Induction Motor Control and Protection Using IOT*

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Abstract:- Control and protection of an electric component system is highly important in any sector. This concept proposes employing wireless technology to run an ac motor for the needed purpose. To get the necessary output, we used an Arduino microcontroller that is connected to a motor driver. We utilise an Android application that connects to the WIFI modem of the control circuit that is connected to the motor over the internet. The microcontroller is connected to the WIFI modem. The order is received by the WIFI modem through the internet via the mobile phone app. The signal is sent to the Microcontroller via the WIFI modem. The signal is decoded by the microcontroller and sent to the appropriate relays. The relays then switch between high voltage, low voltage, and over current. Asa result, this project.

Keywords:- *Internet of Things , IOT , Induction Motor, TRIAC,Arduino.*

I. INTRODUCTION

Machines systems are preferred driven by electric motors in today's developing industries. AC Because of the simplerotor structure, induction motors are low-cost and need lit- tle maintenance. Induction motors also have a high power factor, are small and compact, are durable, and are less ex- pensive. An induction motor offers the advantages of supe- rior speed control, long-term overload capacity, and strong beginning torque. As a result, induction motors are em- ployed in industries, crane elevators, residential, and farm motors.

The Internet of Things (IOT) has received much attention as a technology that has accelerated current wireless com- munication innovations. For the most part, it has a lot of advantages. The Internet of Things (IoT) is lending a hand in achieving industrial automation via remote access. IoT devices that make up a system can connect with other de- vices on the Commman platform. As a result of this sys- tem, important data and numerous other parameters infor- mation are exchanged across devices in order to optimise their performance. This prototype exhibited IOT-based In- duction motor monitoring parameters such as voltage, cur- rent, and speed using a senser and cloud, and managing thespeed of the induction motor using TRIAC control sinceits speed can be readily changed by altering the supply voltage. The project's major goal is to develop a low-cost, effective protection system for induction motors. The pro- tective system should guard against undervoltage and overvoltage. The sustainability of production in industries can be maintained by continuously monitoring the parame-ters, and the production of industry may be improved by using more efficient motors. Detect any problems that oc- cur in the induction motor.

II. LITERATURE REVIEW

The majority of the project work was done in the field of induction motor control and protection to regulate different induction motor parameters. [1] suggested utilising an ATMega328 microprocessor to automate and monitor in- duction motors. Overcurrent single phasing is protected by the microcontroller. [2] shows a PIC microcontroller-based control system that protects single-phase motors from un- dervoltage, overvoltage, and overheating, as well as meas- uring motor speed. However, the PIC microcontroller's programme is long and has a complicated structure. [3] presents a review paper on a microprocessor-based control system for a three-phase induction motor fed by a PWM IGBT inverter. A complexity issue emerges here as well.

[4] presents a technique for obtaining a time-protectionmodel for an induction motor from voltage imbalance. The approach is based on the thermal impact of mechanical overloads and voltage imbalance conditions on the motor.

[5] Multilevel inverters employ the Phase-shifting Pulse width Modulation (PSPWM) approach, whereas induction motors use the Space Vector Modulation Strategy (SVM).

[6] used a PIC 16C84 microcontroller to build a system. [7] We have examined a system that uses an Arduino micro- controller to monitor metrics like as speed, temperature, current, and voltage. This necessitates the use of extra mo- tors. The suggested method is a senser-based technology

[8] that is implemented using a PLC.

Multiple researches on different control and protection systems for Single Phase Induction Motors have been un- dertaken [9][10]. As a result, there are limited studies on IoT-based Induction Motor Control and Protection [13][14]. Using the most recent IOT[11], we suggested thissystem for parameter control and protection of induction motors. There is a downside of complicated structure in GSM,PLC, and PIC Microcontroller[12] by completing Research scope by Analyzing literature study. With the us- age of GSM, there is a restricted pace of data transfer, as well as a considerable amount of electromagnetic radiation. This can be solved by IOT, which reduces human labor and work while also transferring data at a high rate and providing personal safety and security. A speed control ap-proach based on TRIAC is used.

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As a result, the induction motor will need to be controlledand protected in the future. However, there is an issue withthe speed control approach, as well as an efficient protec- tion strategy for other parameters. Which was fixed by us- ing an IoT-based protection system that increased depend- ability. additionally uses an android application to check parameters 24 hours a day. Been programmed to act as a Flash driveconverter.

III. PROPOSED SYSTEM

Fig 1 shows a block schematic of the proposed system. It motor, and a Relay Driver Circuit. The voltage senser, IoT module, and LCD display are all wired directly to the Arduino UNO. Relay driver circuit connects capacitor start induction motor to Arduino UNO. The TRIAC is utilised to control the motor's speed. We can control the motor with the Blynk app onAndroid**.**

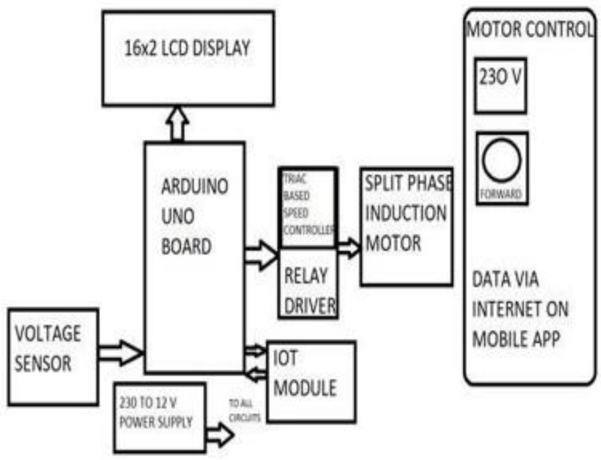

Fig.1 System Block DiagramHardware Description

1) Arduino UNO

The Arduino Uno is a microcontroller board based on the ATmega328. On this board, there are 14 digital input/output pins (six of which are PWM outputs), six analogue inputs, a 16 MHz crystal oscillator, a USB connection, a power connector, a Hdmi port, and a reset button. It includes everything you'll need to get started with the microcontroller; simply connect it to a computer through USB or use an AC-to-DC converter or battery to power it. The Uno is different from prior boards in that it does not use the FTDI Flash drivedriver chip. Instead, an Atmega8U2 is used, which has been programmed to act as a Flashdrive converter.

Speed controller is made up of an Arduino uno, an LCD display, an IoT module,a voltage senser, a supply, a TRIAC, a capacitor-start induction is a low-cost, miniature display. Because of the integrated controller, dealing with a microcontrol- ler is simple (the black blob on the back of the board). This is a standard controller included on many screens (HD 44780).

2) 16x2 LCD

An LCD is a low-cost, miniature display. Because of the integrated controller, dealing with a microcontrol- ler is simple (the black blob on the back of the board). This is a standard controller included on many screens (HD 44780).

Features

- 5 x 8 dots with cursor
- Built-in controller (KS 0066 or Equivalent)
- + 5V power supply (Also available for + 3V)
- 1/16 duty cycle
- B/L to be driven by pin 1, pin 2 or pin 15, pin 16 or A.K (LED)
- N.V. optional for + 3V power supply

Fig.3 LCD

3) An LCD

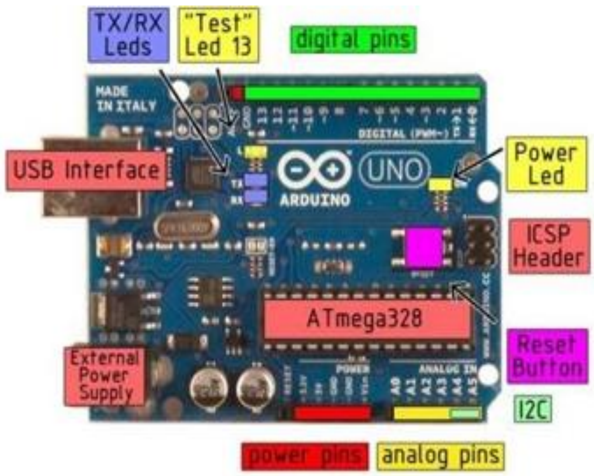

Fig.2 Arduino

3) speed controller

The TRIAC speed-control circuit for induction motors illustrated in FIG. 4 is similar to the universal motor speed-control circuit displayed. To delay the phase of the gate trigger, the circuit in FIG. 4 uses a single- time-constant circuit. Because induction motors can- not be slowed down enough to enter the difficult hys- teresis area for which the double-time-constant gate circuit is required, this simpler technique is permitted. This speed-control circuit is appropriate for induction motors with permanent split capacitors. This control method is also applicable to shaded-

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pole inductionmotors. When the load is a fan or blower, this speed- control approach works well with any type of induction motor.

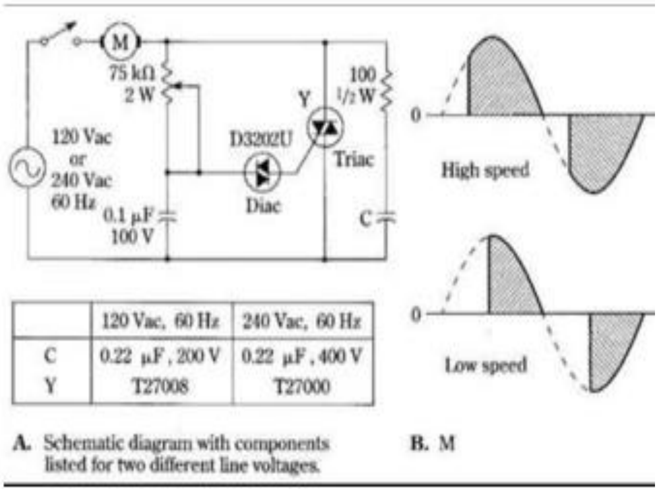

Fig.4 TRIAC Speed Control

FIG.4 Induction motor speed control using a TRIAC circuit. RCA is the manufacturer of this product. (A. Components for two different line voltages are shown in a schematic design.) M. B.)

Under some circumstances, TRIAC control of resistance-start and capacitor-start induction motors is possible. In most cases, the speed-control range must be limited; the speed should not be decreased to the point where the centrifugal switch reconnects the be- ginning winding or capacitor. All things considered, the permanent split-capacitor motor will provide the greatest range of speed control. There is no centrifu- gal switch on this type of induction motor. It also works effectively in a high-slip environment.

When the load is resistive, as it is with lights or heaters, the RC "snubbing network" linked across the TRIAC does not normally show in the circuit. TRIACturn-off will occur at zero current due to the inductive nature of a motor load, but the voltage across theTRIAC will not be zero at that moment. Despite the lack of a gate signal, a voltage step is created across the TRIAC, which might result in retriggering. Even though the TRIAC's voltage-blocking capabilities surpasses peak ac voltage by a significant margin, thiscan happen. It's not the amplitude of the voltage step, or "spike," that's the problem, but the rate at which it changes.

4) IOT Module

Fig.5 ESP2866 IOT Module

The ESP8266 WIFI Module is a self-contained SOC with an integrated TCP/IP internet protocol suite that allows any microcontroller to connect to your WIFI network. The ESP8266 may run a programme or of- fload all Wi-Fi networking tasks to another processor. This module comes with AT instructions firmware, which allows you to get capabilities comparable to an Arduino WIFI shield; however, you may load differ- ent firmwares to generate your own programme on themodule's memory and CPU . This module has an in- herent low-power 32-bit CPU running at 80 MHz that may be used for custom firmware. This also means that small website may be hosted without the use of a controller. The ESP8266 features an identity RF and supports APSD and Bluetooth co-existence interfaces for VoIP applications.

Circuit Diagram Description

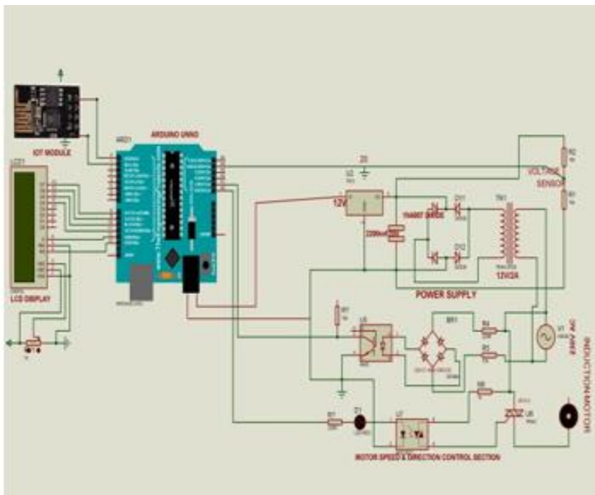
Fig.6 Circuit Diagram

The circuit diagram of an induction motor's protection and control system is shown in Figure 5. The diagram above depicts the connections between various sec- tions of the system that receive 12 volt dc power from the power supply system portion. The power supply part has a 12v/2A transformer that converts 230 volts to 12 volts. A bridge rectifier is used to convert AC to DC. A 2200 mf capacitor is employed to smooth the output. The LM317 voltage regulator is used to obtaina 12 volt dc continuous supply.

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The Arduino is powered by a 12 volt DC source. It has 14 input/output pins and 6 digital input/output pins. The ground and VCC pins of the IOT module are linked to the 0 pin of the Arduino's 0 I/O pin,while VCC is attached to the 1 pin. The operation of the LCD is divided into three parts. 1) pins for power and 2) pins for control 3) Pins for data. There are three supply pins, one of which is grounded. The 2and 3 pins are connected to a potentiometer, which adjusts the LCD's contrast. The 4 and 6 control pins are connected to an Arduino, which controls the data. The 5th control pin is connected to the ground. We utilise a four-bit LCD. The Arduino I/O pins are linked to four data pins. The voltage sensor is attached to the Arduino's A4pin. Through R2 and LED, the A0 pin is linked to the optocoupler. Through a resistor, the A1 pin is linked to the zero crossing detection circuit. Because we can't connect the motor directly to the Arduino, we created a relay driver circuit as well as a TRIAC con- troller circuit to regulate the motor's speed. The opto-coupler in the TRIAC controller circuit provides agate pulse to initiate the TRIAC. TRIAC is also linkedto a zero crossing detection circuit. The motor re- ceives the main supply's neutral as well as phase through TRIAC. The Arduino UNO is programmed with the necessary code to control the motor.

IV. HARDWARE SETUP

Hardware setup consist of Arduino uno ,LCD display, IOT module ,Voltage sensor ,supply ,TRIAC ,capacitor start induction motor , relay driver circuit. Voltage sensor , IOT module and LCD display is di- rectly connected to Arduino uno .Capacitor start induc-tion motor is connected Arduino through relay driver circuit .TRIAC is used for speed control of motor .Wecan operate motor from blynk app

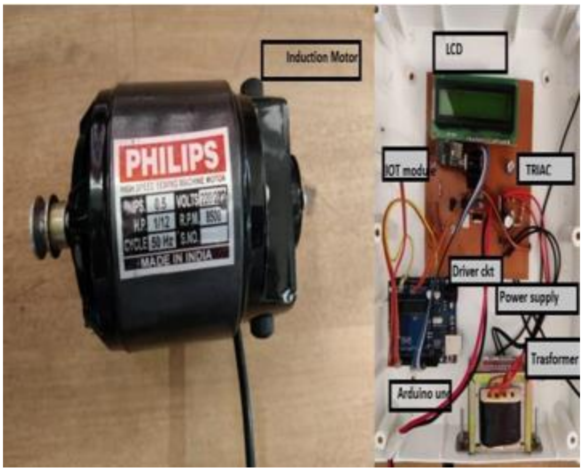

Fig.7 Hardware Setup

V. RESULT

1. Under Voltage

If supply voltage of Induction motor is less than 260 vthen fault under voltage is detected and motor stop running

Fig.8 undervoltage on kit display

Fig.9 Undervoltage Notification

2. Overvoltage

If supply voltage is more than 260 v then fault over-voltage is detected and motor turns off

Fig.10 overvoltage Notification

3. Speed Measurement
   1. 0% Speed applied

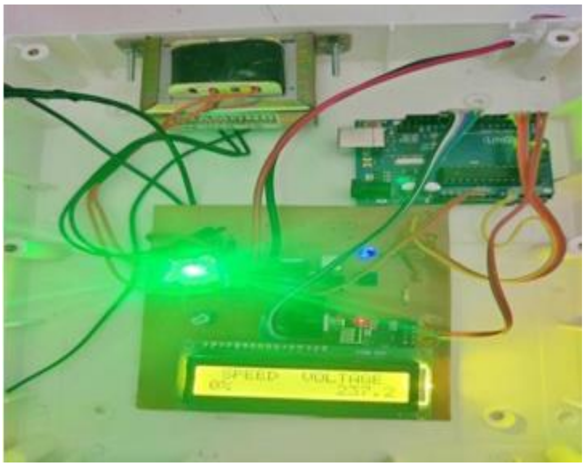

Fig.11 Speed mesurement 1 on kit display

Fig.11 Speed measurement 1 notification

1. When 50% speed applied

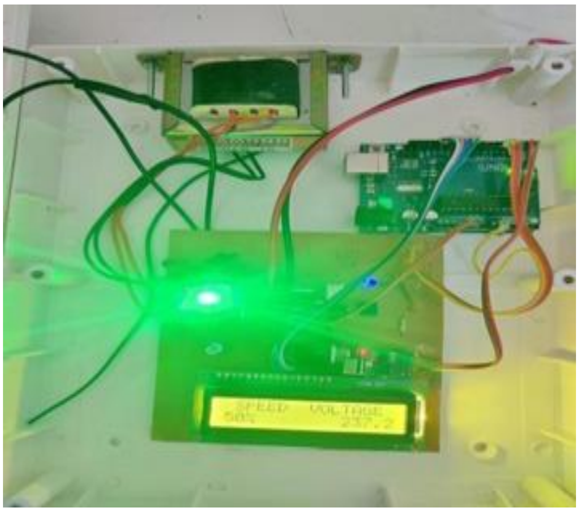

Fig.12 Speed measurement 2 on kit display

Fig.13 Speed measurement 2 Notification

3.100% Speed applied

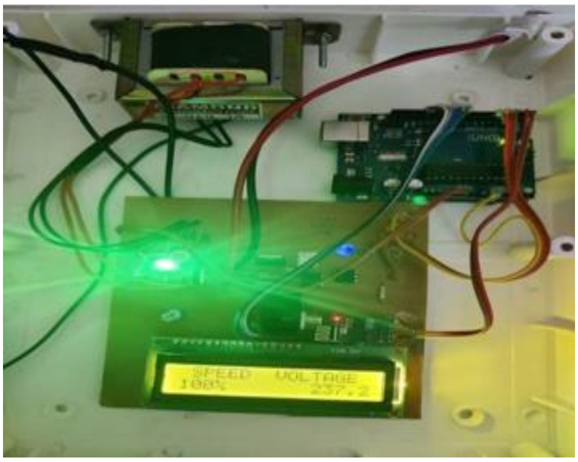

Fig.14 Speed measurement 3 on kit display

Fig.15 Speed measurement 3 Notification

From observations or result. This system will protect the motor from several faults such as undervoltage, overvoltage andcircuit will switch on motor under safety conditions . It Displayall results on kit display as well as mobile phone . when fault occurs it sends notification to user also measures speed of induction motor accurately. It improves motor performance and make it reliable and increases its life.

VI. CONCLUSION

This paper represents the IOT is well known and most rapidlygrowing nowadays .Now IOT is becoming an integral aspect of human life. In the future, many items will be connected to the cloud. IOT has recently gained ground into fields such asindustry, home, automation, medical field etc. With help of controllers , sensors this prototype gives IOT based condition monitoring parameters and controlling the speed of motor with help of TRIAC .Visualize and analysis voltage parameters on a LCD display .By analyzing motor parametersmake the motor to be operated in protective and safe in nature, It also helps in calculating a new data to interact with social media and other gadgets from blynk app, We operate motor parameters on mobile application by connecting to hotspot module. Through blynk app continously monitored the motor parameters and if fault takes place it will get alert notificationon android application. In industries required monitoring datavalue for maintenace and power consumption. In case the motor gets overvoltage ,undervoltage than its rated value it will get automatically disconnected from supply and motor gets off.

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