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Protection of Three Phase Induction Motor using Microcontroller

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1.ABSTRACT:-

Three-phase induction motors are industry's workhorses and widely used as electromechanical energy conversion devices. Although induction machines are considered relatively reliable and robust due to their simple design and well-developed manufacturing technologies, failures to occur and may severely disrupt industrial processes and even lead to disastrous accidents. To prevent these failure happen, many techniques have been developed for early condition monitoring. The computer based protection methods are costlier and the electrical parameters cannot be visualized by Programmable Logic Controller (PLC) based method. The old classical methods are complex. Hence to protect an Induction motor easily, a microcontroller based fault detection and protection of Induction motor is proposed. To develop for protection of three phase induction motor from over voltage, over current, temperature.The proposed system is tested with the setting of various preset values of parameters. From the results, it is observed that the results are satisfactory, reliable, gives quick response, cost effective and highly versatile.

Keywords:- Microcontroller, 3 phase induction motor ,LM 35

2.INTRODUCTION

Three phase induction motor are industries workhorses and widely used for electromechanical energy conversion devices. Although, induction machines are considered relatively reliable and robust, due to their simple design and well-developed manufacturing technologies. In industries 3 phase induction motors are the most common and frequently encountered machines. The electrically related faults like over/under voltage, over/under current, over-heating, single phasing, etc. The proposed system uses three-phase power

supply where in three single-phase transformers are connected to it. This system design is based on microcontroller. We use sensors are used for fault detection and LCD display is used for displaying normal condition parameters such as voltage, current, temperature, fault occurring in the motor. Over vibration may lead to damage in the bearings, loosen windings, consume excess power, create excessive noise and also damage the foundation. Due to this electrical fault the winding of motor get heated which lead to insulation failure and reduce the life time of motor. When the three phase induction motor supply with higher voltage than is rated then induction motor starts overheated. This fault is generated in induction motor due to variation in induction motor parameters. When three phase induction motor runs continuously, it is necessary to protect the motor from these anticipated faults.

LITERATURE SURVEY

Although induction machines are considered relatively reliable and robust due to their simple design and well-developed manufacturing technologies, failures do occur and may severely disrupt industrial processes and even lead to disastrous accidents. To prevent these failure happen, many techniques have been developed for early condition monitoring. The computer based protection methods are costlier and the electrical parameters cannot be visualized by Programmable Logic Controller (PLC) based method [1]. The different alternatives to detect and diagnose faults in induction machines have been proposed and implemented in the last years. These new alternatives are characterized by an on-line and non-invasive feature, that is to say, the capacity to detect faults while the machine is working and the capacity to work sensor less [2].

This paper is for monitoring the speed, torque and protection of three phase induction motor from overload by implementing ZigBee based wireless sensor network. The design of the system maintains security, provides high reliability and is susceptible to many types of faults [3].

The main aim of this project is to detect faults of three phases IM and control the faults. This project deals with speed control of Induction Motor. The three phase induction motor may experience many incipient faults due to various reasons. So the protection of these motors from such faults is very important. The various faults are over-voltage/current, under-voltage/current, overload, single phasing, speed variation,over-temperature etc [4].

In this paper, they present the Induction motor easily, a microcontroller based fault detection and protection of Induction motor is proposed. This paper tends to develop for protection of three phase induction motor from temperature by using temperature sensor and also use of single phase to three phase convertor circuit to prevent from over voltage and under voltage, over current, over speed, Line frequency and phase failure [5].

2. Block Diagram:

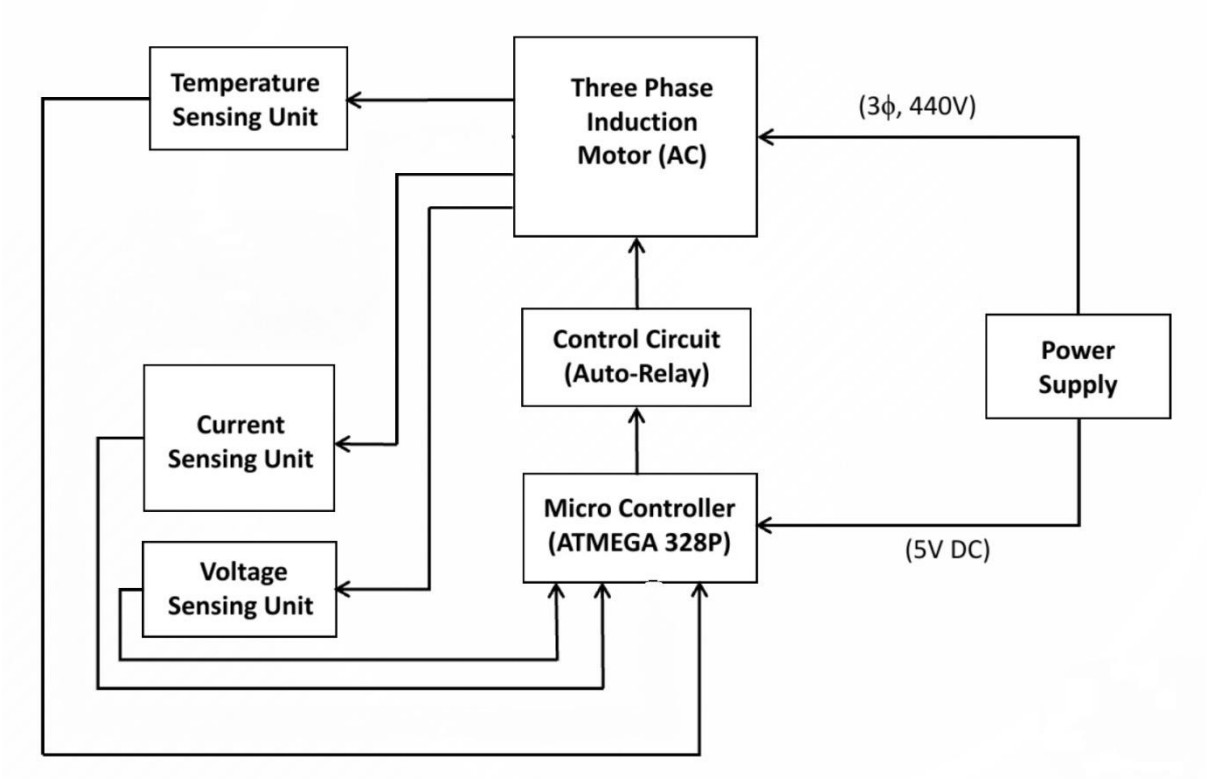

Figure2.1: Block Diagram of Protection system of three phase induction motor using microcontroller

Description of block diagram:

CURRENT TRANSFORMER:

When a current is too high to measure directly or the voltage of the circuit is too high, a current transformer can be used to provide an isolated lower current in its secondary which is proportional to the current in the primary circuit. The induced secondary current is then suitable for measuring instruments or processing in electronic equipment.Current transformers also a current transformer (CT) is a transformer that is used to produce an alternating current (AC) in its secondary which is proportional to the AC current in its primary. Current transformers, together with voltage transformers (VTs) or potential transformers (PTs), which are designed for measurement, are known as instrument transformers.

When a current is too high to measure directly or the voltage of the circuit is too high, a current transformer can be used to provide an isolated lower current in its secondary which is proportional to the current in the primary circuit. The induced secondary current is then suitable for measuring instruments or processing in electronic equipment. Current transformers also have little effect on the primary circuit. Often, in electronic equipment, the isolation between the primary and secondary circuit is the important characteristic.

VOLTAGE SENSOR:

A voltage sensor is a sensor used to calculate and monitor the amount of voltage in an object. Voltage sensors can determine the AC voltage or DC voltage level. The input of this sensor is the voltage, whereas the output is the switches, analog voltage signal, a current signal, or an audible signal.

Sensors are devices that can sense or identify and react to certain types of electrical or optical signals. The implementation of voltage sensor and current sensor techniques have become an excellent choice for the conventional current and voltage measurement methods.

TEMPERATURE SENSOR:

LM35 is a precession Integrated circuit Temperature sensor, whose output voltage varies, based on the temperature around it. It is a small and cheap IC which can be used to measure temperature anywhere between -55°C to 150°C. It can easily be interfaced with any Microcontroller that has ADC function or any development platform like Arduino.

Power the IC by applying a regulated voltage like +5V (V_S) to the input pin and connected the ground pin to the ground of the circuit. Now, you can measure the temperate in form of voltage.

If the temperature is 0°C, then the output voltage will also be 0V. There will be rise of 0.01V (10mV) for every degree Celsius rise in temperature.

RELAY:

- A **relay** is an electrical switch that opens and closes under the control of another electrical circuit. In the original form, the switch is operated by an electromagnet to open or close one or many sets of contacts. It was invented by Joseph Henry in 1835. Because a relay is able to control an output circuit of higher power than the input circuit, it can be considered to be, in a broad sense, a form of an electrical amplifier

- Relays are elements connected to the output pins of the microcontroller and are used to turn on/off all that being out off board which has sensitive components: motors, transformers, heaters, bulbs, high voltage components etc Normally-open (**NO**) contacts connect the circuit when the relay is activated; the circuit is disconnected when the relay is inactive. It is also called a **Form A** contact or "make" contact.
- Normally-closed (**NC**) contacts disconnect the circuit when the relay is ac is activated; the circuit is connected when the relay is inactive. It is also called a **Form B** contact or "break" contact.

BUZZER-

Pin Number	Pin Name	Description
1	Positive	Identified by (+) symbol or longer terminal lead. Can be powered by 6V DC
2	Negative	Identified by short terminal lead. Typically connected to the ground of the circuit

3 PHASE CONTACTORS-

When a relay is used to switch a large amount of electrical power through its contacts, it is designated by a special name: *contactor*. Contactors typically have multiple contacts, and those contacts are usually (but not always) normally-open, so that power to the load is shut off when the coil is de-energized.

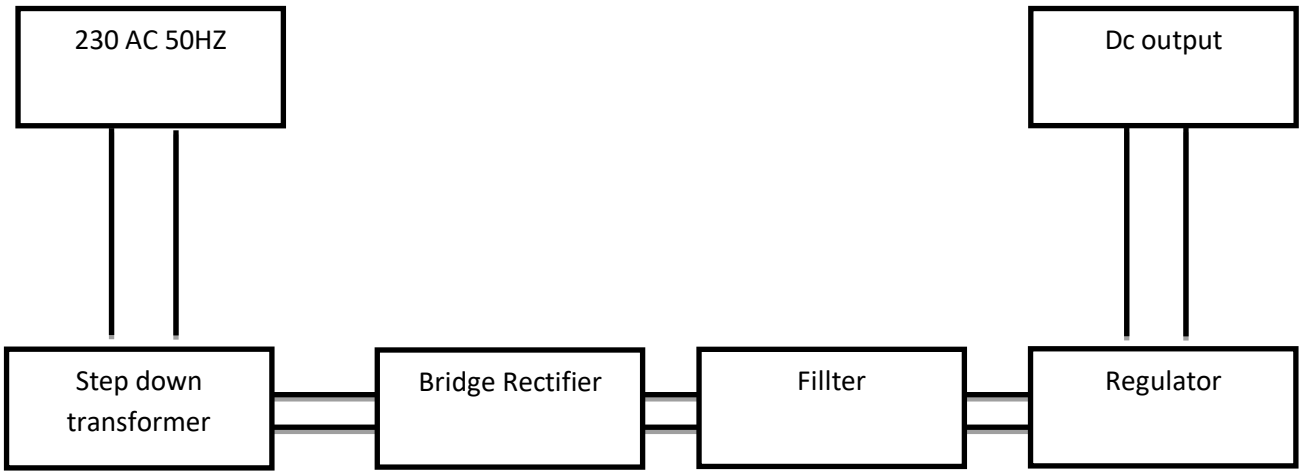

FIG2.2 Block Diagram of Power Supply.

The input to the circuit is applied from the regulated power supply. The AC input i.e., 230V from the mains supply is step down by the transformer to 12V and is fed to a rectifier. The output obtained from the rectifier is a pulsating DC voltage. So in order to get a pure DC voltage, the output voltage from the rectifier is fed to a filter to remove any AC components present even after rectification. Now, this voltage is given to a voltage regulator to obtain a pure constant dc voltage.

3. SYSTEM DESIGN

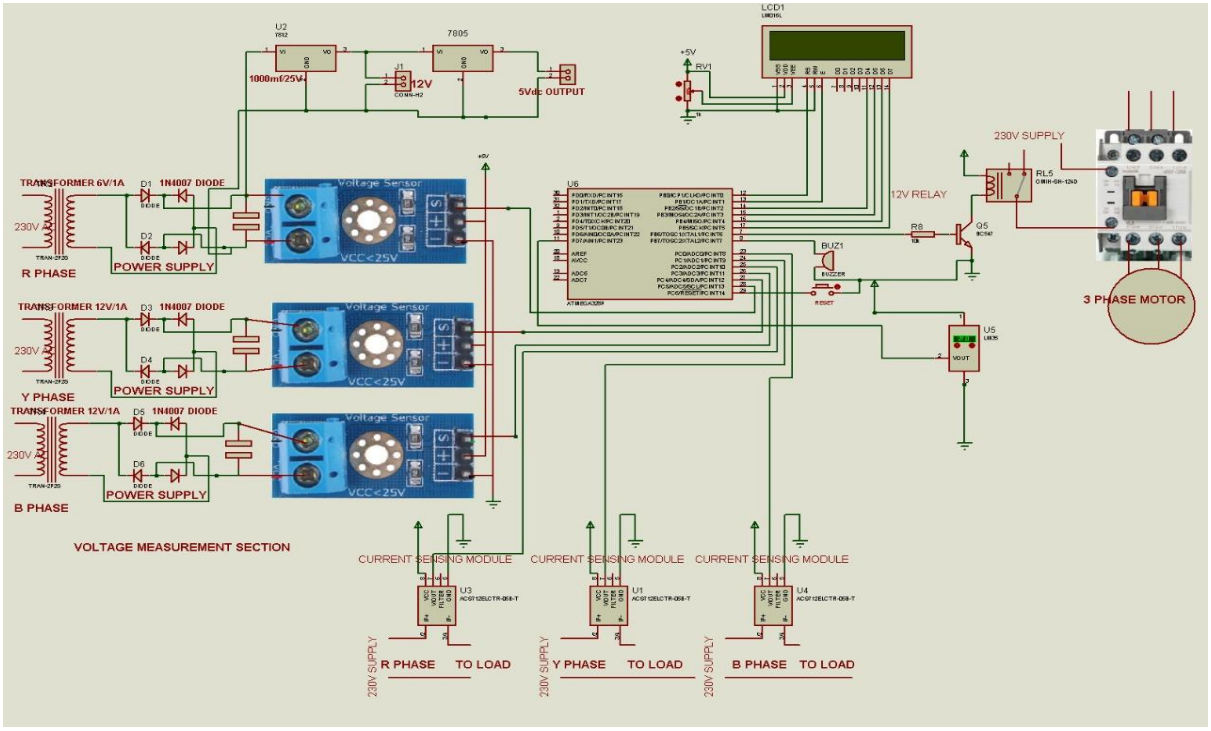

Fig. 3.1 Circuit Diagram of Protection of three phase induction motor using microcontroller

3.1SIMULATION:-

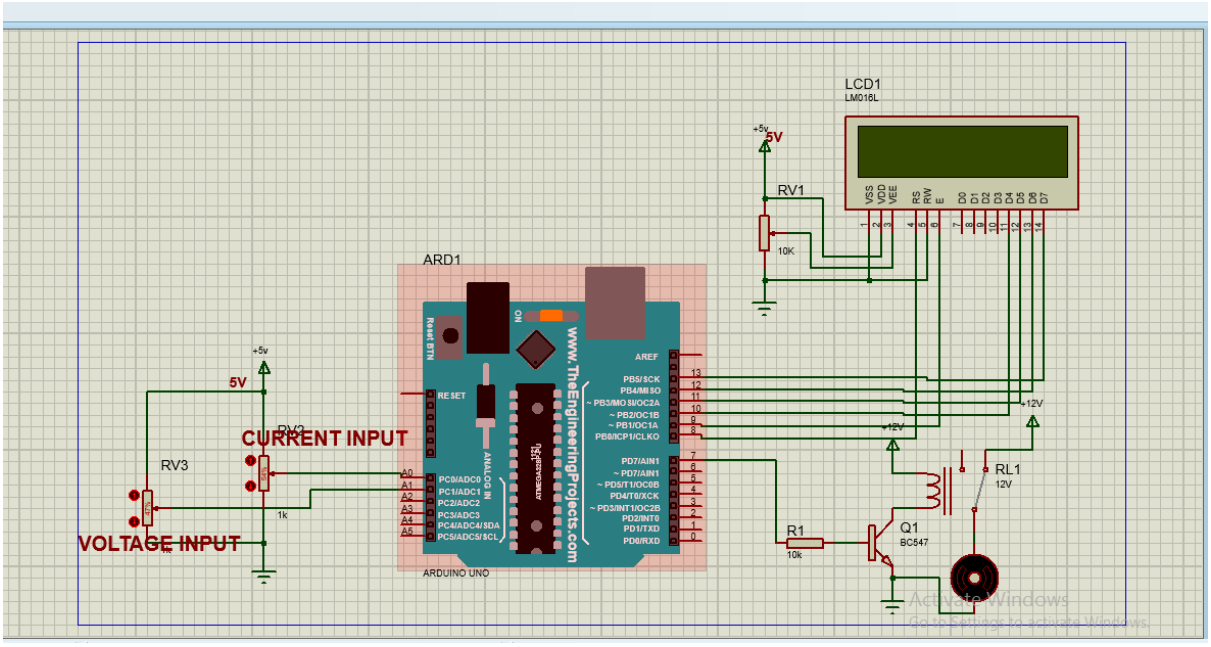

Fig. 3.1 Simulation Diagram of Protection of three phase induction motor using microcontroller

4 . CALCULATION TABLE

Sr.no.	Supply voltage	Phases	v	I	Temperature	Condition
		R	284.6	1.48		
		Y	278.5	1.28		
		B	280.5	280.5		
		R	210	1.00		
		Y	205	1.02		
		B	203.8	1.04		

5.RESULTS

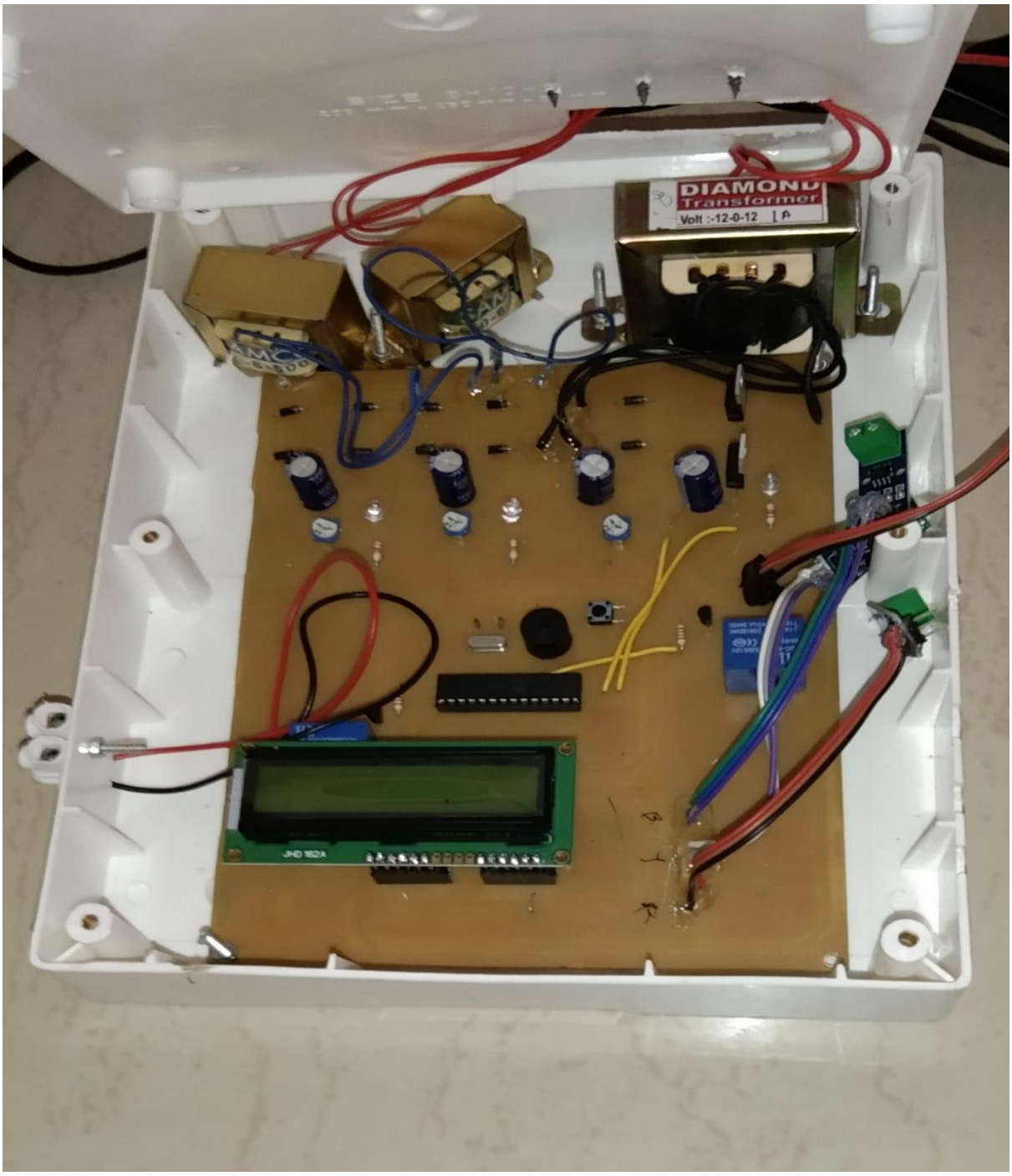

FIG 5.1 Protection System of Three phase induction motor using microcontroller

In this project we work on Protection system of three phase induction motor. The main concept of the project is to develop an induction motor protection system for protecting the motors from any damages occurring from single phasing, under/over current and under/over voltage,over temperature

6.CONCLUSION

The protection system can protect three phase induction motor from under voltage, over voltage,under/ over current .

The dissertation is based on the protection of three phase induction motor under single phasing condition and it is implemented using microcontroller, step down transformers, current transformers and protective relays. The system is very cheap as compared to present protective devices available.

7.FUTURE SCOPE

The dissertation is to implement the inverter system on the large capacity three phase induction motors. In control circuit only the ratings of C.T. and P.T. has to be chosen accordingly while the power circuit has to be designed independently as per the rating of the motor.

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