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Control System For Induction Motor In Real Time Monitoring

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ABSTRACT

This paper describes about the monitoring and controlling system of the induction motor with wireless technology. The maintenance of the induction motor is essential in industries for the better performance. In earlier, for monitoring the induction motor, the system uses wired communication is more expensive and also the data communication in industries may affect during the physical conditions such as human hazards. The proposed can monitor the parameters of induction motor such as voltage, current, temperature and speed of the motor and power factor. The system consists of Peripheral Interface Controller (PIC) Microcontroller which acquires the various parameters from the motor and then measured values are given to the Personal Computer (PC) through Wi-Fi Technology and also displayed in Liquid Crystal Display (LCD). Voltage and Current Transformers are used to measure the voltage and current of the induction motor. The measured values are stored in PC. In addition with this system the speed control is also provided and overloading of the motor is prevented. If an overload occurs in motor the buzzer will indicate the overload condition.

I. INTRODUCTION

In many industries induction motors are used because of simple, reliable and safe structures. The induction motors are used to drive the mechanical system in industries like paper mill, sugar industry and cement industries. The current, temperature, voltage, speed data are very important for driving the system. The maintenance of the induction motor is very essential for better performance. Current, voltage, temperature and speed data of the induction motors are very important for a drive system and performance of an induction motor is directly affected by these fundamental quantities. However, during continuous process of production it becomes dangerous and risky operation to control the machines. In such cases, remote control and monitoring techniques become a considerable solution to eliminate these hazards. Hence, wireless data communication is used in various industries. The monitoring and

controlling operation during the production process becomes dangerous in some cases. The remote monitoring and control scheme is proposed in this system for improving the performance of the motor. The monitoring and controlling operations are realized through Wi-Fi technology where the wired communication is not possible due to the physical conditions and human hazards for safe data communication in industries.

In this paper, we describe the system for monitoring and controlling of induction motor. A low cost system is proposed to monitor the parameters of the induction motor such as voltage, current, temperature of the windings, speed of the motor and power factor. In addition with the monitoring, the speed control of the motor is also performed. If an overload occurs i.e. current exceeds the maximum limit the relay circuit will turn on the buzzer and the Light Emitting Diode (LED) will glow.
This paper is organized as Section II introduces the proposed system, Section III presents the hardware description of the proposed system, Section IV expresses the experimental results, and the paper is finally concluded in section V, Section VI provides the information about the Future Scope this system.

II. PROPOSED SYSTEM

To improve the performance of the induction motor continuous monitoring of the motor is essential. The monitoring systems are particularly useful because the systems are able to capture the information from the motor, both real-time and historical, over the motor's life. The real time monitoring and controlling scheme for induction motor with Wi-Fi technology has proposed in this System. Power monitoring devices such as voltage and current transformers are used to measure the supply voltage and current of the induction motor. These real time data's are stored in Personal Computer and also displayed in Liquid Crystal Display. The system provides the additional information including,

- Power factor.
- Speed of the induction motor.
- Overload alert of the Induction motor.

The systems also have the ability to measure the temperatures of the motor windings and speed of the rotor during the running condition and also control the speed of the induction motor. The system provides the preventive maintenance, and predictive failure analysis.

III. HARDWARE DESCRIPTION

The Fig.1 Shows the block diagram of the proposed system. The each block of the proposed system is explained below.

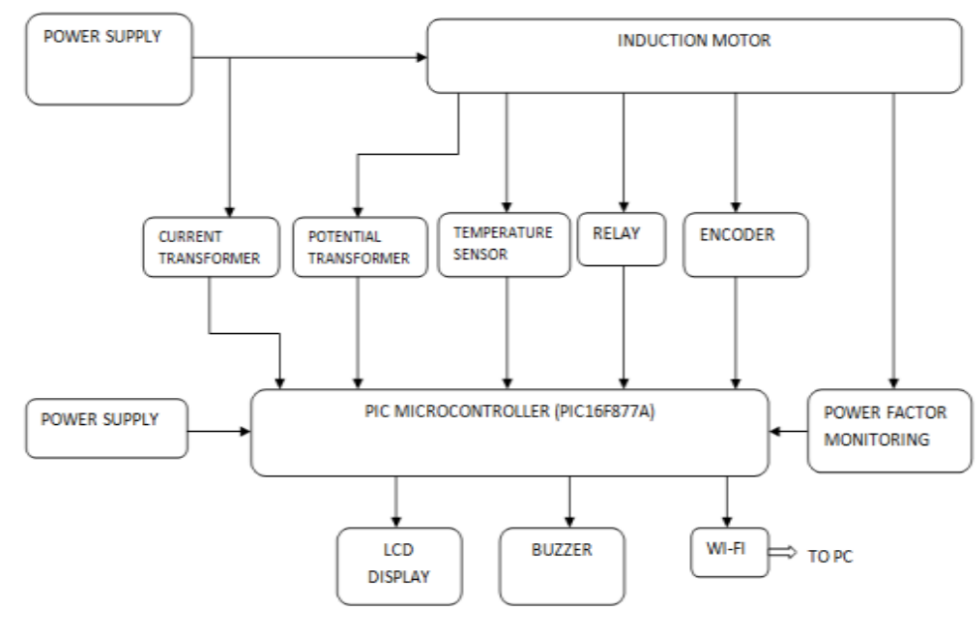

Figure 1: Block Diagram of Proposed System

A. VOLTAGE AND CURRENT MEASUREMENT UNIT

The voltage transformer is used to measure the voltage of the induction motor. The voltage given to the induction motor is measured using the voltage transformer with the transformation ratio of 220/5V. The current consumed by the induction motor is measured using the current transformer. The mini PCB mount current transformer with primary current 5Amps and rated secondary current of 1Amps is used. The measured voltage and current are transferred to the PC and displayed in LCD. The current exceeds the rated value the buzzer is used to indicate the overload condition of the motor.

B. PIC MICROCONTROLLER

The microcontroller IC which we used is PIC16F877A. It is a 40 pin IC. The Microcontroller acquires the various signals from appropriate measurement unit of the induction motor. The data collected from the motor are transferred to the PC through the Wi-Fi using a PIC Microcontroller and also the measured values are displayed in Liquid Crystal Display (LCD).

C. LM35 TEMPERATURE SENSOR

The temperature of the motor windings is measured using the LM35 temperature Sensor. The LM35 series are type of precision integrated-circuit temperature sensors. The output of this sensor is linearly proportional the Celsius. For every 10mv, the temperature value will be increase in 1 degree.It can

measure the temperature from -55° to +150°C range. The measured temperature from the sensor unit was displayed in LCD and stored in PC through the controller circuit.

D. ENCODER

The induction motor speed was measured using the shaft encoder which is connected to the motor shaft. The incremental encoder with 360 Pulse Per Revolution (PPR) was used to measure the induction motor rotor speed. The speed of the motor can be controlled using the PWM technique.

IV. RESULT AND DISCUSSION

This chapter discuss about the simulation results of the induction motor monitoring and control system. The Fig.2 represents the complete view of the Proteus Software implementation of the induction motor monitoring and control system.

The temperature of the motor windings is measured using LM35 temperature sensor. The current and voltage rating of the induction motor, speed of the induction motor are measured using appropriate measuring unit and it can be displayed in LCD display and it is also displayed in virtual terminal. The outputs of the measured units are shown in Fig.3.

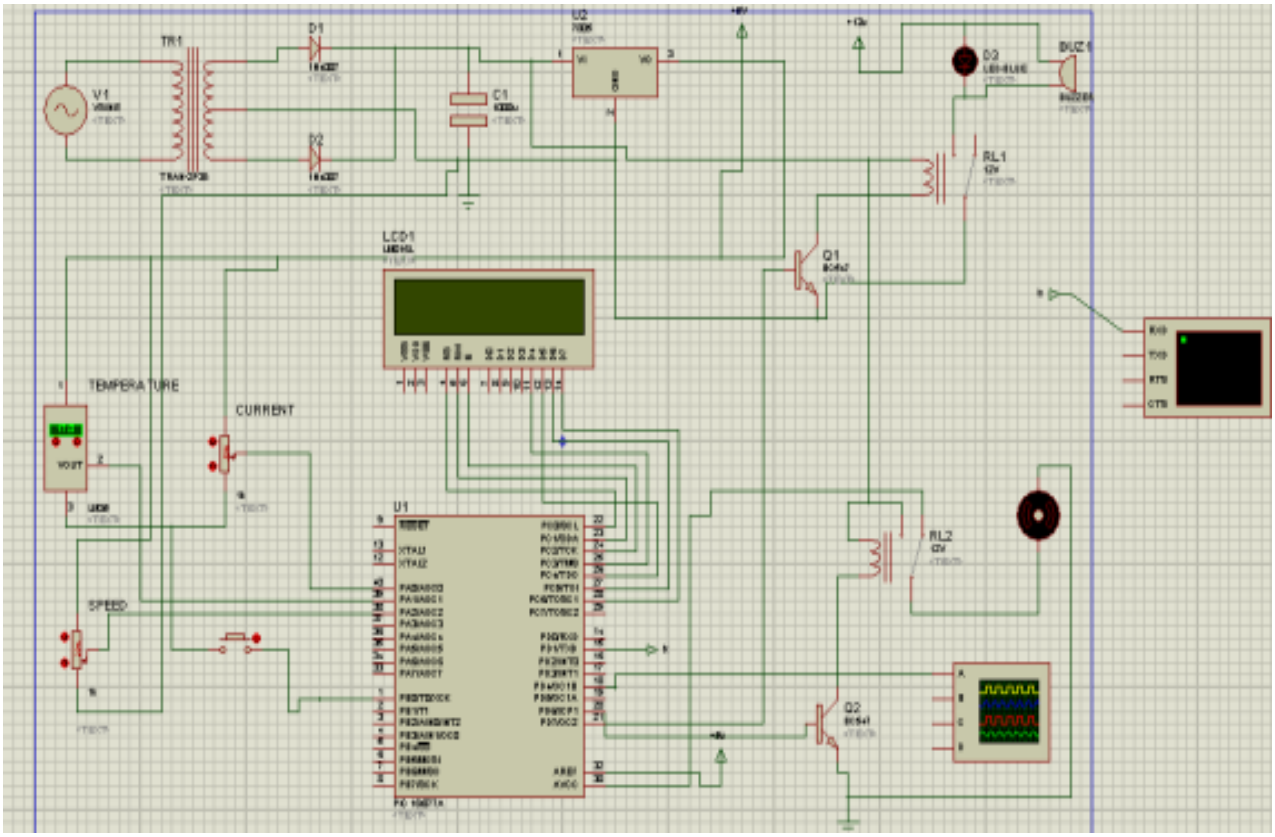

Figure 2: Simulation Representation of the Proposed System

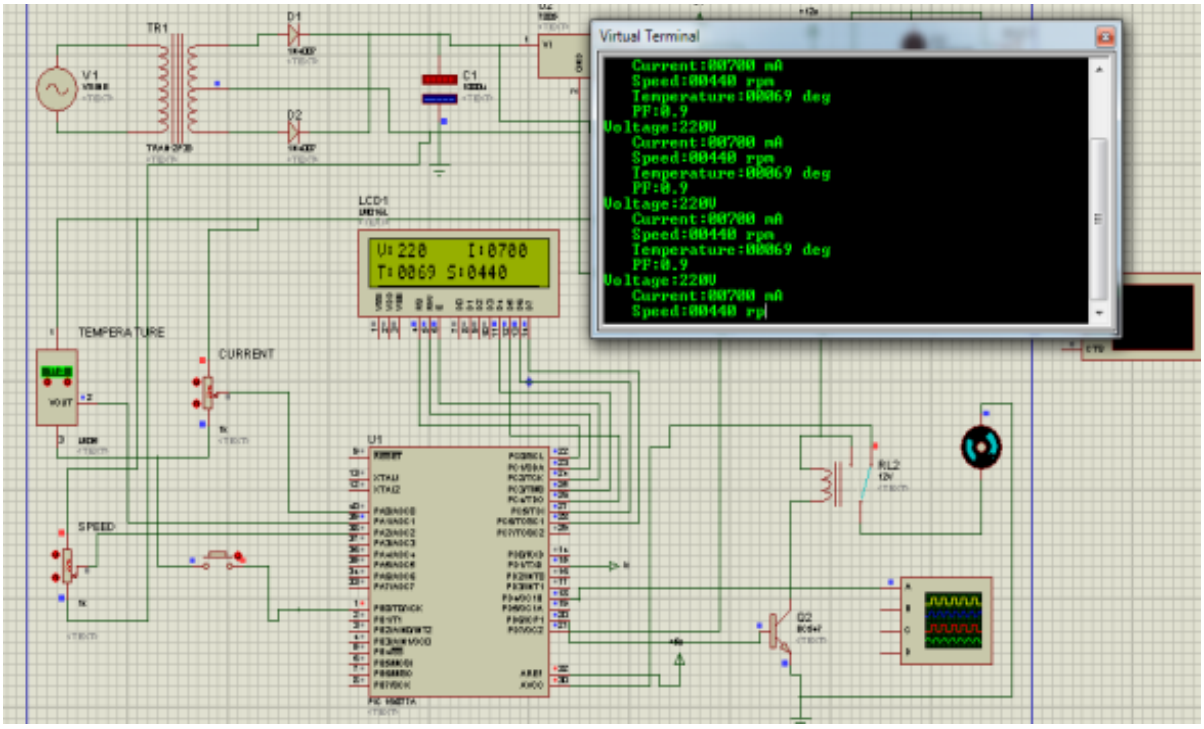

Figure 3: Simulation Output of Induction Motor Parameter Monitoring Unit

The Fig.4 represents the speed output waveform of the induction motor. The waveform is displayed in digital oscilloscope. The speed of the induction motor is controlled by PWM technique. By varying the pulse applied to the motor the speed of the motor is varied. The ON time and OFF time of the speed waveform can be varied. If the Speed increases the ON time of the waveform is increased and OFF time is decreased.

The Fig.5 Shows the overload alert of the induction motor. If a current exceeds the rated current the overload alert will be displayed in LCD display. The relay circuit will turn on the buzzer to indicate the overload and LED will glow.

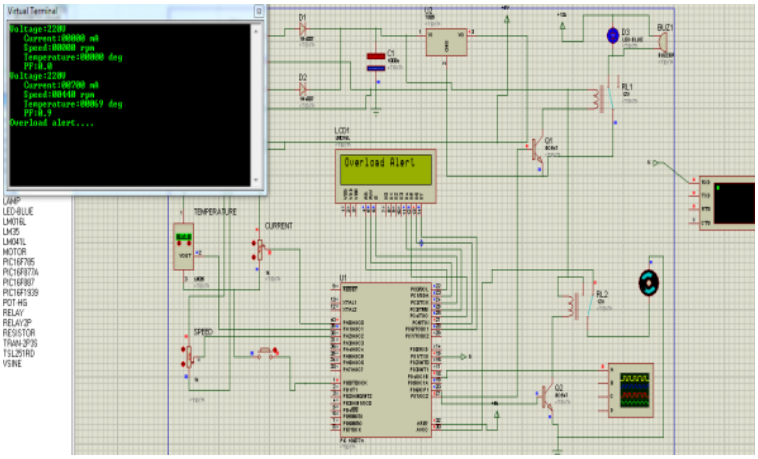

Figure 5: Simulation Output for Overload Alert

V. CONCLUSION

The utilization of induction motors becomes very popular when compared to other motors for many of the industries because of its simple design, rugged performance. Induction motors are used in various industries such as, paper mill, Sugar industry, for driving the mechanical systems. The maintenance of an induction motor is very essential. In Earlier, wired communication is used for monitoring the induction motor which is expensive and the data communication may affect due to physical conditions like human hazards. To overcome this problem, the system is implemented with monitoring and control system with wireless communication. The real time monitoring and controlling method is implemented for the better performance of the motor. The system developed is capable to perform such operations like measuring, monitoring and controlling the most parameters like voltage, current, temperature, speed and Power factor of the induction motor. These real values are transferred through the Wi-Fi technology to the personal computer and it can be stored for the future reference. The monitoring devices can provide additional information needed to maximize energy savings. Monitoring systems also have the ability to providing guidance for preventive maintenance, and predictive failure analysis.

VI. FUTURE SCOPE

The monitoring and controlling system of the induction motor can be implemented in the industries and the monitoring values are updated in industrial website for providing the easy maintenance. The automatic torque and efficiency of the induction motor can be calculated to improve the performance of the Induction motor.

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