “SANMAN CAPACITORS” Sangli. I Would like to express my deep sense of gratitude to my guide Dr. M. S. Patil for his valuable suggestions. I am deeply indebted to him for giving me chance to do this innovative project providing constant guidance throughout this work. I acknowledge with thanks, the assistance provided by department staff, electronics faculty staff. Finally I would like to thank my colleagues, friends and at last but not least my lovely family who helped me directly or indirectly for the same.

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