PROTECTION OF THREE-PHASE INDUCTION MOTOR

Nerlekar Gaurav*1, Yadav Anurag*2, Patil Pranali*3, Ambekar Vaishnavi*4,

Patil Shubham*5, Pukale Rahul*6

*1,2,3,4,5Student, Electrical Engineering, AMGOI Vathar, Maharashtra, India.

*6Asst. Professor, Electrical Engineering, AMGOI Vathar, Maharashtra, India.

ABSTRACT

This project aims at the protection of the 3phase Induction motors. The circuit can take the full management of the motor and it'll defend the motor from many faults such US overvoltage and underneath voltage and also the circuit can turn on the motor underneath safety conditions. This conjointly protects the induction motor from single phasing which is additionally a significant fault. The circuit was controlled by the microcontroller and the microcontrollers can continuously monitor the voltages of the 3 phases and if the voltage goes abnormal then it will switch the motor till they're traditional. All the conditions area unit displayed by it over the show LCD digital display alphanumeric display} display. In our project, we tend to area unit victimization the popular 8-bit microcontroller AT89C51. It is a forty-pin microcontroller. The protection of induction motor with microcontroller has the flexibility to modify off at the required time, monitors phases of the motor at any time and conjointly each driving action is known through show LCD digital display alphanumeric display} display. It conjointly protects the motor from single phasing as its maintenance cost is additionally low-cost.

Keywords: Three-Phase Induction Motor, Microcontroller.

I.   INTRODUCTION

The induction motor is one of the foremost necessary motors employed in industrial applications. it's accustomed convert power into energy. Its low price a high performance additionally to its responsibleness create them the foremost standard electricity motors employed in business} and commercial fields. These motors have the flexibleness of application fields; they'll be employed in massive power applications like the rock oil business. Despite the very fact of the high responsibility of induction motors, the operational conditions might expose the machine to totally different fault conditions. These faults might result in machine close up, therefore inflicting industrial production losses. Avoiding sudden shutdowns is a vital task for industries. to realize this task, the induction motor should be frequently monitored to spot faults in the early stages. the most sorts of external faults toughened by associate induction motor area unit over-loading, single phasing, unbalanced provide voltage, barred rotor, section reversal, ground faults, and under/overvoltage.3 section induction motor usually suffers from underneath voltage, overvoltage, warming, single phasing, and section reversal issues. once the three-phase induction motor is furnished with a higher voltage than it's rated then it starts hot. once provide voltage is underrated motor fails to begin. once one in all the provision lines fails, it's termed as single phasing and provide voltage falls below the rated price and all over again motor fails to begin. within the case of motor warming, an RTD is employed that senses the temperature of winding. If it exceeds the desired limit then the motor fails to begin. it's extremely desired that three section induction motor works freely from these every type of faults.

II.   METHODOLOGY

BLOCK DIAGRAM:
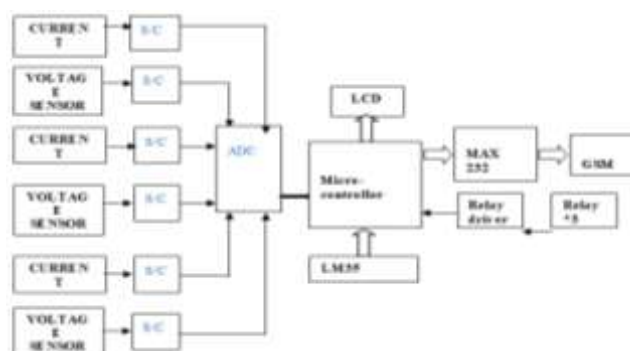
Fig. Block Diagram

DESCRIPTION OF BLOCK DIAGRAM:

Main Components

1.Regulator

2.Buzzer

3.Display 16*2 LCD

4.Temperature Sensor

5.Current Transformer

6. Potential Transformer

7.GSM Module

8. Proximity Sensor

9. DOL Starter

10. Microcontroller

1.1 VOLTAGE REGULATOR IC7805:

A transformer could be a framework planned precisely to keep a proceeding with voltage level. A transformer could utilize a clear feed-forward style or could accept input it should utilize an Associate in Nursing mechanical gadget system or electronic parts.

1) looking at the arranging, it ought to be wont to control one or a ton of

2) AC or DC voltages.

Voltage controllers or stabilizers are wont to get up to speed with voltage variances in mains power. monster controllers could likewise be acceptably placed in on dissemination lines. minimal movable controllers could likewise be obstructed in the middle of touchy instrumentality and a divider A three-stage bank of voltage controllers won't to the executives the voltage on long AC power circulation lines. This bank is mounted on a picket post-construction. each controller weighs concerning 1200 weight unit and is appraised at 576 kVA. outlet. Programmed voltage controllers are utilized on generator sets on ships, in crisis power gives, on oil rigs, and so forth to balance out vacillations in power interest. for instance, when an outsized machine is turned on, the interest for power is out of nowhere bounty higher. The transformer makes up for the load adjustment. modern voltage controllers generally treat a spread of voltages, as an illustration, 150–240 V or 90–280 V.

Electronic voltage controllers are found in gadgets like pc power gives any place they settle the DC voltages utilized by the processor and elective segments. In and focal station generator plants, voltage controllers the executives the yield of the plant. In an electrical force appropriation framework, voltage controllers could likewise be placed at a station or on conveyance lines so All clients get consistent voltage independent of what extent power is drawn from the street. it's a steady five v Dc offer to the project.

1.2 VOLTAGE REGULATOR IC 7812:

7812 Voltage controllers could be a type of independent mounted direct transformer PC circuit. The IC has a place with the IC 78xx transformer family.

The 7812-voltage controller IC is convenient and offered at a horrendously low cost. The last 2 digits of 7812 demonstrate the yield voltage that is twelve V.

The IC 7812 could be a positive transformer which recommends that it produces the positive voltage with connection to the balance.

for good measure if each the positive and negative voltage offer is needed inside a similar circuit. The transformer IC 7812 is joined with its comparing 79XX family IC that is 7912 IC.

The transformer 7812 is out there most normally in TO-220 bundles well as TO-3, TO-92, and surface mount Packages.

The IC 7812 Voltage controllers do work at their ideal ability if the information voltage is at least a couple of.5 V greater than the yield voltage (i.e 14.5 V min.) and the current is one or one.5 Amperes a ton of. albeit the voltage and current differentiation are very surprising for elective IC Packages.

1.3 VOLTAGE REGULATOR IC 7912:

Normally to deliver negative voltages to the circuit like - 3.3V Associate in Nursing offered support voltage of - 5V drawn from the transformer-based force offer is utilized. anyway, these voltages can not be controlled precisely.

Positive voltage controllers will be utilized for this reason anyway they add commotion and aggravation to the yield voltage. Besides, to control the yield voltage, the circuit can utilize the resistive divider upheld - 5V rather than 0V. This winds up in the helpless precision of the controller.

Voltage controllers are expected to think of stable yield even once the information is flimsy. By and large, these circuits have a differential electronic hardware that goes about as a comparator among info and yield voltages. this is regularly prepared a reference voltage satisfactory to the yield voltage.

The base voltage differentiation in yield and reference voltage that might be distinguished by the differential electronic gear and constrained by the controller is named a Dropout worth of the controller.

The info voltage to be applied for the working of the controller should greater than the all-out of yield voltage and dropout worth of the controller. If the information voltage conditions aren't applied, the controller simply fills in as a resistive circuit any place input is satisfactory to yield.

LM7912 could be a negative transformer utilized to control negative voltages. These are uniquely intended to control negative voltages. These are planned with the base commotion and most noteworthy force offer dismissal extent connection. The yield voltage of LM7912 is - 12V.

2. BUZZER:

A bell or pager is an Associate in Nursing sound sign ling gadget, which can be a mechanical, mechanical gadget, or power (piezo for short). Regular employments of bells and beepers embrace caution gadgets, clocks, and affirmation of client input like a downturn or keystroke.

A. Mechanical:

A delight bell is an Associate in Nursing illustration of a stringently mechanical signal and that they need drivers. elective examples of them are doorbells.

B. Electromechanical:

Early gadgets were upheld Associate in Nursing mechanical gadget framework clone of an electrical ringer while not the metal gong. A transfer could likewise be associated with intruding on its causative current, dispensing the contacts to buzz. typically these units were moored to a divider or roof to utilize it as a sounding board. "Signal" comes from the grating commotion that mechanical gadget ringers made.

C. Piezoelectric:

A power part could likewise be driven by an Associate in Nursing oscillatory electronic circuit or elective sound sign stock, driven with a powerful speaker. Sounds like a rule wont to show that a catch has been pressed ar a tick, a circle, or a blare.

3. 16*2 DIGITAL DISPLAY

Liquid crystal displays (LCD) are speedily exchange ancient electron-beam tubes (CRT) as a simpler possibility. because of the steady increase in LCDs since the mid-1990s, a major and ever-rising quantity of disposed of the digital display is to be expected within the following years. The WEEE Directive, the results of a rising concern concerning environmental and health risks display by the finish of life physics, needs WEEE to be recovered and LCDs larger than one hundred cm2 to be treated singly because of their potential risky material content. The article can assess the event of digital display material content and utilization practices in Finland, in light-weight of the RoHS and WEEE Directives.

Properties of digital display Display:

1) Lightweight (Typ. 1/5 of CRT)
2) power consumption (Typ. 1/4 of CRT)
3) Completely flat screen - no geometrical errors
4) Crisp photos - digital and uniform colors
5) No magnetism emission

6)   Fully digital signal process doable

7)   Large screens (>20 inches) on desktops

8)   High worth (presently 3x CRT)

9)   Poor viewing angle (Typ. fifty degrees)

10)   Low distinction and luminosity (Typ. 1:100)

4. LM35 TEMPERATURE SENSOR:

LM35 may be a temperature sensing element that outputs an associate degree analog signal that is proportional to the fast temperature. The output voltage will simply be taken to get a temperature reading in the stargazer. The advantage of lm35 over the thermal resistor is it doesn't need any external standardization. The coating conjointly protects it from self-heating. Low value (approximately $0.95) and larger accuracy create it fashionable among hobbyists, DIY circuit manufacturers, and students. several low-end products make the most of low value, larger accuracy and used LM35 in their product. It's close to 15+ years to its 1st unleash however the sensing element continues to be living and is employed in any product.

Features:

• Calibrated Directly in stargazer (Centigrade)

• Linear + 10-mV/°C multiplier factor

• 0.5°C Ensured Accuracy (at 25°C)

• Rated for Full −55°C to 150°C vary

• Suitable for Remote Applications

• Operates from four V to thirty V

• Less than 60-µA Current Drain

• Low Self-Heating, 0.08°C in Still Air

• Non-Linearity solely ±¼°C Typical

• Low-Impedance Output, 0.1 one for one-mA Load

5. CURRENT TRANSFORMER:

A] Iron core can saturate at a current level beyond its rated current or a large DC. Once magnetized, its accuracy will degrade.

B] The solution to combat saturation: use high permeability material core but it leads to poor phase characteristics over current and temperature.

C] A current transformer is a device for measuring a current flowing through a power system and inputting the measured current to a protective relay system. Current transformers are well known in the field of electronic circuit breakers, providing the general function of powering the electronics within the circuit breaker trip unit and sensing the circuit current within the protected circuit.

D] A current transformer is designed to produce an alternating voltage proportional to the current being measured.

E] Low Power consumption.

F] Low Output variation with temperature.

6 . POTENTIAL TRANSFORMER:

A] The potential transformer works along with the same principle of other transformers.

B] It converts voltages from high to low.

C] It will take them thousands of volts behind power transmission systems and step the voltage down to something that meters can handle.

D] These transformers work for single and three-phase systems and are attached at a point where it is convenient to measure the voltage.

7 . GSM MODULE:

The SIM800A Quad-Band GSM/GPRS Module with RS232 Interface can be a completed Quad-band GSM/GPRS course of action in a {very} very LGA (Land lattice group) kind which could be embedded within the vendee

applications. SIM800A support Quad-band 850/900/1800/1900 rate, it'll send Voice, SMS data} information with low power usage.

With a tiny low size, it'll see however into skinny and littlest solicitations of hand produce. alongside and Embedded AT, it licenses outright price speculation and fasts a perfect chance to exhibit for vendee applications.

The SIM800A electronic gear incorporates a SIM800A GSM chip and RS232 interface whereas allows a direct relationship with the computer or computer exploitation the USB to the Serial connective or the smaller than traditional controller exploitation the RS232 to TTL widget. after you interface the SIM800A electronic hardware exploitation the USB to RS232 connective, you would like to follow down the correct COM port from the Device Manager of the USB to Serial Adapter.

Around then you will open Putty or Associate in Nursingother terminal programming connected open an affiliation thereupon COM port at 9600 information live, that may be that the default information measure speed of this electronic gear. once a back-to-back affiliation is open through the computer or you've scaled down the controller you will begin to exploit the AT orders. At the rationale, once you send AT orders as Associate in Nursing illustration "AT\r" you need to be unnatural to withdraw to a solution from the SIM800A electronic gear discourse "Okay" or elective response relying upon the request sent.

8. PROXIMITY SENSOR:

Proximity Sensor" includes all sensors that perform non-contact detection compared to sensors, like limit switches, that discover objects by physically contacting them. Proximity Sensors convert info on the movement or presence of an associate degree object into an associate degree electrical signal. There are unit 3 sorts of detection systems that do that conversion: systems that use the eddy currents that area unit generated in aluminiferous sensing objects by magnetic attraction induction, systems that discover changes in electrical phenomenon once approaching the sensing object, and systems that use magnets and reed switches.

9. DOL STARTER:

A DOL starter (also called an on-spot online starter or across-the-road starter) could be a methodology of beginning a three-part induction motor. in an exceedingly DOL Starter, an associate degree induction motor is connected directly across its 3-phase provide, and also the DOL starter applies the total line voltage to the motor terminals.

Despite this direct association, no hurt is completed to the motor. A DOL motor starter contains protection devices, and in some cases, condition observation. A schematic of a DOL starter is shown below:

Since the DOL starter connects the motor to the most itinerary, the motor attracts a high inpour current compared to the total load current of the motor (up to 5-8 times higher).

A direct online starter will solely be employed in circumstances once the high inpour current of the motor doesn't cause an associate degree excessive dip within the provided circuit. If a high dip has to be avoided, a star-delta starter ought to be used instead. Direct online beginners are unremarkably accustomed to starting little motors, particularly three-part cage induction motors.

As we know, the equation for coil current within the motor. the worth of back electromotive force (E) depends upon speed (N), i.e. E is directly proportional to N.

In beginning, the worth of E is zero. So, the beginning current is incredibly high. in an exceedingly little rating motor, the rotor contains an additional extensive axial length and tiny diameter. So, it gets accelerated fastly.

Hence, speed will increase and so the worth of coil current decreases apace. Therefore, little rating motors swimmingly run once it's connected to a 3-phase provide.

If we tend to connect an outsized motor directly across a 3-phase line, it'd not run swimmingly and can be broken, as a result of it doesn't get accelerated as quickly as a smaller motor since it's the short axial length and bigger diameter additional large rotor. However, for large-rated motors, we can use an associate degree oil-immersed DOL starter.

10.MICROCONTROLLER:

The AT89C51 could be a low-power, elite CMOS 8-digit personal computer with 4K bytes of Flash programmable and eradicable scan simply memory (PEROM). The appliance is created utilizing Atmel's high-

thickness nonvolatilizable memory innovation and is viable with the business commonplace MCS-51 steerage set and pinout. The on-chip Flash permits the program memory to be reinvented in-framework or by a standard nonvolatilizable memory developer. By connexion associate adaptable 8-bit electronic equipment with Flash on a solid chip, the Atmel AT89C51 is an improbable personal computer which supplies associate exceptionally adaptable and savvy account some ingrained management applications. The AT89C51 could be a well-established 8-cycle microcontroller from the Atmel family. It works with the standard 8051 styles and consequently is employed by most amateurs to date. it's a forty-pin IC bundle with 4Kb blaze memory. it's four ports, and everyone along offers thirty-two Programmable GPIO pins. It does not have an in-fabricated ADC module and supports simply USART correspondence. Despite the very fact that it o.k. could also be interfaced with outer ADC IC just like the ADC084 or the ADC0808.The AT89C51 isn't, at this time afoot and Atmel does not uphold the new setup. Rather the new AT89S51 is recommended for brand spanking new applications. Since the AT89C51 includes solid native space support within the event that you intend to find out inserted, AT89C51 will in any case be a good call.

Highlights of AT89C51

• Compatible with MCS-51™ merchandise

• 4K Bytes of In-System Reprogrammable non-volatile storage – Endurance: one,000   Write/Erase Cycles

• Fully Static Operation: zero cps to twenty-four MHz

• Three-level Program Memory Lock

• 128 x 8-digit Internal RAM

• 32 Programmable I/O Lines

• Two 16-digit Timer/Counters

• Six Interrupt Sources

• Programmable Serial Channel

PRINCIPLE OF OPERATION:

The basic distinction between an associate induction motor and asynchronous AC motor is that within the latter a current is equipped into the rotor (usually a DC) that successively creates a (circular uniform) force field around the rotor. The rotating force field of the mechanical device can impose associate magnetic force on the still force field of the rotor inflicting it to maneuver (about a shaft) and rotation of the rotor is made. it's known as synchronous as a result of at steady state the speed of the rotor is that the same because the speed of the rotating force field within the mechanical device.

By manner of distinction, the induction motor doesn't have any direct offer onto the rotor; instead, a secondary current is iatrogenic within the rotor. to realize this, mechanical device windings square measure organized around the rotor so that once energized with a point offer they produce a rotating force field pattern that sweeps past the rotor. This dynamic force field pattern induces a current within the rotor conductors. This current interacts with the rotating force field created by the mechanical device and in impact causes a move motion on the rotor.

However, for these currents to be iatrogenic, the speed of the physical rotor should be but the speed of the rotating force field within the mechanical device, as an alternative the force field won't be moving relative to the rotor conductors and no currents are going to be iatrogenic. If by some likelihood this happens, the rotor usually slows slightly till a current is re-inducted then the rotor continues as before. This distinction between the speed of the rotor and the speed of the rotating force field within the mechanical device is termed slip. it's unitless and is that the magnitude relation between the relative speed of the force field as seen by the rotor (the slip speed) to the speed of the rotating mechanical device field. thanks to this associate induction motor are typically noted as an associate asynchronous machine.

BEGINNING OF INDUCTION:

In a 3 section induction motor, the iatrogenic voltage in the rotor circuit depends on the slip of the induction motor, and also the magnitude of the rotor current depends upon this iatrogenic voltage. once the motor is started, the slip is adequate because the rotor speed is zero, that the iatrogenic voltage in the rotor is giant. As a result, a high current flows through the rotor. this can be kind of like an electrical device with the secondary

short-circuited, that causes the first coil to draw a high current is drawn by the mechanical device, on the order of five to nine times the complete load current. This high current will harm the motor windings and since it causes significant line fall, different appliances connected to identical line is also laid low with the voltage fluctuation. To avoid such effects, the beginning current ought to be restricted. A starter could be a device that limits the beginning current by providing reduced voltage to the motor. Once the rotor speed will increase, the complete rated voltage is given thereto.

GENERAL FAULTS IN INDUCTION:

There square measure numerous faults occurring in three section induction motor, however in our project, we've got protected the induction motor from the subsequent faults solely

Overloading

Single phasing

Overheating

Under voltage

Overvoltage

Ground Fault

1. OVERLOADING –

Overload fault happens once the mechanical torsion exceeds the brink purpose by applying mechanical load to the motor larger than the full load rating. Overloading causes an increase in section currents, overheating the machine. in a very ancient relay protection system, the over -

The current relay visits the motor off-line once this transformer (CT) encounters over current within the line.

2. SINGLE PHASING –

Single phasing is one of the unbalanced cases of the motor. It happens once one amongst the 3 lines square measure open. a lot of current flows through the opposite 2 lines and a lot of heat is generated in mechanical device winding. within the ancient protection systems, a high-set fast trip unit relay is employed Single phasing additionally offers rise to negative sequence current. A negative sequence relay may also be wont to defend against this fault.

In single phasing protection to three section induction motor, if alternative 2 phases are faulted and only 1 protection of motor section starts functioning. Generally, in a single section offer voltage is a lower price than the nominal price. At this price of voltage, the motor is unable to begin. A comparator that compares single phasing offer voltage and rated nominal voltage, and single sends to microcontroller and microcontroller generates single that stop the motor if the motor is running and doesn't permit to motor begin just in case of standstill. generally, single phasing protection wanting abundant motor necessary once the motor is tight that necessary perform like furnishing, pump driving, and crane driving, etc.

Single phasing happens as a result of many potentialities. A loose wire, a nasty association, unhealthy starter contacts, overload relay issues, a nasty breaker, a blown fuse, and alternative things will cause this damaging condition. Obvious signs square measure a louder than traditional buzzing from the motor and/or a shaft that vibrates instead of rotating.

3 .WARMING –

Overheating definition of the motor means that protect the motor from warming of its winding. This warming in the motor is mostly caused by overloading of motor, bearing seizes up one thing fastened the motor shaft from turning. Motor merely fails to begin properly, a failure {to begin|to start |to begin} of the motor might cause by faulty start in winding in the motor

4. OVERVOLTAGE –

Overvoltage occurs if the 3 section voltages square measure larger than the rated voltage. The impact of this fault is increasing current flow that leads to unacceptable stress on the motor insulation because of high chilling. standard protection systems use the overvoltage relays to protect the motor throughout this condition In the overvoltage protection system of three section induction motor, protects the motor from overvoltage, the voltage that is beyond the rated voltage**.**

5 . GROUND FAULT –

Ground faults occur once any of the phases touches the bottom. Ground faults square measure a lot of frequent in motors than the other installation, attributable to their violent condition and frequent starts. the results of this fault square measure intensive like inflicting hazards to human safety and interference with telecommunication. It is often detected by activity the bottom outflow current.
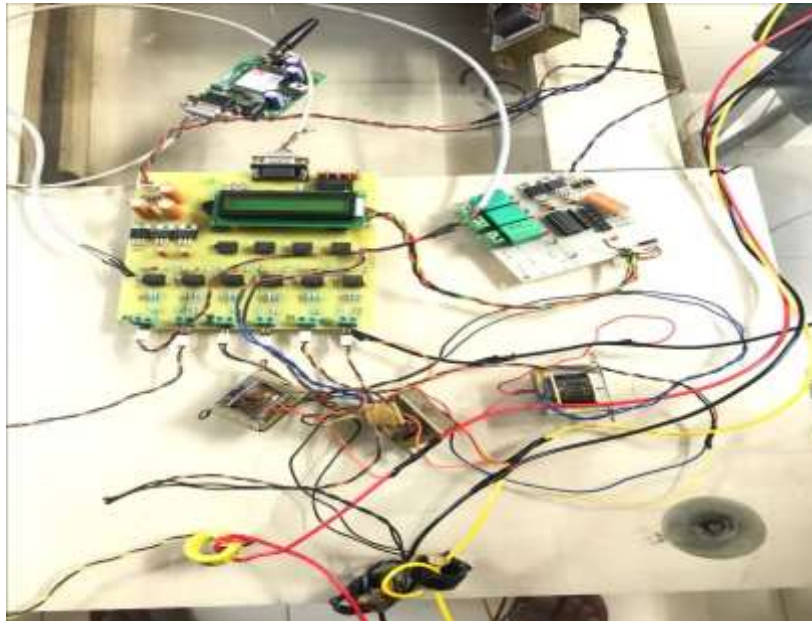
APPLICATION

1.This project is often employed in any form of 3 section motors, and therefore the motor with any rating is often simply adopted by simply connecting the relay connections to the starter of the motor.

2.Agricultural motors

3.Industrial motors

III.   MODELING AND ANALYSIS

PROJECT DEMO KIT

IV.   RESULTS AND DISCUSSION

RESULT

This project issues experimental studies on the protection of induction motor kind over and beneath voltage and single phasing. The experiment is conducted by connecting the wires kind experimental kit to the starter of the motor. we conclude that the effective and reliable protection of 3 part induction motor from the faults of unbalanced provides voltages and single phasing.

FUTURE SCOPE

A real clock is accessorial so that the ON time and also the time of the motor is entered, and also the system can turn on the motor and it'll cut at the present time. An electronic lock is provided so that unauthorized persons will 't use the motor. Higher application. Wireless implementation by FM/RF. This project is extended to guard the induction motor kind phasor faults and part reversal.

V.   CONCLUSION

 In this project, we tend to square measure victimization luminous flux unit 393 twin comparator to match over/under voltage. In addition to the present we tend to square measure victimization 2 switches one for the machine on and another for the machine off. Here the motor can run mechanically once the machine on is ready and it'll stop the motor mechanically when a specific time if the machine off is ready. According to the program written into the microcontroller, the circuit can mechanically ON/OFF the motor The prime use of the microcontroller is to shield the motor from over and underneath voltages and to begin and stop the motor mechanically. The microcontroller sends the signal to relays that are connected to the starter of the motor.

consistent with the signal from the controller the relay can begin /stop the motor. We have with success completed the code needed for the protection of the three-phase induction motor from the faults of unbalanced provide voltages and signal to phase. The circuit is fictitious, the code is derived into the microcontroller, and that we got the required results .

VI.   REFERENCES

[1]   D. Kornack and P. Rakic, "Cell Proliferation whereas not Neurogenesis in Adult Primate cerebral cortex," Science, vol.294, Dec. 2001, pp. 2127-2130,doi:10.1126/science.1065467.

[2]   W.H. Kersting, "Causes and effects of single-phasing induction motors", IEEE Transactions on business Applications, vol. 41, no. 6, pp. 1499-1505, Dec. 2005.

[3]   P.E. Dame Joan Sutherland and T.A. Short, "Effect of Single-Phase Reclosing on Industrial Loads", business Applications Conference 2006. forty first Annual Meeting, vol. 5, pp. 2636-2644, 8–12 Oct. 2006.

[4]   G.C. Stone, M. Sasic, D. Dunn and I. Culbert, "Recent issues practised with motor and generator windings", 56th AnnualPetroleum and industry Conference PCIC 2009, pp. 1-9, 14–16 Sept. 2009 .

[5]   W. T. Thomson, D. Rankin, and D. G. Dorrell, "On-line current perceptive to analyze airgap erraticism in huge three-stage period of time engines— Modern case narratives check the forecasts

[6]   R. Bayindir and that i. Sefa, "Novel methodology smitten by microcontroller to online insurance of period of   time engines," Energy Convers. Oversee., vol. 48,

[7]   microcircuit True RMS-to-DC device knowledge Sheet (AD 536A). (1999).

[8]   Shaft kind Rotary encoder knowledge sheet (ENB arrangement). (2005). exactitude Centigrade Temperature device (LM 35) knowledge Sheet National Semiconductor. (2000, Nov.).