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PROTECTION OF SINGLE PHASE INDUCTION MOTOR FROM OVER VOLTAGE, UNDER VOLTAGE CONDITION

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Abstract: The purpose of this study is to design a method to safeguard induction motors against overvoltage and undervoltage. The winding of the motor becomes heated as a result of this electrical problem, which leads to insulation failure and consequently reduces the motor's life span. Variations in induction motor characteristics cause this problem in the induction motor. When an induction motor is running constantly, we need to safeguard it from these potential defects. Induction motors are directly connected to the supply, so if the supply voltage sags and rises due to a defect, the motor's performance is harmed, and in certain circumstances, the windings are burned out. The protection of the motor from such errors is critical, as faults might reduce its efficiency. IMs may be secured by utilizing Timers, contactors, voltage, and current relays are some of the components. We're utilizing a microcontroller-based circuit to identify defects and safeguard the motor from a variety of them.

Keywords - Single Phase, Induction Motor, Under and over voltage.

I. INTRODUCTION:

In various industrial operations, ac induction motors (IMs) are employed as actuators. IMs are dependable, although they are susceptible to several unfavorable stresses, resulting in defects and failure. Monitoring an IM is a new tool for detecting early defects that is rapidly gaining traction. It prevents an industrial process from failing unexpectedly. Traditional and digital monitoring techniques are two types of monitoring approaches. Mechanical and electrical monitoring devices are commonly used to offer traditional monitoring approaches for three-phase IMs. Electrical defects, such as stator insulation failures, are also difficult to identify using mechanical motor sensing. Furthermore, mechanical portions of the equipment might cause issues during operation, reducing the system's life and efficiency. It is common knowledge that IM monitoring has been investigated by a lot of researchers and evaluated in a number of publications. There have been reviews of numerous stator problems and their causes, as well as detection techniques, newest trends, and diagnosis methods backed by artificial intelligence, PLC, computer, and other monitoring and protection technologies. Other current research topics include ball bearing failures, speed ripple effect, air gap eccentricity, broken rotor bars, shaft speed oscillation, damaged bearings, unbalanced voltage, inter turn faults, stator winding temperature, and PLC-based digital protection. While one or two factors were evaluated together in these works to safeguard the IMs, the motor variables were not considered collectively. This might make protection more difficult. A computer-based defense system has been implemented. Voltages, currents, and temperatures were measured and then sent to a computer for a final protection decision. Although all of the motor's variables were examined in this article, the use of an analog-to-digital conversion (ADC) card increased the system's cost and size. With the aid of the PLC, numerous defects of phase currents, phase voltages, and winding temperatures of an IM that occur during operation were solved; these electrical parameters were presented on a screen. Power supply has long been a top focus for engineers and academics working on industry development. They devised certain condition monitoring techniques, such as vibration monitoring and heat monitoring. monitoring of chemicals All of these monitoring approaches need the use of specialised tools and expensive sensors, but parametric monitoring with a microcontroller eliminates the need for extra sensors. In comparison to traditional mechanical-based systems, experimental results reveal that microcontroller-based hardware solutions provide excellent precision as well as a safe and visible environment. We present a new way for protecting induction motor devices using an AVR microcontroller in this work (at mega 328). We are continually checking the parameter with the aid of the microcontroller in order to safeguard the load from unfavorable parameter values. We also provide self-diagnosis, which will inform us which parameter caused the problem, and if the parameter returns to its original value, the system will automatically reset.

II. EXISTING SYSTEM:

Some components, like as timers, contactors, voltage, and current relays, can be used to safeguard IMs. The classical technique, which is quite fundamental and contains mechanical dynamic aspects, is termed as such. The majority of mechanical components have been replaced by computer and programmable integrated circuit (PIC)-based protective technologies.

The computer-based protection approach, on the other hand, necessitates the use of an analog-to-digital conversion (ADC) card, whilst the PIC-based protection method does not display the electrical characteristics measured.

III. TYPES OF FAULTS MONITOR:

1. Under Voltage:

Causes: When a lower supply voltage is combined with a rated mechanical load on the motor, undervoltage results.

Increased currents, excessive machine heating, and increased Stator and Rotor losses are all effects.

2. Over Voltage:

Over voltage fault occurs when any of the line voltages exceeds 110 percent of the rated value.

Effects include damage to machine insulation, insulation burning, and degradation of insulating qualities..

IV. PROPOSED METHODOLGY

The block schematic for the entire protection system is shown below. Each circuit is built for individual fault protection, such as overvoltage and undervoltage. The Arduino device receives the outputs of these circuits. The Arduino programming is done in such a way that if any of the above-mentioned errors occur, the fault name will be shown on the LCD screen, and the Solid-State Relay will be given the operation instruction. The load will be linked to an SSR switch, and the Arduino unit and all other circuits will be powered. In this manner, the defect on the induction motor is recognized, and the motor is isolated from the supply in the faulty state to prevent any harm to the motor or the spread of the fault in the healthy condition sections of system.

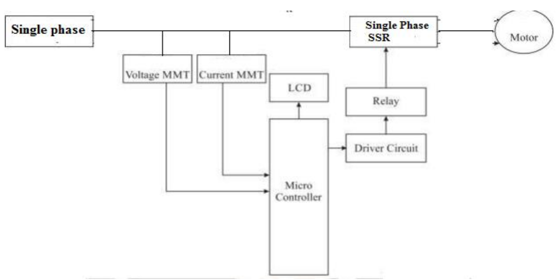

Fig 1 Block Diagram For proposed system

Induction motors with in-voltage protection safeguard against undervoltage and overvoltage. When the supply system has a lower voltage than the induction motor's rated voltage, the motor is protected by the under-voltage protection portion of the protective supply. Single phasing is effective. It works on the same principle as overvoltage and includes a comparator that compares two voltages: one from the supply and the other from the voltage drop across the variable resistance. This signal is sent to the microcontroller when the voltage drop across the variable resistance is less than the required value, and the microcontroller stops the motor from running in the event of running and fails to start in the case of beginning. Preset is a method of determining a value. We've decided on a voltage reference value of at the motor terminals, this is referred to as the required voltage. When the voltage across the motor terminal falls below this value, the condition is known as under voltage. Undervoltage is defined as a decrease of 10% or more of the rated voltage. When the voltage between the motor terminals is 10% less than the rated voltage, the motor experiences an undervoltage situation and is safeguarded against failure.

V. Proposed System Working:

The motor is protected against undervoltage by the undervoltage protection of a single phase induction motor. When the supply system has a lower voltage than the induction motor's rated voltage, the motor is protected by the under-voltage protection portion of the protective supply. It works on the same principle as overvoltage and includes a comparator that compares two voltages: one from the supply and the other from the voltage drop across the variable resistance. This signal is sent to the microcontroller via ADC when the voltage drop across the variable resistance is less than the predefined value. If the input voltage exceeds a certain threshold, both contactors will trigger. Relay driver and relay circuit are used to link the contactors. The purpose of a relay driver is to increase the current handling capability of receiving signals from a microcontroller unit and When the motor is going, the microcontroller stops it from running, and when it is beginning, it fails to start. In a three-phase induction motor system with single phasing protection, if one of the phases fails, both contactors are automatically tripped. In general, the supply voltage in single phase is lower than the prescribed value. The motor will not start at this voltage level. When the single phasing supply voltage is compared to the rated specified voltage, the comparator sends a single to the microcontroller, and the microcontroller generates a single, the contactor is tripped through the relay drive, which stops the motor if it is running and prevents it from starting if it is at a standstill. There are various reasons why single phasing occurs. As if it were a stray wire, a faulty connection, faulty starting contacts, overload relay issues, a faulty breaker, a blown fuse, and so forth When the load on the motor exceeds the prescribed value, the motor is protected by over-current protection. Overloading a motor, a bearing seizing up, or anything locking the motor shaft from rotating are the most common causes of excessive current in motors. Each phase's current is measured by a current transformer, and if the current level exceeds the specified amount, a comparator sends a signal to the microcontroller, causing the motor to halt. All LCD defects and messages are displayed on the LCD.

VI. Result:

Fig 2 Show complete hardware setup of our system.

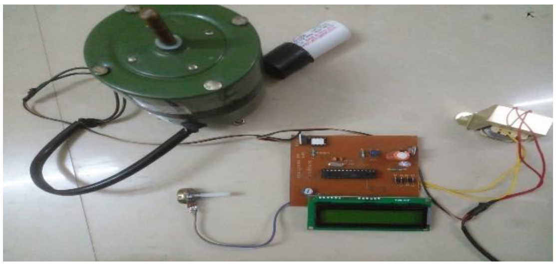

Fig 2: Hardware Setup.

1. Over voltage:

If the motor's supply voltage exceeds 230 degrees, a fault under voltage is recognized, and the motor is turned off.

Fig 3: System reach over Voltage condition

2. Under voltage:

If the motor's supply voltage is less than 180 degrees, a fault under voltage is recognized, and the motor is turned off..

Fig 4: System reach Under Voltage condition

3. Normal voltage:

If the motor's supply voltage is between 180 and 230 volts, no problem is detected and the motor begins to f unction.

Fig 5: System at normal Voltage condition

VII. CONCLUSION

The non-committal operation of an induction motor is ensured by protection and monitoring against overvoltage and undervoltage. Make it more civilized in terms of lifespan and efficiency. These problems occur when the supply system fails to meet its rating. When an induction motor is operating at its rated voltage, current, and load, certain defects do not occur. For a motor to work smoothly, the supply voltage must be kept within prescribed limits, and the load generated by the motor must also be kept within set limits.

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