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An Improved Method for Protection of Three Phase Induction Motor Using Arduino

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Abstract: ***Recently observed that the conventional method used for protection for three phase induction motor is taking time to Operate and the cost of the system is high. So to overcome this, there is need of a protection system which can operate in less time and has low cost. The mission is to create a system which has slow cost and fast operation. This condition gave the basic idea about what was required in current Scenario. The idea was to create a system which is cheap and will reduce the operation time. The system has the ability and the economic value to for fulfilling the protection of three phase induction motor. This system is cost effective and easy to maintain.***

This paper addresses to make a cheap and reliable protection system for three phase induction motor. The protection system should protect the motor from voltage unbalancing, single phasing, under voltage, over voltage and thermal protection. To improve the technique to run the motor below single phasing. Taking the cost factor into consideration the design has been proposed using Arduino, relays, small CTs and PTs. However the sensitivity of the protection scheme has been not compromised.

Keywords: Induction Motor Protection; Overvoltage; Under Voltage; Single Phasing; Overcurrent.

I. INTRODUCTION

In this paper we develop an improved method for protection of three phase induction motor using arduino for industries. Our main target is to protect three phase induction motor from various fault with using one circuit in minimum time and at low cost by considering different factors such as ease of operation, time of operation, cost of equipment. This is very cheap in cost but mainly used for protection of three phase induction motor. So therefore we design a circuit which can protect motor from various faults. This protection method protects motor from various faults such as over voltage, under voltage, overcurrent, single phasing, thermal protection. This protection system requires minimum time for operation as it can work very instantly. It will detect the fault and stop the motor. As the induction motor is main part of industry it is important to provide a better protection system. There is a need of better protection system for three phase induction motor as the conventional system requires more time to operate. The system designed by us is better than conventional system as it can operate in less time .As these system can detect the fault in less time and operate quickly due to which the fault in motor does not extend. As the fault occurs in induction motor the system detect the fault and stops the motor and display the fault on the screen. Due to this feature it is easy to rectify the fault as this is less time consumption process. Due to the fast operation the fault can't damage the motor.

II. LITERATURE REVIEW

Single phasing of three phase induction motor. William H. Kersting.

From this paper we had surveyed about the single phasing of the motor. How the single phasing occurs how it can be prevented, so we developed a circuit which can detect the single phasing and can protect the motor as the motor can run on a single phasing but it can damage the motor .so the circuit is developed which can detect single phasing.

Single Phasing, Phase Reversal, Overvoltage, Under Voltage And Overheating Protection Of Three Phase Induction Motor. Devesh Kumar,Piyush KumarVerma.

From this paper we understand how the single phasing, under voltage, overheating occurs and how to protect induction motor from this fault .So as per information the proposed work was to develop a system which can detect this fault and provides protection to motor in a less time.

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III. THE PROPOSED SYSTEM

A. Working

The data collected from voltage sensing and current sensing circuits are transferred to the arduino. The arduino has inbuilt analog to digital (ADC) converter. Hence, external ADC unit is not needed. Arduino A/D converter (ADC) is competent of processing input, which is less than 5V signal. Hence sensors are to be selected according to the values.

The comparison are made with the practical value and the value which are entered in the program by which the arduino can operate. When an abnormal condition occurs the motor is stopped by the control signals .The motor parameters such as full load voltage, full load current are to be entered in protective relaying program so as to automatically calculate and protect the motor.

The arduino based motor protection system is combination of control, monitoring and protection of induction motor from the different faults in a single circuit assembly. The system provides protection from single phasing, under voltage, over voltage, over current, overheating .The controller of the system is implemented by arduino. LCD display is used to display the fault occurred in the system.

The system is very sensitive and fast it can detect the fault while running or before starting of motor. The system is developed and tested on three phase induction motor with rated current of 3A and the results of the testing are satisfying. When the values of under voltage and over voltage get exceeds from the programmed values then controller generates trip signal which switch off the motor and display the fault which are occurred in induction motor by which it is easy to detect the fault and correct it in less time.

Hence induction motor is protected from overvoltage, under voltage, over current. The other faults are also monitored and protected which are occurred in induction motor. The circuit diagrams are provided below

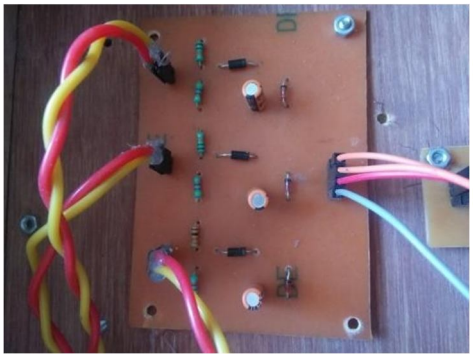


Fig no. 4.1a Model Half wave rectifier

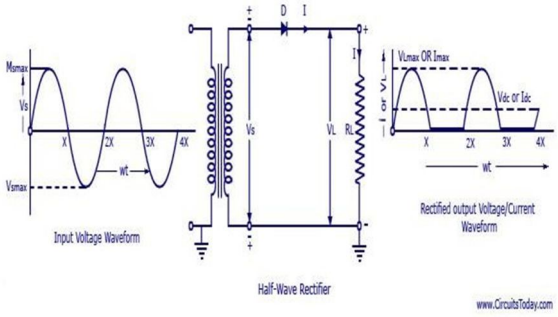


Fig no. 4.1b Half Wave Circuit diagram

B. Half Wave Rectifier

A simple Half Wave Rectifier is nothing additional than a single pn junction diode connected in series to the load resistor. As you know a diode is to electric current ,it allows electric current to flow in only one direction. This property of the diode is very useful in creating simple rectifiers which are used to convert AC TO DC.

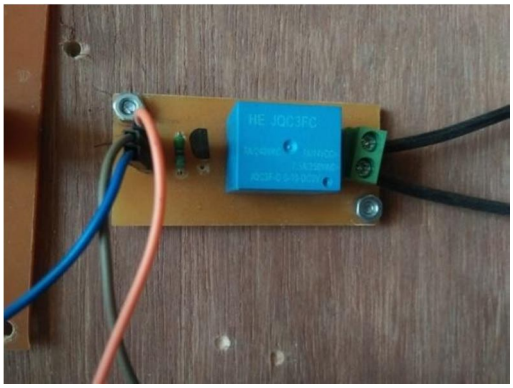


Fig no. 4.2a Model Relay circuit

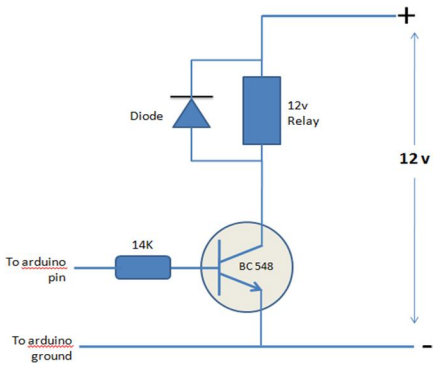


Fig no. 4.2b Relay Circuit diagram

C. Relay Circuit

It is an electro-magnetic relay with a wire coil, surrounded by an iron core. A path of terribly low reluctance for the magnetic flux is provided for the movable coil and additionally the switch purpose contacts. The movable coil is connected to the yoke that is automatically connected to the switch purpose contacts. These components area unit safely command with the assistance of a spring. The spring is used stop produce an air gap in the circuit when the relay becomes de-energized.

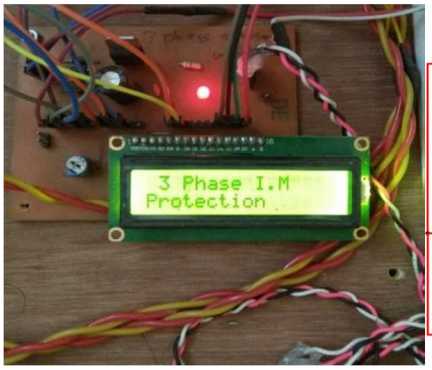


Fig no : 4.3a Model LCD Display

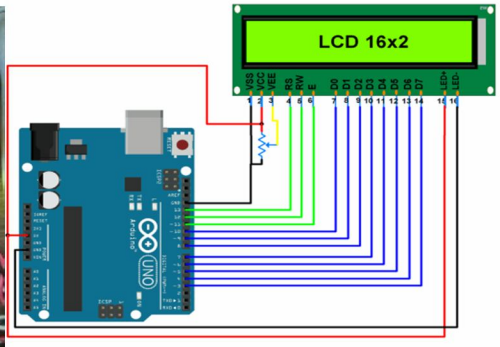


Fig no : 4.3bLCD Display Circuit diagram

D. LCD Display

LCD (Liquid Crystal Display) screen is associate degree electronic show module and notice a good vary of applications. A 16x2 LCD display is incredibly basic module and is incredibly unremarkably employed in varied devices and circuits. These modules are preferred over seven segments and other multi segment LEDs. The reasons being: LCDs are economical; easily programmable; have no limitation of displaying special & even custom characters (unlike in seven segments) animation and so on.

A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data.

Fig no. 4.4a Model Current Sensor

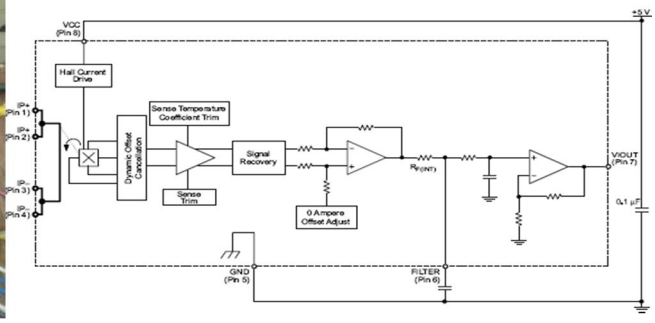


Fig no. 4.4b Current Sensor Circuit diagram

E. Current Sensor

ACS712 current detector operates from 5V and outputs analog voltage proportional to current measured on the sensing terminals. You can simple use a arduino ADC to read the values. Sensing terminal can even measure current for loads operating at high voltages like 230V AC mains while output sensed voltage is isolated from measuring part.

Features:

100 mV/A output sensitivity

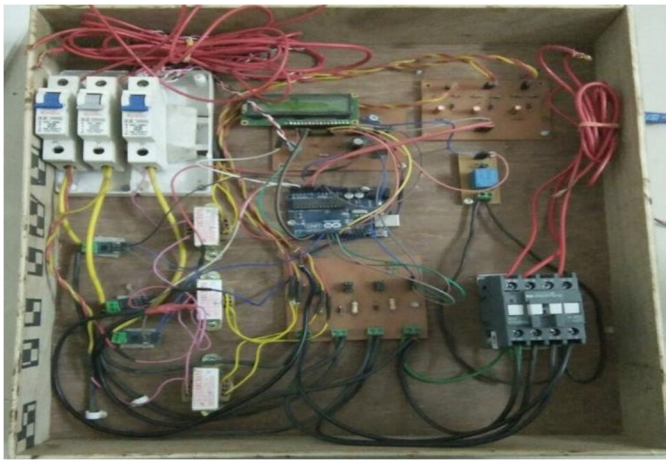
5.0 V, single supply operation

Output voltage proportional to AC or DC currents

Ratio metric output from supply voltage

5 microsecond output rise time in response to step input current

V.MODEL CIRCUIT



VI.BLOCK DIAGRAM

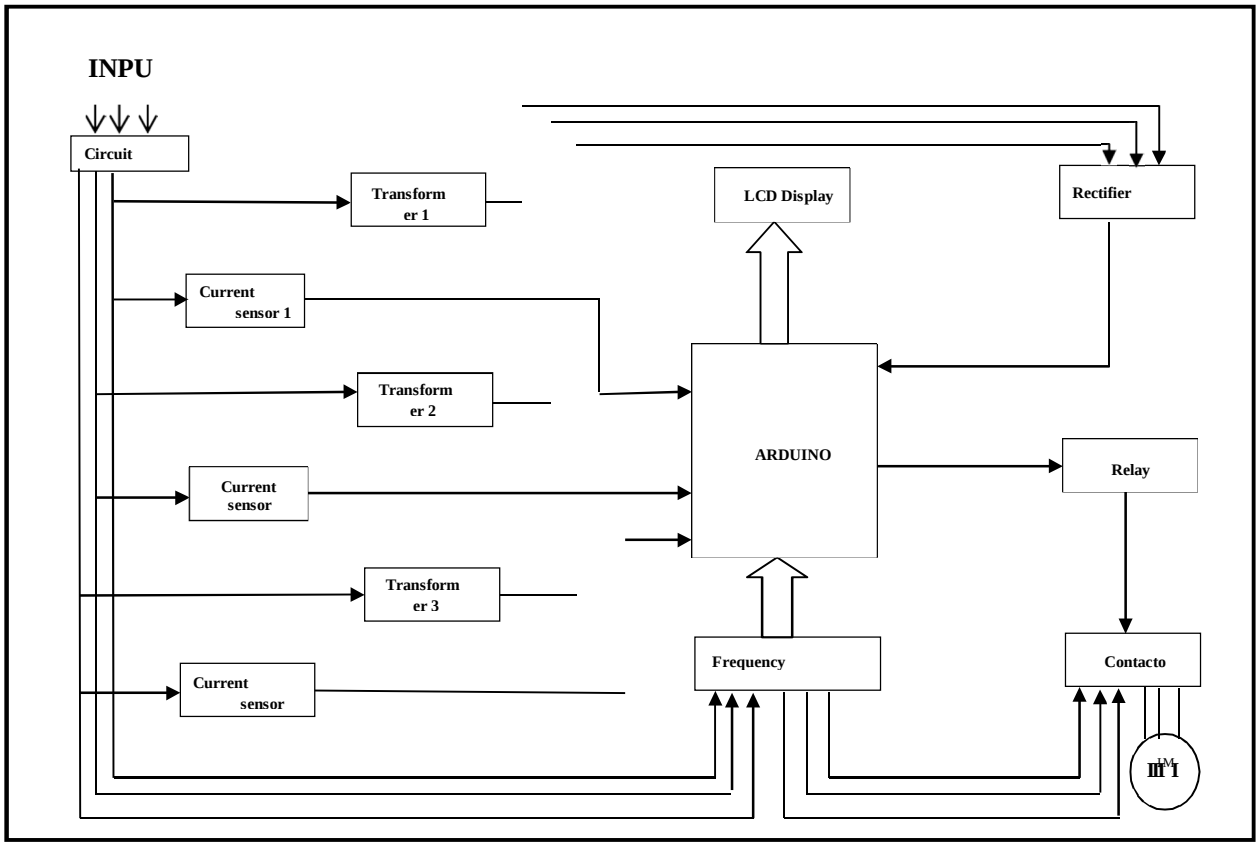


Fig no 6.1 Block diagram of Protection Technique for 3 phase IM.

VII. ADVANTAGES OF ARDUINO BASED PROTECTION SYSTEM

A. This system is fastest method as it takes less time to operate due to which the the fault did not increase in motor and the damage to the motor is less.

B. The operation time of the system is less due to which it can detect fault in less time and stops the motor

C. The operation of the sytem is safe as it can be handle very easily

D. Simple circuit as it can be understandable to all.

1) Drawbacks of the Present Protection System

a) The speed of the operation of the convention system is more as it can damage the induction motor.

b) The system required different circuits for different faults protection due to which the the cost of the protection system is increased .

c) The conventional system has complicated circuit due to it becomes difficult to understsand .

d) Due to the different circuits the system becomes bulkier.

VIII. RESULT AND DISCUSSION

Over voltage tripping	R-Ph:272.4 volt
	Y-Ph:272.4 volt
	B-Ph:272.4 volt
Under voltage tripping	R-Ph: 197volt
	Y-Ph: 197 volt
	B-Ph: 197 volt
Over current	3.1 A
Single phasing	R-Ph or Y-Ph or B-Ph Are Absent
Tripping Time	2.3 sec

This protection System is improved method because the convention system used in industries are complicated and the conventional system are bulkier because different circuits are used for different protection. But our system is having a single circuit from which the different fault can detected and the protection is applied to motor as the motor supply is cut off after the fault detection and it also display the fault on the screen due to which becomes easy to rectify the fault. As the conventional system requires more time to operate due to which the fault can increase and result in severe damage of motor .But the system designed by us operate in less time due to which the fault did not increase. In our protection system single circuit can detect different faults and protect the motor due to which it requires less space. In this system we had used electronic circuit which can operate quickly. Hence it is the improved method for protection of three phase induction motor.

IX. CONCLUSION

This protection system is an improved method because it is very less time operating and low cost protective device as compared to other protective devices. The system is tested in the laboratory for many times on three phase induction motor under faulty condition and it gives desirable results. The system is reliable and rugged. This is for the protection of motor for under voltage, over voltage, unbalance voltage, over current and single phasing.

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