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IOT BASED SINGLE-PHASE PREVENTER

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Abstract *– The main Objective of this Research review is to basically provide the protection to the 3-phase load against any Single Phasing fault with the help of IOT and WI-FI. In any 3-Phase load, the supply in all the 3-phases should be present to run the load smoothly and in efficient manner. If anyone/two of the 3-phase is missing due to any fault condition then this Preventer will stop supplying power to the circuit or cutoff the supply to prevent the load from overheating and over speeding. When any of the phases is missing the main relay, which is connected to other 4 relay's get discontinued because of any one relay not being working, so the main relay delivering 3-Phase supply gets discontinued. The work study done here should help us in the field of Automation. In Addition to this basic Single Phasing Protection, we have used IOT/GSM Based components here to make it SMART SINGLE-PHASE PREVENTER.*

The Basic idea behind this whole review is to make smart and intelligent preventer that monitors all the 3-phase supplies and automatically gives notification to us when one/two of any phase gets discontinued so that it works smartly in Home and Big Automation Industries.

Keywords: IOT, Wi-Fi, Preventer, Relay's, GSM, Automation, Single-phasing.

INTRODUCTION

Galileo Ferraris realized induction motor first time in **1885** in Italy. Ferraris published his research paper in 1888, where Ferraris exposed the theoretical foundations for understanding the way the motor operates. The induction cage motor was invented by **Mikhail Dolivo-Dobrowolski** about a year later.

A 3-Phase supply provides a rotating magnetic field in induction motor. The main difference between induction motor and synchronous AC motor is that the current enters in the rotor which create a magnetic field around the rotor. The rotating magnetic field of the stator will impose an electromagnetic torque and one magnetic field create by current in the rotor and interaction of these two rotating magnetic fields hence here create a resultant torque that is called a net torque around the shaft, which rotate the shaft and motor will start.

The induction motor does not have any direct supply onto the rotor. Stator winding arranged around the rotor so when they energized with a poly phase supply, they create a rotating magnetic field which sweeps past the rotor.

The magnetic field changing this pattern induces current in the rotor conductors, by the

Interaction of this current and rotating magnetic field created by the stator and in effect causes rotational motion on the rotor.
However, for these current to be induced the speed of the rotor must be less than the rotating magnetic field in the stator. The difference between the speed of the rotor and speed of rotating magnetic field in the stator is called a slip. Slip is unit less.
The stator consists of the wound poles which carry the supply current to induce a magnetic field. In a simple motor there would be a single projecting piece of the stator. The winding is distributed in many slots magnetic field.
The causes of the motor failure

- Over loads 30%
- Contaminants 19%
- Single phasing 14%
- Bearing failure 13%
- Old age 10%
- Rotor failure 5%
- Miscellaneous 9%

From the given above data, it seen that the 44% cause of the failure of the motor is HEAT. Motor operates at a 10°C temperature and above this temperature motor life will reduce 50% because due to heat. When the motor temperature will increase than heat will increase and due to increase heat the motor copper losses and iron losses, friction of bearing will continue operates a loss in a huge quantity. Until the heat dissipation equals the heat being generated. In our day-to-day Developing Generation Automation is something which keeps on growing in every field when it comes to digitalization. When it comes to make anything Smart through Artificial Intelligence, IOT, Machine Learning etc. we basically reduce the time consumption of human working and can increase the efficiency of that object by automatically set the sensors and various rating values of output we get in that device/object. Our new Upcoming Generation is wholly based on this Smart Automation Equipment and Digitalization.

So, in this Research review project, we basically try to make a Smart Single-Phase Preventer.

It is basically an upgraded version of single-phase preventer (commonly used in our industries an Electrical equipment) in terms of its smartness as we connect it through IOT, so when there is any single phasing fault it can automatically sends notification to our mobile BLYK App with all other information's of this single phasing fault occur in the 3-phase supply. We generally use 3-phase supply in industries for big electrical machines/equipment so there are moreover chances of getting faults in supply like Overvoltage, under voltage, Overheating, Phase reversal, Single-Phasing etc. and this single-phasing fault is harmful for the motor as it damages induction motor stator winding rapidly. So, to prevent 3-phase supply from single-phasing we use this single-phase protection. In this if any one of the 3-phase is absent then this preventer stops the supply to the main 3-phase load by Discontinuing the main Relay. By this our 3-phase load equipment can be prevented from faulted or burning out condition.

Methodology

Single phase preventer circuit is used to protect 3-phase load/induction motor from single phase fault condition. In the basic circuit of this single-phase preventer, we use three step-down transformers, these step-down transformers convert the voltage from 230V to 12V. After then we connect diodes in the circuit and here, we are using bridge rectifier, Rectifier converts AC to DC. After this we add Resistor's, Resistor basically

Control or opposes current, Resistors make compete path of Circuit current. Then we add capacitor in the circuit, the main function of the capacitor is to store energy. Voltage regulator regulates voltage of stored energy. After this we put the transistor in the circuit which will amplify the voltage, similarly in this circuit we put crystal oscillator which gives the frequency in megahertz. In this preventer circuit module, we used op-to coupler an op-to coupler/isolator transfer's signals in between the isolated circuits by the In circuit, it basically locks the circuit. Now we will install flash LCD which will show the load of three phases. If the supply of any phase is cut then it will be LCD show and the circuit will be close and it will prevent motor to get supply and by this our any heavy 3-phase supply load can be prevented by single phasing fault. In Place of Micro-controller, we basically use Arduino board here to get the Notification of the Single Phasing fault on our mobile through BLYNK app with all the information of the fault. This Implementation of IOT in it makes this Single-Phase preventer Smart. Single phase preventer is used for protection and burnouts of pumps and motor against phase unbalance, missing and Negative phase sequence. The relay resets automatically and remains off when a voltage is low, unbalance or Negative phase sequence. Single phasing is a power supply-related electrical fault in case of an induction motor. It occurs when one of the three phase circuits in a three phase Motor is opened, hence the remaining circuit carry excess current. Single phasing is a very dangerous fault to the electrical motor and which damage the motor stator winding.

In single phase preventer, the motor runs with the three-phase supply and which takes Help of using light. After this we put microcontroller in this circuit which acts as a small computer and operates the function. Then we use relay, relay is basically an electrically operated type of a switch. This Relay consists of a minimum no. of set of input terminals for a single or multiple control signals and a set of operating contacting terminals used in this circuit. This relay detects the fault and if the fault remains there in circuit, it will act Balance current in each phase winding but the motor still in a rotating position which tries to rotates at the same speed. The three – Number of current transformers is placed in each phase of the power supply. The output of the current transformer is placed in each phase of the power supply. The output of the current transformer is given to the Negative sequence filter circuit and which sense the filter circuit will be connected to the control circuit. The control circuit sends the trip commons to the circuit breaker if the Negative sequence current exceeds the preset value. If the failure of single phase the unbalance current flow in the motor and the current will be sensed by the Negative sequence. Current sensing single phase preventer works like a negative sequence relay. It gives

Protection up to motor terminals. It operates on the principle of sensing negative sequence components of the system.

Different types of relay manufacturers give additional function such as reverse phasing unbalance supply and under voltages / over voltage trip with that single phase preventer.

Component used

- ARDUINO UNO
- LCD
- RELAY
- TRANSISTOR NPN DIODE
- VOLTAGE REGULATOR
- CAPACITOR
- VOLTAGE TRANSFORMER
- WIFI MODULE
- BUZZER
- Load
- Supply

Merits

- Lightweight
- Compact unit
- Efficient transmission
- Less substation required
- High efficiency
- Low maintenance required
- Continuity power supply
- save the 3-phase supply from singlephasing fault

Scope for further studies

Further research can be done in designing and connecting the above designed system with artificial intelligence and machine learning implemented modules to make this smart single-phase preventer being used smartly in home and big automated industries. With the help of microcontroller in future to control the three phase of induction motor. The motor protection is required as day-to-day life induction motor usage increase a lot as it has many future scopes. With the help of single-phase preventer overall system will be efficient.

Conclusion

Protection of 3-Phase Load against Single phasing fault has been done through IOT. In which we can automatically get the notification of the fault in our mobile app by which we can prevent our 3-phase load From Burning out by cutting or switching off the main supply of 3-phase. This can help us in Big Industries Automation with full protection of big machines.

Result

IOT Based Single Phase Preventer, we run this project successfully, and we found below output result when voltage of phase is under the rated limit the contactor Relay open and trip the circuit instantly and LCD shows the fault which occurs in the system and protect the induction motor from damaging. The controlling of the equipment can be done by using the IOT, GSM and Wi-Fi. The previous study done; Author's hasn't made simultaneous study. The main focus in this study is to switch and fault detection of electrical motor. we came to know about this paper by comparing it with others paper, we get ability to detect fault, single phasing, over voltage, under voltage, over speeding is very fast.

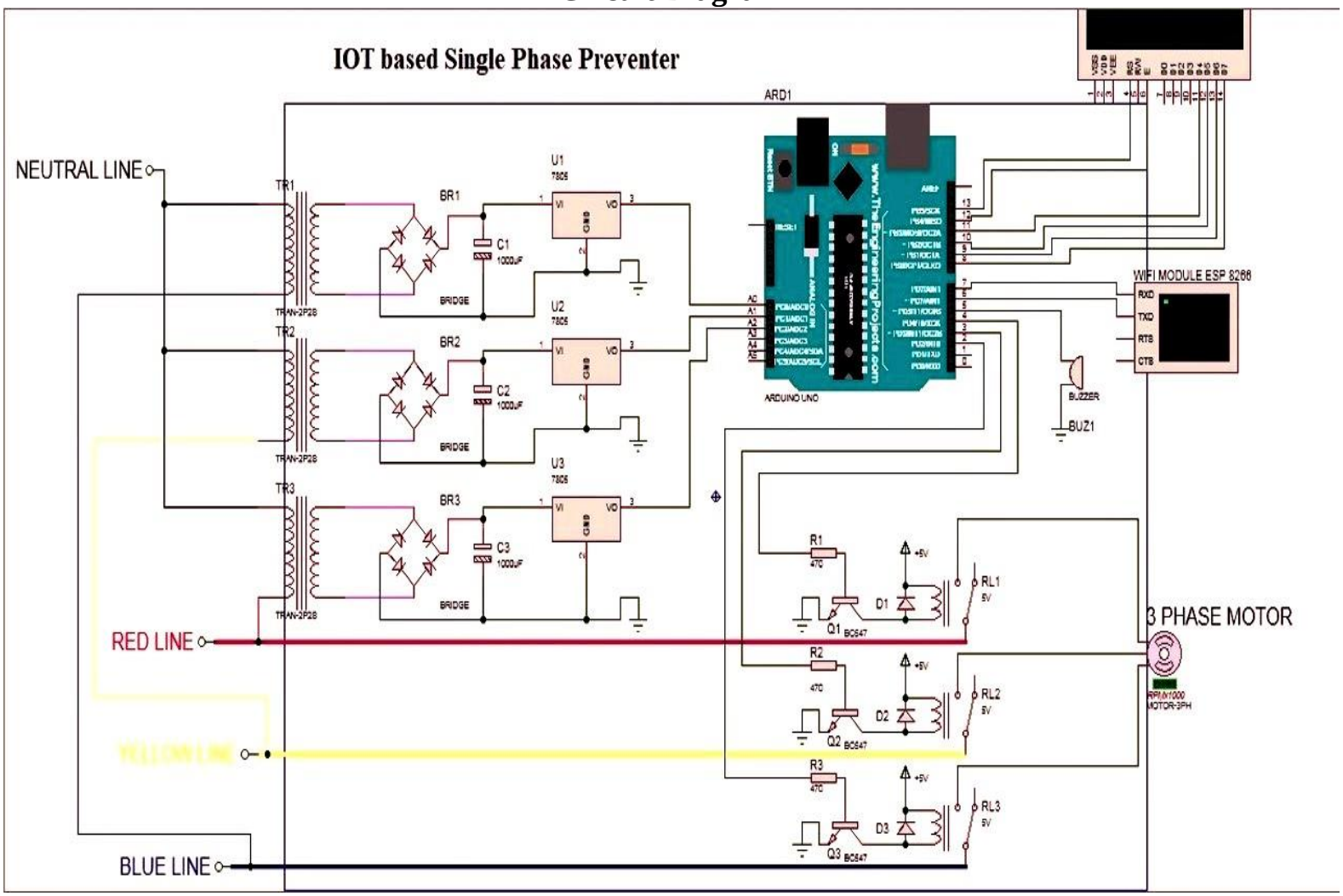
	Voltage in Volts		
Time(s)	Red	Yellow	Blue
0.15	169.50	185.45	180.24
0.19	139.29	148.90	147.12
0.23	110.62	101.52	100.42
0.30	0.00	0.00	0.00

This is our Hardware Calculation Results on the basis of an Un-Balanced Three-phase Voltage Supply with the Shorted respective RED, YELLOW and BLUE Phases.

This is following steps of Results: -

1. Test was conducted by connecting the motor power cables to A direct AC mains supply and observations were made on the motor operation in a good working condition.
2. A Multimeter was used to measure the voltage level of three phase at Normal operating condition.
3. First of all we have connected the voltage terminal of Multimeter to the Red phase and measure the red phase supply.
4. After this, in the same way, I measured the supply of yellow and blue phase with the help of Multimeter.
5. In this circuit, we detect fault in milli seconds with help of Relay. And save the three-phase induction motor from burning.

Circuit Diagram



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