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Automatic Thread Winding Machine using Embedded System

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Abstract-The advances in Automation, has brought innumerous development in various fields especially in textile industries. But the small scale textile industries are unable to make use of the automatic machines for winding the thread due to complexity and the high cost. In order to overcome the above scenario, we have proposed this project to wound the thread automatically at low cost. And also the status of the machine can be monitored and controlled by the sensors. There are three sensors used to detect the machine is running in proper mode. Piezo sensor is used to detect thread status is in proper mode or cutting mode. Proximity sensor is used to find the thread length and vibration sensor is used to detect the level of the voltage. Buzzer is used to provide the indication about the machine status is normal or abnormal. In the simulation process, we use proteus software to simulate the output and MP Lab is used for programming. ZigBee is used to communicate between user and the processor. The current status of the thread winder is displayed on the PC.
Keywords: PIC Microcontroller, ZigBee, MP Lab, Proteus, DC Motor.

I. INTRODUCTION

An embedded system performs more functions in a computer design with real-time. Embedded is a part of a complete device which combines both the hardware and software. A general-purpose computer like personal computer is designed to be flexible and is more comfortable to meet a wide range of a user's needs. Nowadays, embedded systems control many of the common devices. Embedded systems are controlled by a main processing core that may be either a microcontroller or a processor. Since the embedded system is used for specific tasks, design engineers can optimize it, reducing the size and cost of the product, or increasing the reliability and performance. Some embedded systems are benefited economically, due to mass-production. Embedded system is suitable for both the portable devices such as digital watches, MP3 players, etc., and for the non-portable devices such as traffic light, factory controllers, etc. Life is getting simple and easy in all aspects due to automation. Automation is mainly used for controlling the operating systems and it is applicable in industries, aircraft, etc. The benefit of automation is used to improve the quality, accuracy and precision. Nowadays, the thread winding machines used are very sophisticated and costly. So, small factories running loom machine are not able to purchase those costly thread winding machines. So, we thought of upgrading the older thread winding machines which are still use in small factory. The proposed system is to provide automation in thread winding machines in small scale industries. In this project, thread is winded automatically without any manpower. Once default mode or user mode has set, the thread gets started to winding. When it reaches the count of thread value, it automatically stops the motor. When the machine is in process, the count value of thread is detected by the proximity sensor and the piezo sensor detects the thread cutting. Nowadays, many industries have one of the major issues like voltage maintenance. In order to reduce the issue, we proposed to use the vibration sensor which detects the level of the voltage. Here zigbee is used as a communication medium between the machine and the user. ZigBee and the Personal Computer (PC) can be easily communicated through MAX RS232 which is a serial port communication.

II. LITERATURE SURVEY

In this table 2.1 shows the different analysis of existing thread winding machine used in large scale industries.

Table2.1: Analysis of the existing thread winding machine

winding machines	introduction	observation

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manual thread winding machine 	this machine is used for wounding woollen threads, especially in preparing to weave where the yarn is wound onto a bobbin and then used in a shuttle.	1.the thread is winded manually. 2. it takes more time to complete the process. 3.during this process the thread gets easily twisted.
semi-automatic thread winding machine 	by using this machine, we can automatically wind the thread	1. cost of the machine ranges from 50,000-80,000. 2. difficult to
automatic thread winding machine 	the working of the machine is fully automatic even the packing is automatically done by this machine. it displays the speed of the motor and the level of the voltage.	1. the cost is very high that it ranges in lakhs. 2. replacement of the machine is very complex.

A. Problem Statement

To propose an automatic thread winding machine which is suitable for small scale industries which includes various features like

1) Consumes time
2) Low Cost
3) Partially it reduces the manpower
4) Measures the accurate length of the thread
5) Update the status of the machine to the user

III. EXPERIMENTAL WORK

In this project, threads are winded automatically and the machine is controlled by three sensors. In Figure 3.1 shows the block diagram of automatic thread winding machine (transmitter).There are two modes one is default mode which works based on the predefined value. Second mode is set mode here we set values for each winding using the keypad. When the winding count is set, corresponding thread will run for specified count. This will be controlled using proximity sensor. The piezo (photo) sensor used to sense the thread status whether it is normal or broken. And proximity sensor will sense the rpm of the motor and vibration sensor

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senses the motor speed. Buzzer is used to indicate status of the machine. In a receiver side, monitoring section is placed. ZigBee is connected to PC through MAX232 which is serial communication port and the status of the machine is updated currently in a personal computer. In Figure 3.2 shows the block diagram of monitoring section (receiver).

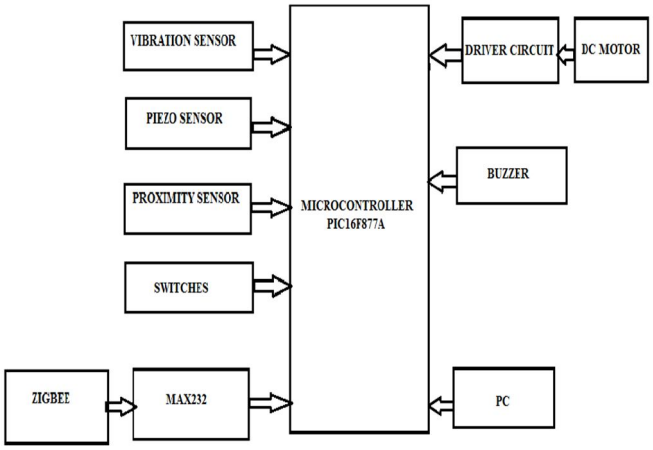

Figure 3.1: Block Diagram of Automatic Thread Winding Machine (Transmitter)

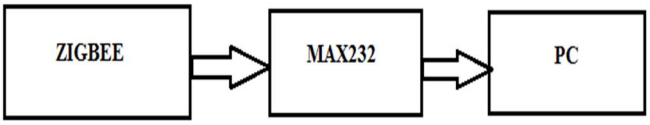

Figure 3.2: Block Diagram of Monitoring Section

IV. PROPERTIES OF USED MATERIALS

A. *Hardware Used*

Microcontroller Pic 16f877a

Figure 4.1: IC PIC16F877A

B. *I/O Ports*

General purpose I/O pins are the peripherals. PIC microcontroller is allowed to monitor and control the other devices. Many pins are multiplexed with an alternate function to add flexibility to a device.

C. *Port A And Tris A Register*

In PIC microcontroller, RA4 pin is used as a Schmitt Trigger input and open drain output. Remaining RA port pins have TTL input levels and CMOS output drivers. All pins have data direction bits which can configure these pins as output or input. The corresponding output driver is in high impedance mode when TRISA register bit is set. The contents of the output latch on the selected pin(s) when a bit is cleared in the TRISA register.

D. *Port B And Tris B Register*

PORTB is an 8-bit wide bi-directional port. The TRISB is corresponding data direction register. The output driver is in high-impedance input mode after TRISB is set. When clearing a bit in the TRISB register puts the contents of the output latch on the selected pin(s). Each pin in PORTB has weak internal pull-up. A single control bit turn on all the pull-ups which is performed by

clearing bit RBPU. The weak pull-up is turned off automatically when the port pin is configured as an output. The pull-ups on a Power-on Reset are disabled.

E. Port C And The Tris C Register

PORTC and the TRISC Register is an 8-bit bi-directional port. By using TRISC register, each pin is individually configured as an input or output. PORTC pins have Schmitt Trigger input buffers. Some peripherals override the TRIS bit to make output, while other peripherals override the TRIS bit to make an input.

F. PORT D and the TRIS D Register

PORTD is an 8-bit port with Schmitt Trigger input buffers. Each pin is configured as an input or output individually.

G. PORT E and the TRIS E Register

PORTE is an 8-bit port with Schmitt Trigger input buffers. Each pin is configured individually as an input or output. The upper bits of the TRISE register are used for the Parallel Slave Port control and status bits in some devices with PORTE.

H. DC Motor

A DC motor is designed to run on DC electric power (shown in Figure 4.2). Two examples of pure DC designs are Michael Faraday's monopolar motor (which is uncommon), and the ball bearing motor, which is (so far) a novelty. By far the most common DC motor types are the brushed and brushless types, which use internal and external commutation respectively to create an oscillating AC current from the DC source—so they are not purely DC machines in a strict sense.

Figure 4.2: DC Motor

I. ZigBee

ZigBee is a high-level communication protocols used for wireless networking. It is an unique wireless technology developed for its low-cost, low-power wireless M2M networks. ZigBee (CC2500) is a low cost true single chip 2.4 GHz transceiver designed for very low power wireless applications (shown in Figure 4.3). The RF transceiver is combined with configurable baseband modem. ZigBee devices are required to confirm the Low Rate Wireless Personal Area Network (LR-WPAN) standard. The standard specifies the lower protocol layers are the physical layer (PHY), and the Media Access Control portion of the data link layer (DLL). The specification is simple and less expensive than Bluetooth or Wi-Fi. Its transmission limit ranges from 10–100 meters. ZigBee devices can transmit data over long distances by passing data through mesh network of intermediate devices to reach more distant ones. It is used in low data rate applications that require long battery life and secure networking.

Figure 4.3: ZigBee

J. Sensor IR Sensor

IR LED emits infrared radiation. Amount of light reflected varies, depends on surface of reflectivity. The reflected light is incident on reverse biased of IR sensor. Depending on intensity of incident IR radiation, the amount of electron and hole pairs generated. As the intensity of incident ray varies, voltage across the resistor will also vary accordingly. It is an electronic device that emits to sense

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the aspects of the surroundings. It measures the heat of an object and detects the motion. All the objects that radiate thermal radiation in infrared spectrum which are invisible to our eyes which is detected by an infrared sensor. The emitter is an IR LED and the detector is an IR photodiode which is sensitive to IR light of same wavelength. In Figure 4.4 IR Sensor works as when IR light falls on the photodiode, the resistances and these output voltages, change in proportion to the magnitude of the IR light received.

Figure 4.4: IR Sensor

K. Vibration Sensor

Vibration sensor usually at any angle switch is ON state, by the vibration or movement, the rollers of the conduction current in the switch will produce a movement or vibration, causing the current through the disconnect or the rise of the resistance and trigger circuit. The characteristics of this switch is usually general in the conduction state briefly disconnected resistant to vibration, so it's high sensitivity settings by IC, customers according to their sensitivity requirements for adjustments. The vibration sensor detects the shock intensity caused by sudden knocks and continuous vibration. Vibration sensors are easily installed and fixed. Two sensors is not connected in idle condition. The blue LED indicates communication, online and activation. In Figure 4.5 shows the vibration sensor.

Figure 4.5 Vibration Sensor

L. Proximity Sensor

In Figure 4.6, Proximity Sensors using high-frequency oscillation to detect ferrous and non-ferrous metal objects and in capacitive models to detect non-metal objects. Inductive Proximity Sensors detect magnetic loss due to eddy currents generated by an external magnetic field in a conductive surface. A proximity sensor is a sensor detects the presence of nearby objects without any physical contact. A proximity sensor emits an electromagnetic field and changes the field. The object being sensed is referred as the proximity sensor's target. The maximum distance detected is defined nominal range. A proximity sensor measures the current flow between the electrode and the target provides readouts in units. Proximity sensors can have high reliability and long functional life due to the absence of mechanical parts and lack of physical contact between the sensor and the sensed object.

Figure 4.6: Proximity Sensor

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M. Software Used

The following software supports have been taken for the system.

1) *MPLab:* MPLab IDE refers to integrated development environment. It provides flexibility to develop and debug firmware for various Microchip devices. It is a Windows-based Integrated Development Environment for the Microchip Technology Incorporated PIC microcontroller (MCU) and dsPIC digital signal controller (DSC) families.
2) *Proteus:* Proteus is software for simulation in microprocessor, schematic capture, and PCB design. It is developed by lap center Electronics.

V. RESULTS AND DISCUSSION

The experimentation is carried out and the following results have been obtained. The status of the machine is updated to the user through PC. Buzzer is used to alert the user when the machine is in improper condition. In Figure 5.1 represents the output of the hardware and the simulation output in Figure 5.2.

Table 5.1: Analysis of existing and proposed thread winding machine

FACTORS	EXISTING THREAD WINDING MACHINE IN SMALL SCALE INDUSTRIES	PROPOSED THREAD WINDING MACHINE FOR SMALL SCALE INDUSTRIES
TIME TO WINED THE THREAD (MINUTES)	30	15
PRODUCTION (%)	45	90

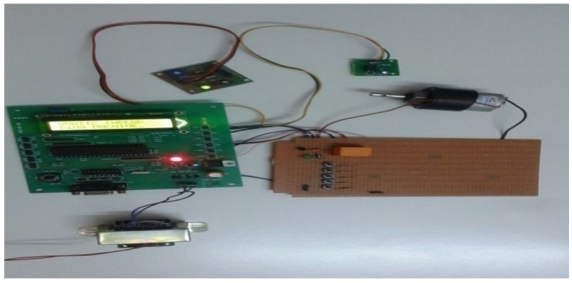

Figure 5.1 Hardware Output

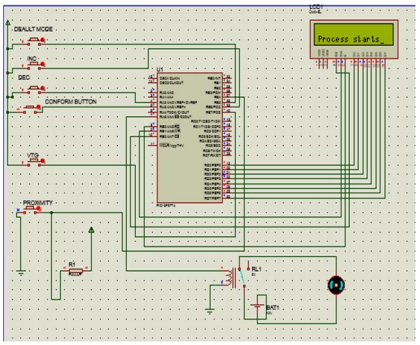

Figure 5.2 Simulation Output

VI. CONCLUSION

In small scale industries, we implement this project to reduce the complexity and cost of the machine. If any fault is identified in the machine, it can be easily replaced. Measures the accurate length of the thread automatically as given by the user. The status of the thread will be updated to the user periodically and also alerts the user when the voltage level is increased than required.

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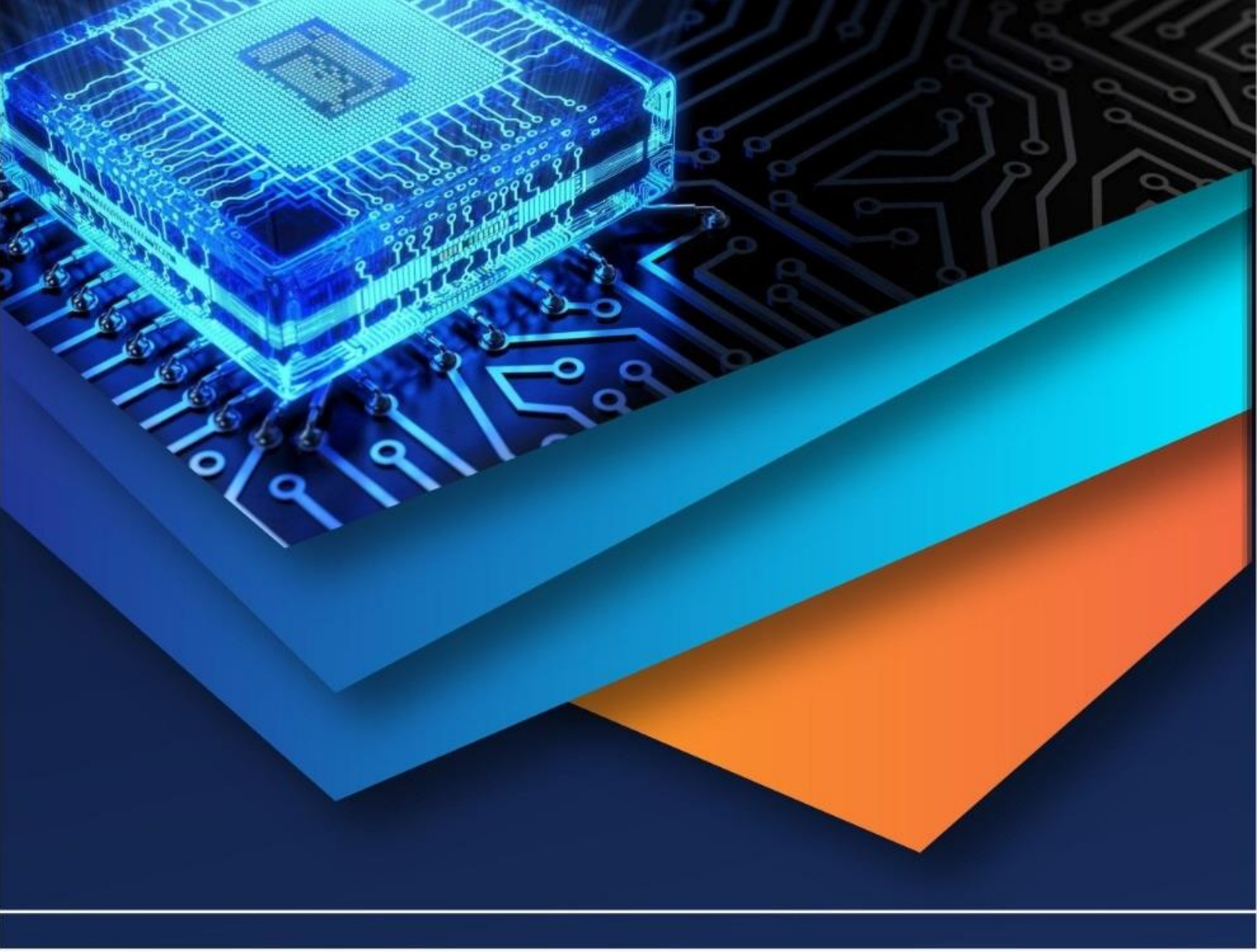

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