International Journal of Aquatic Science
ISSN: 2008-8019
Vol 15, Issue 01, 2024

Review on Fault Detection in Irrigation Pump & Isolation

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Abstract: Farmers often use three phase induction motors for irrigation applications, such as running water pumps. While these motors are reliable and efficient. Generally, farmers are using three phase induction motor to extract the water from open well and irrigate their farm. Induction motor suffers from disturbances we term it faults. 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, unbalanced voltage fault, ground fault and dry run fault by integrating the microcontroller with sensors to make the reliable, cheap, quick response protection system against fault.

Keywords: Irrigation Pump, Induction Motor Three-Phase Supply, Voltage and Current Sensor, Water Level Monitoring, Microcontroller, Auto Cut Off Etc.

1. INTRODUCTION

Protection of induction motor is important because most farmers and industrial applications use induction motors due to their high robustness, reliability, low cost and maintenance and high efficiency. Induction motor is most widely utilized motor. It requires less maintenance as compared to other electrical motors. The primary goal of the work is to make a cheap and reliable protection system for three phase induction motor system.

The protection system should protect the three-phase induction motor from fault such as single phasing fault, voltage unbalanced fault, ground fault, and dry run fault. The major motivation behind this work is to provide safety for the induction motors which are extensively utilized in numerous applications such as irrigation purpose, industry work.

Plenty of researchers have done their work provided various techniques, but all of them were very costly and unreliable for our indian condition. On an average 70% faults are belongs to single phase. In our project we selected some of faults from these such as over voltage, under voltage, over current, dry run. So circuit will detect these faults and indicate the faults. Through display and LEDs and after that circuit will protect the induction motor from these faults when

fault detect through circuit and circuit will cut of power to motor and switch 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 induction motor.

2. PROBLEM IDENTIFICATION

- The main challenges faced by farmers in accessing irrigation includes irrigation pump failure due to the various faults such as single phasing, voltage unbalanced, ground fault and dry run fault.
- 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 gaining importance.
- If the fault are not devine, it may result in large revenue losses as well as pose treat to reliability and safety of operation.

3. OBJECTIVE

- The main objective of the project is to develop low cost three phase motor faults detection and diagnosis protection system.
- To use voltage sensors to identify the abnormal condtion of occurred due to voltage unbalanced fault.
- To use current sensors to identify abnormal condition occurred due to single phasing and ground fault.
- To use water level sensors to identify the level of water during dry running fault.
- Auto cut off system when dry run condition detect.

4. LITERATURE SURVEY

K. Vishnu, Single phasing preventer for the protection of three phase faults, Journal of Emerging Technologies and Innovative Research (JETIR), 2022.
In this paper author suggested the method to protect the three phase induction motor against the single phasing fault. The single phasing preventer circuit is the combination of contactor with the microcontroller. This circuit was fully controlled by the microcontroller and the microcontroller will continuously monitors the parameters such as voltage, current, and temperature and if the parameter goes abnormal then it will switch off the motor until they are normal**.** Rajashree U. Patil, Behaviour of induction motor at voltage unbalanced, International Journal of Engineering Research & Technology (IJERT), 2015.

In this paper author explained about the negative effect of Unbalance voltage on performance parameters of induction motor such as over voltage, voltage unbalanced etc. This paper also includes the various causes of unbalance voltage fault. This negative effect will verified using MATLAB software. As per the test result it is verified that unbalanced voltages at motor terminals cause phase current unbalance ranging from 6 to 10 times the percent voltage unbalance. Efficiency decreases significantly above 1% of voltage unbalance so a motor must be derated for it to operate successfully. The negative effect of voltage unbalance on three phase induction motor is studied by simulation results of MATLAB Simulink setup for proposed

motor setup. Prof. Dushyant Patil, Protection of three phase induction motor using microcontroller, International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering (IJAREEIE),2018.
In this paper author demonstrated that the computer based protection methods are costlier and the electrical parameters cannot be visualized by Programmable Logic Controller (PLC) based method. Hence to protect an 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 over voltage, over current, temperature, Vibration sensing unit. 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.

Ashish Joshi, Microcontroller based system three phase induction motor to avoid dry running, International Journal of Computational Engineering & Management (IJCEM), 2014.
In this paper author explained the protection against dry running fault by using microcontroller. If there is no water available in the well still motor runs then there is a possibility of burn out of motor winding. To avoid this problem author was take precautions by designing auto timer which will run the motor when water is available and stop the motor when water is unavailable. The dry running problem has solved by assembly language programming of the system with on-off delay.

Radwan M. AL-Bouthigy, Protection of three phase induction motor using embedded system, International Journal of Latest Research in Engineering and Technology (IJLRET), 2019.
In this paper author fabricated that a PIC microcontroller – based control system for the protection of a three phase induction motor. Fault types of induction motor like unbalanced 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. The use of microcontroller reduce the response time of the protection system and make it more suitable for real time operation. The proposed protection scheme is simulated using MATLAB Simulink.

5. PROPOSED SYSTEM

Three-phase induction motors find extensive application across various irrigation fields, 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.

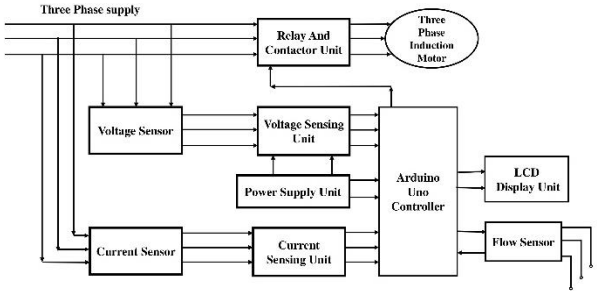

Fig.1. Block diagram of protective system

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. APPLICATIONS

- It is used to provide protection for irrigation pump.
- It is used in various industrial applications.
- This circuit will helps to detect and isolate the numbers of fault simultaneously.
- It can reduce the cost of protection.
- Reliable.
- Quick opration will be done.

7. CONCLUSION

After worked on this protection system we can easily conclude that with help of voltage sensing unit we can detect the abnormal values of voltages and with the help of current sensing unit we can detect the abnormal values of current and it will show on LCD display also water level sensors detect dry running condition. By continuously monitoring critical parameters and implementing automatic protection by using microcontroller. This protection system helps in the irrigation as well as 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 faults occurred on three phase irrigation pump.

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