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AUTOMATED WIRE LENGTH MEASUREMENT AND CUTTING SYSTEM

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ABSTRACT

In this paper we proposed the system for automated wire length measurement and cutting system. Wire cutting system includes length measurement of the wire that uses number of revolutions of DC motor shaft. After length measurement of wire, cutting unit cuts the wire as per user specifications. The proposed system significantly deals with accuracy of wire length measurement and cutting. The system is fully automatic. The proposed system "Wire cutting and Measurement System" is fully automatic and can be operated by non-technical person. In industrial applications it saves time, material and manpower. An experimental result shows that the proposed system outperforms the accurate function which independent of type and category of the wire. System prototype can be changed with few changes in software and hardware for different wire categories and their coatings.

Keywords: Microcontroller, Embedded C Programming, Cutting Unit, DC Motors.

1. Introduction

In 21st century the electronics technology has raised at its glory. Comparing the initial technology and present technology there is vast development in field of electronics. In Industrial, 9electronics sector and household there is inherent need of electric wires. The types of wires vary from single strand wire to the optical fiber cables. The required wire may be in different size and different length. As per industrial demand, we have developed the system which automatically measures the length of the wire and cuts it as per specified length. This system can be easily handled by the subordinates and the unskilled persons in industry. The main components of the system are: Micro-controller, DC motors and cutting unit. Microcontroller is acting as a brain of our system [1]. In the proposed system rotating shaft of fiber DC motor is used for estimation of the length [2]. Subsequently the system uses softwares like Proteus, Keil µ vision, Flash Magic for microcontroller programming etc.

2. Block Diagram of the System

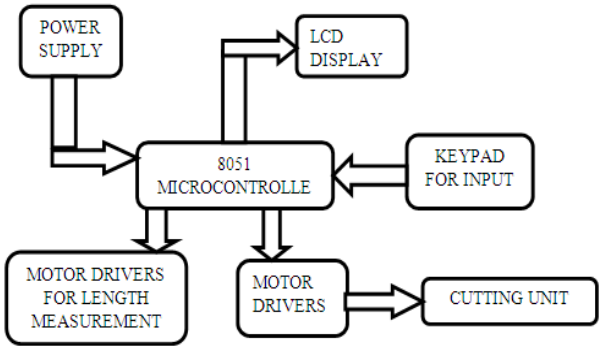

Fig.1 Block diagram of automatic wire cutting machine

The Microcontroller is brain of system that handles all input and output devices. We can interface the LCD display, input keypad and other required peripherals to the microcontroller. The system uses 16x2 alphanumeric Liquid Crystal Display (LCD) that displays the input given by user. The cutting tool is operated by relay switching through microcontroller. The process provides great accuracy with sufficient speed. The system

provides user friendly data input through keyboard. The selection of input will be processed by microcontroller and displayed on LCD display for confirmation of inputs.

3. Hardware Components

a. Microcontroller

The 8051 Microcontroller is designed by Intel in 1980's. It was based on Harvard Architecture and developed primarily for use in Embedded Systems. Microcontroller 8051 has two buses for program and data. It has two memory spaces of 64K X 8 size for both program and data. It has an 8 bit processing unit and 8 bit accumulator. It includes 8 bit B register as main processing blocks. It has some other 8 bit and 16 bit registers. Microcontroller 8051 has in built RAM for internal processing. This memory is primary memory and is used for storage of temporary data. It is Volatile memory i.e. its contents get vanished when the power is turned OFF.

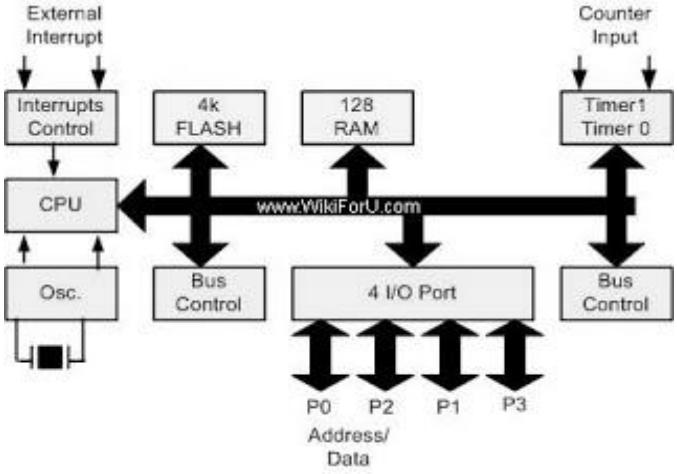

Fig.2 Basic 8051 architecture

b. 16×2 LCD Modules

A liquid crystal display (LCD) is a flat panel display that uses the light modulating properties of liquid crystals (LCs). LCD Modules can present textual information to user. The 2x16 character LCD interface card supports both modes 4-bit and 8-bit interface and also facility to adjust contrast through trim pot. In 4-bit interface 7 lines needed to create 4-bit interface; 4 data bits (D0 – D3), three control lines, address bit (RS), read/write bit (R/W) and control signal (E). 16×2 LCD module is a very common type of LCD module that is used in 8051 based embedded systems. It consists of 16 rows and 2 columns of 5×7 or 5×8 LCD dot matrices. It is available in a 16 pin package with back light, contrast adjustment function and each dot matrix has 5×8 dot resolution.

c. Key Pad

The 4x4 matrix keypad has eight input/output ports. As per user requirement input is given through keypad i.e no. of pieces required and length for one piece of wire in meters. The status of each key can be determined by the process called scanning. In normal case all the column pins are pulled up (high state) by external or internal pull up resistors. Matrix Keypad is made by arranging push button switches in row and columns.

d. Motor Drives

L293D is a dual H-Bridge motor drive. With one IC, we can interface two DC motors which can be controlled in both clockwise and counter clockwise directions. L293D has output current of 600mA and peak output current of 1.2A per channel. Moreover for protection of circuit from back EMF, output diodes are included within the IC.

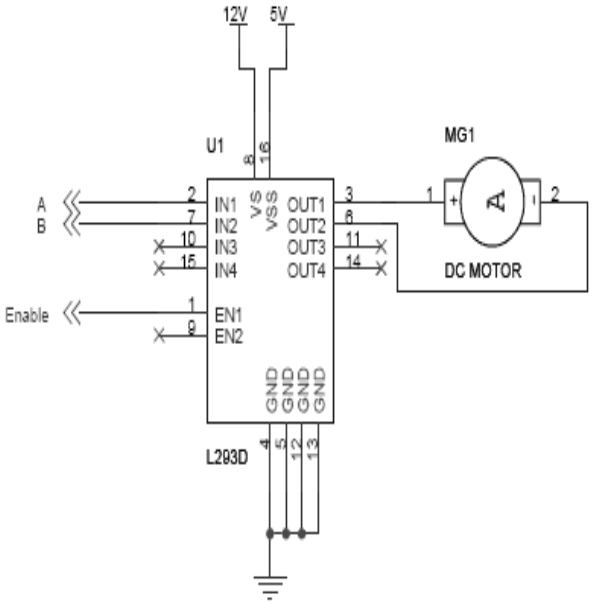

Fig.3 Schematic for interfacing a DC motor using L293D

Table 1: Truth Table for DC Motor

A	B	Description
0	0	Motor stops or break
0	1	Motor run anti-clockwise
1	0	Motor run clockwise
1	1	Motor stops or breaks

For above truth table enable has set to 1. Motor power supply voltage is 12volt. Three pins are needed for interfacing a DC motor (A, B, Enable). To enable output completely, connect Enable to VCC and only 2 pins needed from controller to make the motor work.

4. Practical Automated Wire Cutting System

Fig.4 Automated Wire Cutting System

In proposed system spring is used to create tension in wire which helps to get accuracy in cutting. DC motors operates on 5V supply. Total five DC motors are used to complete the process of wire length measurement and cutting. Four DC motors are used for measuring the length of wire and one DC motor is used for cutting unit. Metal pistons are used to hold wire properly.

4. Software Design

a. Keil µ Vision: Keil Software provides software development tools for 8051 based microcontrollers. With the Keil tools, that can generate embedded applications for virtually every 8051 derivative. Keil Software development tools for the ARM microcontroller family supports professional applications engineer as well as new learners. The industry-standard Keil C compilers, macro assemblers, debuggers, real-time kernels, and single-board computers support all ARM-compatible derivatives. µ Vision is an IDE (Integrated Development Environment) that helps to write, compile, and debug embedded programs. It encapsulates the project manager, a make facility, tool configuration, editor etc.

b. Flash Magic: NXP Semiconductors has produced a range of Microcontrollers that feature both on-chip Flash memory and the ability to be reprogrammed using In-System Programming technology. Flash Magic is Windows software from the Embedded Systems Academy that allows easy access to all the ISP features provided by the devices. These features include:

- Erasing the Flash memory (individual blocks or the whole device)
- Programming the Flash memory
- Modifying the Boot Vector and Status Byte
- Reading Flash memory
- Performing a blank check on a section of Flash memory
- Reading the signature bytes
- Reading and writing the security bits
- Direct load of a new baud rate (high speed communications) Sending commands to place device in Boot loader mode.

c. Proteus: Proteus is software for microprocessor simulation, schematic capture and printed circuit board (PCB) design. It is developed by Lab center Electronics. Application Framework Proteus 8 consists of a single application (PDS.EXE). This is the framework or container which hosts all of the functionality of Proteus. ISIS, ARES, 3DV all open as tabbed windows within this framework and therefore all have access to the common database. The common database contains information about parts used in the project. A part can contain both a schematic component and a PCB footprint as well both user and system properties. Shared access to this database by all application modules makes possible a huge number of new features, many of which will evolve over the course of the Version 8 lifecycle.

5. **System Flow chart**

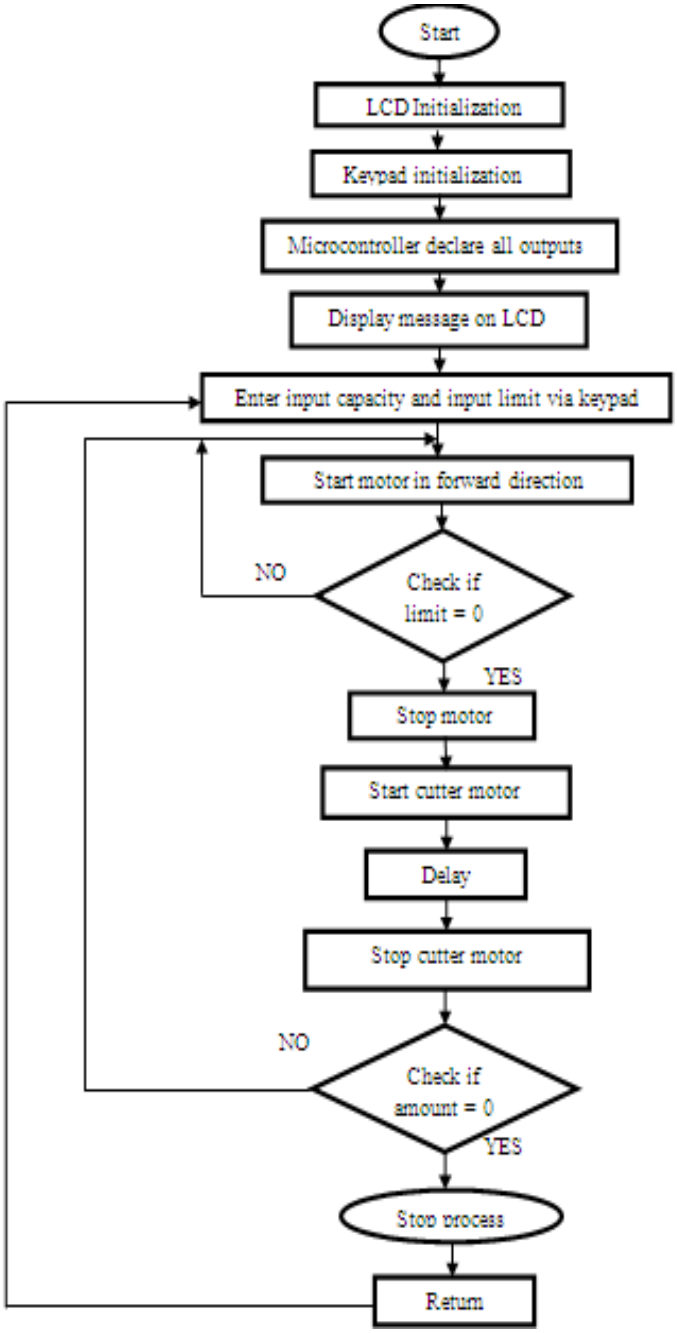

Fig. 5 system flowchart

Flowchart is the required sequence of programming steps for automated wire length measure-ment and cutting system [4], [5]. It includes initialization of LCD and KEYPAD. Message is displayed on LCD after declaration of all output ports of microcontroller. The system asks user to enter the length of wire in meters and user has to provide required input via keypad. The motor starts rotating in forward direction and the number of turns of motor shaft are used to measure length of the wire. First it checks whether the input limit is zero or non zero if it is zero then it stop the motor and if not then it will return to the previous loop. After counting the required length system starts the cutter motor. Again system checks input if it is zero it will stop all processes and if not it returns to the first loop.

7. Experimental Results

Table 2: Practical length of the wire

Sr. No.	Input (meters)	Output (meters)		Error (cms)
		Ideal	Practical	
1	1	1	1.008	0.8
2	2	2	1.007	0.7
3	3	3	3.007	0.7
4	4	4	4.006	0.6
5	5	5	5.005	0.5

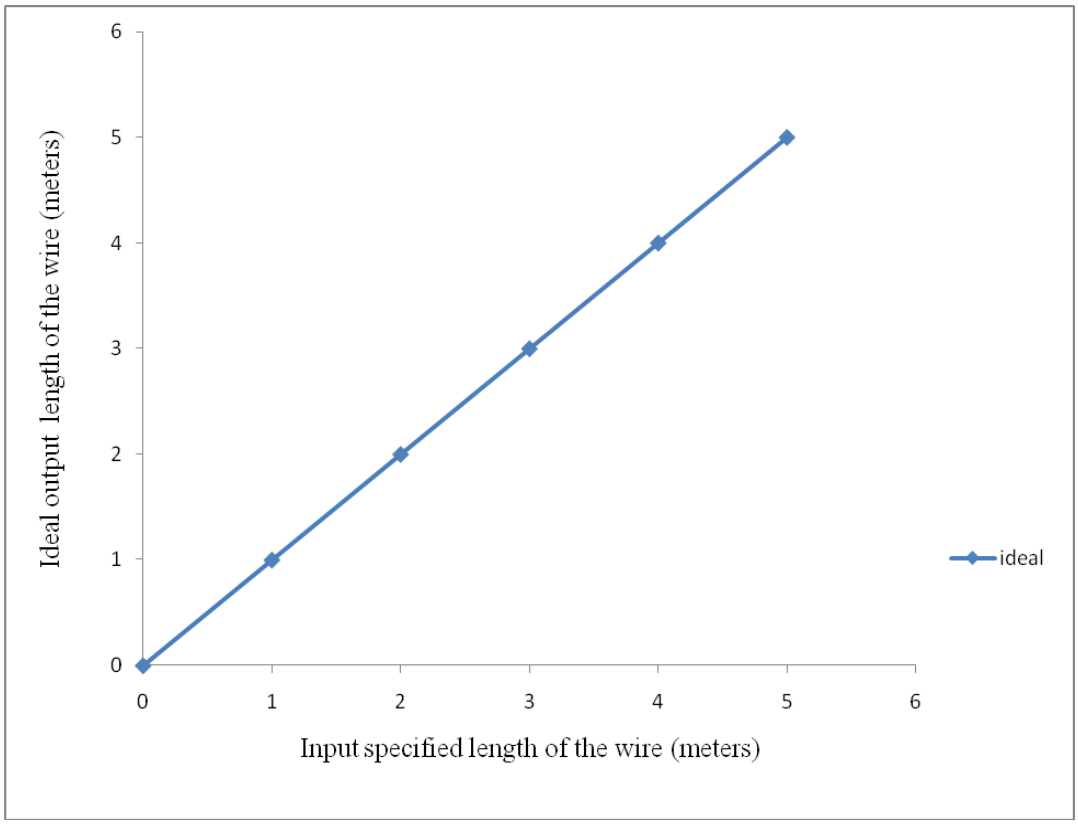

Fig.6 Ideal Performance of the system

The input length specified by the customer and the ideal expected length to be cut is shown in the Fig.6.

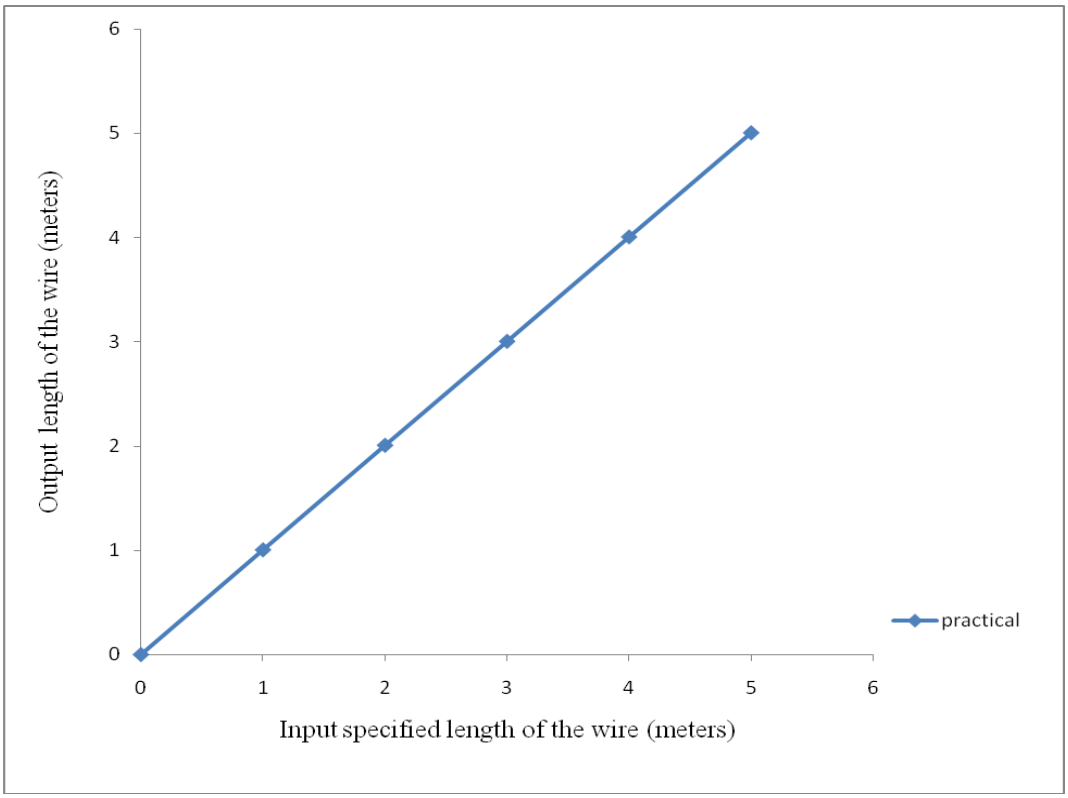

Fig.7 Practical Performance of the system

The input length specified by the customer and the practically cut length of the wire by the system is shown in the Fig. 7.

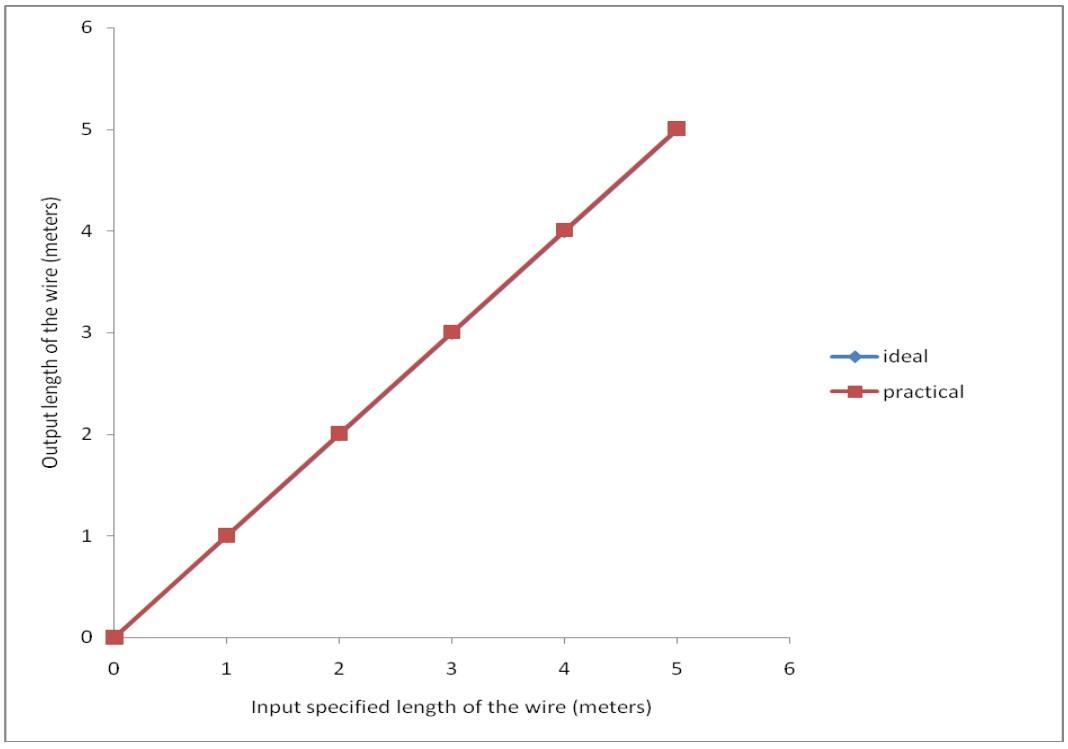

Fig.8 Combined Performance of the system

The combined performance is shown in the Fig.8. From figure it is seen that the practical (actual) performance of the system is close to the ideal performance. The small amount of error is only due to mechanical design limitations. The appropriate compensation eliminates the errors.

8. Conclusion

The proposed system is fully automatic and can be operated by non-technical person. In industrial applications it saves time, material and manpower. An experimental result shows that the proposed system outperforms the accurate function which is independent of type and category of the wire. System prototype can be changed with few changes in software and hardware for different wire categories, wire sizes and their coatings.

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