Review on 3 Phase Induction Motor Monitoring and Protection System

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Abstract: Damage to the electrical parts can inevitably occur. It can be caused by many factors either from within and outdoors the system. three phase induction motor is that the most typically utilized in trade, however the issues like over current and voltage along with dry water level condition on the motor are still found. they will cause fatal harm to the motor. Therefore, a relay protection system that utilizes a microcontroller has been created to shield the three phase induction motors. This relay protection is meant otherwise from standard relay protection that normally utilized in trade. it's designed supported the microcontroller management. This paper presents a protection system for three phase appliances from over voltage and under voltage. Because of this electrical fault it get heated which lead to insulation failure and thus reduces the life. In the suggested system limit is set for voltage range that is considered normal working condition. PIC microcontroller checks the condition, if not satisfies trip load and it isolates from the supply. Undervoltage and overvoltage are two of the most common problems that impact electrical equipment in industries. This type of protection is capable of greatly resolving this problem. A lamp load is used in this work to test the working of proposed system.

Keywords: 3 Phase Supply, Induction Motor, Microcontroller, Volateg, Current, Water Level Monitoring, Auto Cut Off Etc.

1. INTRODUCTION

The three-phase induction motor are widely used industries for various application, this motors are more expensive. The protection system are essential to perform continuous and reliable operation. The major fault occurs in three phase system is overvoltage and under voltage. Todays technology has give the opportunity to use the latest trends, and microcontrollers are one of the requirement to apply in the remote protection of the appliances. The protection relays sense the accurate values of abnormal or normal condition. The input information for measuring equipment from power system is through CT and PT. The normal supply voltage does not cause higher stress on insulation but at the condition of overvoltage its majorly affects and insulation get damaged. To prevent the three phase appliances from the fault the overvoltage and under voltage protection system is made.

Three phase induction motors are widely used in industries as industrial drives because of the rugged, less costly, reliable and economical. It use to transform electrical power into mechanical power, so there are necessary need to protection of IMs from faults occur motor in motor. Also there are need to detect the faults and unnecessary condition occurs in induction motor because undetected faults may cause failure of motor. Failure of motor is biggest

problem in industries and at many other places where induction motor widely used. Motor failure may cause production shut down and loss of processing time.

The motor faults are because of electrical and mechanical hassles. Mechanical faults caused by overload and changes of load, which can cause bearing fault in motor as well as bar breakage of rotor of induction motor. Electrical faults are connected with power supply, electrical faults occur in induction motor due to over voltage, under voltage, over current, under current, water level imbalance, overheating, etc. in our project we selected some of faults from these such as over voltage, under voltage, over current, under current, level imbalance. So circuit will detect these faults and indicate the faults. Through display and LEDs and after that circuit will protect the IM from these faults when fault detect through circuit and circuit will cut of power to motor and switch of the motor until the normal. Here we used automatically control of motor so when there are normal condition after faulty condition. Circuit will automatically switch on the IM.

2. PROBLEM IDENTIFICATION

- Induction motor is the backbone for every industry. However like any other machine, they will eventually fail because of heavy duty cycle, poor grounding environment, installation and manufacturing factors etc. With escalating demand for reliability and efficiency, the field of fault diagnosis in induction motor is gaining importance.
- If the fault are not devine, it may result in large revenue losses as well as pose threat to reliability and safety of operation. Three phase induction motor generally suffers from under voltage, over voltage, overheating, single phasing and phase reversal problems. When the three phase induction motor supply with higher voltage than is rated value then induction motor starts overheated.

3. OBJECTIVES

- The main objective of this project is to develop the low-cost 3 phase motor parameters monitoring and protection system.
- To use voltage sensors to identify the voltage required.
- To use current sensors to identify the current required.
- To use water level sensors to identify the level of water for pumping required.
- Auto cut-off system when dry run condition detect.
- Results and conclusion.

4. LITERATURE SURVEY

Radwan M. AL-Bouthigy et. al. 2019, This paper present a PIC microcontroller – based control system for the protection of a three phase induction motor.The use of microcontroller technology has enabled the design of energy efficient and cost-effective reliable control systems for induction motors. Faulttypes of induction motor likeunbalanced voltage, over voltage, under voltage, over current, phase failure, over heat and more considered in this work. Fault monitoring and diagnosis are performed using proteus environment. Fault classification is achieved through the microcontroller which includes a program for fault classification. When the fault occurs, the microcontroller sends a signal to the interfaced digital relay to trip the motor circuit and another signal to an LCD to display the type of fault.

C.S Boopathi et. al. 2020, In this paper, The various faults affiliated with the induction motor are unbalanced supply voltage, over current, single phasing, under voltage, current faults, over

voltage, ground faults and this paper comprehends detection and clearing of these. Fuzzy logic controller rule base system classifies each type of fault detected on the basis of observed parameters and hence is more effective in fault identification. Fuzzy logic controller 'mamdani' system type classifies each type of fault based on observed inputs and hence is more effective in fault identification. They are able to segregate faults in much lesser time compared to other controllers. Hardware involves use of PIC micro controller and Atmega32 to make decisions on how to clear different types of faults. The efficiency of this system is higher and is robust in construction.

Vijayakumari K V et. al. 2015, This paper is based on the "Three phase motors protection" from various faults. This paper emphasis on various difficulties such as phase reversal in single and three phase systems, drop out of line, damage due to overload, failure of single phase there will be usually recommended to perform in complex environmental conditions. This includes in built cut-off frequency having several facilities together with timer in off condition and a starter which is automatic. This main circuit of this controller comprises of a circuit with power supply, a latch and a counter which is used for phase sequence, timer of a motor with on and off conditions. There is a special provisions for check phase sequence and is modified with decade counter and IC timer which simultaneously check the phase and allows the phase only if its frequency is 42Hz to 50 Hz.

Igbinoba, C.K. et. al. 2020, In this paper, This paper presents the design and construction of a system for the protection of three phase induction motor from external faults such as overvoltage, under voltage and single phasing using operational amplifiers. The operational amplifier used in this work is LM 324 and was configured in the comparator mode by setting one of the inputs at a reference voltage and while varying the other input according to the mains input supply. The mains input voltage from each of the phase was stepped down to 12 VAC, regulated and divided using a potentiometer and fed to the varying input of the operational amplifier.

Dr. M. Chakravarthy et. al. 2014, In this paper , protection for three-phase Induction Motor is enabled using Crouzet Millenium PLC. The PLC correlates the operational parameters of the 3-Ø Induction Motor with the desired values preset by the user in the PLC that continuously monitor the system and isolate it during fault conditions. Thus, PLC proves an effective tool in industrial control of electric drives. Induction Motors (IM) are used in many industrial applications in a wide range of operating areas as they have simple and robust structure, and low production costs. The knowledge about fault behavior of an Induction Motor drive is extremely important from standpoint of improved system design, protection, and fault tolerant control.

Shital S. Kalbande et. al. 2017, This paper describes protection of three phases Induction Motor from single phasing phase reversal, over voltage, and under voltage. Due to this electrical fault the winding of motor get burned which produce insulation damage and thus mitigate the life time of Motor. This fault is inducing in Induction Motor due to variation in Induction Motor parameters. When three phase Induction Motor works regularly, it is compulsory to protect the motor from these unlikely faults. Three phase Induction Motor directly connected through the supply, if the supply voltage has sag and swell due to damage the performance of Motor is affected and in some cases winding is heated .When phase sequence is reversed due to wrong connection then motor begin to rotate in another direction, if supply system has only one phase and other phase is disconnected then it is single phasing problem. Online condition monitoring of the Induction Motor has been widely used in the detection of fault.

Prof. Jaydipsinh B. Zala et. al. 2017, This paper presents the protection of 3 phase induction motor by using numerical relay. This project is based on the study of three phase induction

motor and its faults and other is study of numerical relay. This protection system is different to others because of numerical relay. Motor is connected to the three phase supply with help of contactor and MCB. Contactor is provided continuous supply to the motor. CT is connected to the numerical relay. When any fault is occurred in the motor at that time relay is sense the fault and sends a tripping signal to the contactor. Contactor opens the contacts and motor is disconnected from supply. Now motor is perfectly protected.

Prof. Anjum A. Attar et. al. 2017, This paper presents a protection system for three phase appliances from over voltage and under voltage. Because of this electrical fault it get heated which lead to insulation failure and thus reduce the life. In suggested system limit is set for voltage range that is considered normal working condition. PIC microcontroller checks the condition, if not satisfy trip load and it isolates from the supply. Undervoltage and overvoltage are two of the most common problems that impact electrical equipment in the industries. This type of protection is capable of greatly resolving this problem.. A lamp load is used in this work to test the working of proposed system.

5. PROPOSED SYSTEM

Three-phase induction motors find extensive application across various industries, albeit they tend to be costlier. Ensuring continuous and reliable operation necessitates robust protection systems. Among the primary faults encountered in three-phase systems are overvoltage and undervoltage. Modern technology affords the utilization of cutting-edge trends, with the incorporation of microcontrollers emerging as a requisite for remote appliance protection. Protection relays accurately detect abnormal or normal conditions, with input information sourced from power systems via current transformers (CT) and potential transformers (PT). While normal supply voltage doesn't exert excessive stress on insulation, overvoltage conditions can significantly impact insulation, leading to damage. To safeguard three-phase appliances against such faults, an overvoltage and undervoltage protection system is imperative.
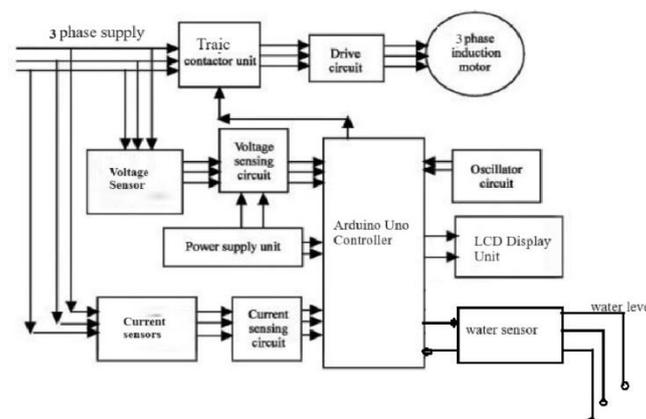

Fig.1. Block diagram of system

The block diagram of protection system is shown in fig1. The Arduino controller which drives the system according to the characteristics. Separate current and voltage sensors are used for sensing the undesirable conditions for three phases. Water level sensor is use to measure the level of water for auto-cut off condition for 3 phase motor. The power supply is given to the microcontroller. 16*2 LCD display is used to shows the fault condition or voltage level.

6. ADVANTAGES

- Protection for short circuit.
- Protection to low voltage.
- Security to current caused by overload.
- Security to single or two phasing failure.
- Things needed for high starting.
- Low speed will leads to more efficiency.

7. DISADVANTAGES

- It avoids the need for DC motor.
- We cannot get constant speed.
- It will refuse DC application.

8. CONCLUSION

After worked on this protection system we can easily conclude that with help of numerical relay we get different features like self-checking of fault, adaptive capacity, self-monitoring, easily programmability, better communication, low burden and multiple functions. Numerical relay is different than other relay because of by using numerical relay we have done all the faults occurs in the motor and how to minimize these faults. This protection system helps in the industrial purpose how the motors can be protected. Three phase devices are widely used in industries and it has more expensive so that protection given to this equipment is more essential .The method explained above it gives the best solution for prevent the 3 phase appliances from get damage from faults like under voltage, over voltage and overheating etc.

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