Abstract
Three phase induction motor play important role in agriculture and industry. The developed system will have advantage of loading and unloading concept of three phase induction motor. Because of the unloading process the water circulated will be stopped and the temperature of the three phase induction motor goes on increasing order. Due to this more heat will be generated and when this process repeats several times there is a risk of motor burn. In the agriculture field, the motor used pulling water from the well and provide it for irrigation purpose. The water in bore well is pulled up with the help of induction motor, but there are so many chances of failure of motor because of improper level of water in the well as well as bore well. In the continuous process of pulling up of water from the well/bore well at that time the current remains in constant state. At the time of unloading process of three phase induction motor the current does not remains constant. In this developed a system where the current and voltages is measured using current sensor and the motor is switched off automatically when the current exceeds it specified limit. This system also develops such a condition where the motor will stop working when the voltage becomes low and hence protect the motor from under voltage. For three phase motor the loading current while pumping the water is up to 7.5 A.
1. Introduction

This paper presents techniques for estimating the electrical and mechanical model parameters of a three phase induction motor. Three phase induction motor generally suffers from under voltage, overvoltage, overheating, and phase shifting problems. When the three phase induction motor supply with higher voltage than the rated voltage, it will start overheating. For free motor (not pumping the water) the current ranges from 3 ampere to 6 ampere. The current ratings are different when HP of induction motor changes, such as three horse power motor require 7.5 ampere current while pumping the water, five horse power motor is 11-12 ampere current required while pumping the water, for motor used in bore the current requirement will be more for pumping the water. In this system a variable resistance is used when supply voltage is lower than rated then voltage drop across the resistance is higher than it protects the motor from this fault. When supply voltage is lower than voltage drop across the resistance is lower than specified value and motor fails to start. It is highly desired that three phase induction motor works freely from these all types of faults.

2. Background To The Study

In overvoltage protection system of three phase induction motor, protects the motor from overvoltage, the voltage which is higher than the rated voltage. In circuit diagram of overvoltage protection it consists the comparator which compare two voltages one is supply and another one is drop across the variable resistance. When the voltage drop across the variable resistance is higher than specified value then comparator generates signals. This signal is fed to microcontroller and microcontroller takes the appropriate action.

Phase reversal problem occurs in motor when the supply phase is reversed due to wrong connection (except than RYB) due to phase reversal motor starts running in anticlockwise (opposite direction from normal) would cause operation and safety problem. Most of three phases motor run opposite phases. This type of protection is used in application like elevators where it would be damaging or dangerous for the motor to run in reverse. Generally when motor is connected with the important application then type of protection being much more important. When the load is connected with motor then reversal of phase means Direction of rotation is changed. It could cause serious problem therefore much more care is required to protect the motor form such type of fault. The overheating protection system is placed to turn the motor off when the exceed heat is generated within the motor. This protection system rested the motor cools to safe operating temperature. Direction by switching the connection of any two of three although the motor having shut down because it tripped the thermal limit in inconvenient. Overheating protection of motor means protect the motor from overheating of its winding. This overheating in motor is generally caused by overloading of motor, bearing seizes up something locked the motor shaft from turning. Motor simply fails to starts properly, a failure to start of motor may cause by faulty start in winding in motor. For sensing the heat LM 35 sensor is used for this purpose. This sensor is connected to comparator inputs. With the help of sensor which sense the temperature of winding & its temperature exceeds to some particular level then comparator sends this signal to microcontroller.

3. Aim of Project

Recently, starter were used which could not be automatically turned on/off. It had to be manually operated. To overcome this limitation auto starter got developed which could be automatically
Switching Of Three Phase Induction Motor Using Current Control Technique

turned on/off. But when there is no water in the well, the motor still operates due to which it gets overheated. Hence in this system the three phase induction motor will be switched on when pumping the water and get it off when the water is not pumping. The automatic control will be done by using current control technique. The three phase induction motor will be switched on when pumping the water and get it off when the water is not pumping. The automatic control will be done by using current control technique. The current will be accepted by current transformer, processed in ARM processor and motor will be switched on or off in open control loop.

4. Block Diagram Description

Figure 4.1: block diagram of switching of 3PH induction motor using current control technique
The system consists of following section:
1. Three phase voltages measurement.
2. Phase current measurement signal Conditioning Unit.
3. Starter control using relay driver unit.
4. ARM controller interface.
5. Precision controller interface.

**ARM7:**
LPC2148/LPC2138 is ARM7TDMI-S Core Board Microcontroller that uses 16/32-Bit 64 Pin (LQFP) Microcontroller No.LPC2148 from Philips (NXP).

**Starter control and Relay driver section:**

To control the induction motor 3 phase starter is controlled from relay driver unit. By controlling I/O pin of arm controller relay can be turned on or off.

**Precision rectifier:**

The precision rectifier also known as super diode is a configuration obtained with an operational amplifier in order to have a circuit behave like an ideal diode and rectifier. It is useful for high precision signal processing.

**Current Transformer (CT) & Potential Transformer (PT):**

This block provides information about low and high level of voltages and current drawn by motor. This is the input stage of the protection system it actually senses the consumed power by load. Since the magnitude of voltage and current, which can process these high level signals is difficult. So these signals are transformed into equivalent small level signals 0-230 V range is dropped to 0-6v by potential transformer and 0-5A current is dropped to 0-50 mA current while measuring voltages and current with the help of microcontroller, proportional DC analog voltage is applied to its ADC. Initially AC voltages and current (step down) by PT or CT, which is converted into DC. Capacity of CT and PT will depend upon load handling capacity and mains supply available. In our project work 5A/50 ma CT is used to sense the load current, which is connected in series with load. 230V to 6V or 9V or 12V PT may be used to measure the voltage. If input voltage is greater than 300V then special PT is used to withstand for 440V.

Current capacity of PT is not important. Current capacity of PT up to 300 mA is suitable. In case of PT voltages ratio of primary and secondary is linear. In case of CT current ratio is important. Secondary current is directly proportional to primary current. Current ratio will depend upon the number of turns for secondary and primary.

5. **Circuit Diagram Details**

The current from the main supply is sensed by the current and potential transformer. It provides information about low and high level of voltages and current drawn by motor. Since the magnitude of voltage and current, which can process these high level signals is difficult. So these signals are transformed into equivalent small level signals 0-230 V range is dropped to 0-6v by potential transformer and 0-5 ampere current is dropped to 0-50 mA current .In the precision rectifier the ac is converted into pulsating dc. Advantages of precision rectifier are that, it will overcome the problem of nonlinear char. of rectifier diode. The output of filter circuit is pure DC and directly proportional to the input AC voltages or AC current of the system. The DC output of this block is applied to ADC of microcontroller which is inbuilt in it. The microcontroller processes and gives the output which is displayed on the LCD. The relay acts as a switch which gives action to the
starter to start the three phase induction motor. To control the induction motor 3 phase starter is controlled from relay driver unit. By controlling I/O pin of arm controller relay can be turned on or off. At the time of unloading process of three phase induction motor the current does not remains constant. In this developed a system where the current and voltages is measured using current sensor and the motor is switched off automatically when the current exceeds it specified limit. This system also develops such a condition where the motor will stop working when the voltage becomes low and hence protect the motor from under voltage.

![Circuit diagram of switching of induction motor using current control technique](image1)

**Figure 5.1:** Circuit diagram of switching of induction motor using current control technique

**RELAY DIVER SECTION WITH ISOLATION**

![Wiring diagram](image2)

**Figure 5.2:** Relay diver section with isolation
3 PH AC VOLTAGE SIGNAL COND.

Figure 5.3: 3 Phase AC voltage signal cond

Figure 5.4: Current Measurement Block
Hardware part
- CT/PT sensor Data.
- ARM controller Board.
- LCD, relay driver circuit.
- Power supply.

Software
- Or cad for block and circuit diagram.
- Protel for PCB layout.
- Kiel-4 for controller.
- Simulation software

6. Conclusion
Protection of three phase induction motor from over voltage, under voltage, single phasing, and overheating and phase reversal provide the smooth running of motor improves its lifetime and efficiency. Generally these faults generated when supply system is violating its rating. In three phase induction motor when running at rated voltage, current and load these faults are not generated. For smooth running of three phase induction motor generally concentration on supply voltage under the prescribe limit and load which is driven by the motor should also be under the specified limit.

References