SPEED CONTROL OF 1-PHASE INDUCTION MOTOR THROUGH IOT

Vinay.I, Akram.SD, Saleem.N, Satheesh.P, Humayun Raj.SK UG Scholars
Naresh Babu.U Associate professor
Department of EEE, Narayana Engineering College (Autonomous), Gudur, SPSR Nellore, AP.

Abstract:

General purpose of motors is increasing widely in our surrounding from household equipments to machine tools in industrial applications. In many applications the speed control plays a vital role which can be done using many control strategies. The objective of this paper is to generate PWM frequency in PIC microcontroller to control the speed of the single phase induction motor.

This paper is used to control the speed of single phase induction motor by using IoT and ATMEGA-328P microcontroller. 230V AC voltage regulator is required for the control of induction motors and temperature sensors are required to find excessive thermal stress. Therefore a drive system without sensors is required. This paper presents a tender for sensor less variable speed single phase IM drive based on IoT. The speed of the single phase induction motor is controlled by using the NODE MCU controller. The PULSE GENERATOR is used to produce the pulse width modulation (PWM) signals. And the motor speed is controlled by using the Servo Motor and TRIAC. In this paper, Node MCU is used to increase and decrease the speed of the induction motor which is connected to the servo motor. The Node MCU transfers the speed signal through Wi-Fi.

Keywords - *Induction Motor, Internet of Things, Wi-Fi module ESP8266-12E, Proteus software.*

Introduction:

As many of the industries use induction motors. So, controlling of induction motor playsa very vital role. So, our paper concentrates on controlling the speed of induction motor using Android phone remotely by the help of the WIFI technology. The progress in science and technology is a non-stop process. New things and new technology are being invented. As the technology grows day by day, we can imagine about the future in which thing we may occupy every place.

Today's IOT plays an essential role in our day to day life. This paper deals with the hardware part for monitoring the continuous parameters and speed control part of Induction Motor. In that monitored parameters with the help of sensors is a voltage sensor, current sensor, speed sensor, and temperature sensor. And by controlling the speed part of the induction motor with the help of PWM techniques. By monitoring the parameters of the induction motor, it should help to maintain the before any fault occurs and prevent delay in production, which is the reliability of the induction motor obtained. If there is any fault takes place in the induction motor should be automatically disconnected from the supply by using IoT applications. Also analysis the results in graphical form.

Existing Methods: An induction motor is practically a constant speed motor that means, for the entire loading range, change in speed of the motor is quite small. In Induction motors, speed reduction is accompanied by a corresponding loss of efficiency and poor power factor. Different speed control methods of induction motor are explained below.

Induction Motor Speed Control from Stator Side

1. By Changing the Supply Voltage:

The speed of an induction motor can be varied by changing supply vol. The torque developed in this method is proportional to square of the supply voltage.

Therefore, $T \propto V^2$

this means, if supply voltage is decreased, the developed torque decreases. This method is the easiest and cheapest, still rarely used, because change in supply voltage is required for relatively small change in speed.

2. By Changing the Supply Frequency

Synchronous speed of the rotating magnetic field of an induction motor is given by, $N_S=120f/P$

Where, f = frequency of the supply

and P = number of stator poles.

Hence, the synchronous speed changes with change in supply frequency. However, this method is not widely used.

3. Constant V/F Control of Induction Motor

This is the most popular method for controlling the speed of an induction motor. As in above method, if the supply frequency is reduced keeping the rated supply voltage, the air gap flux will tend to saturate. This will cause excessive stator current and distortion of the stator flux wave. Therefore, the stator voltage should also be reduced in proportional to the frequency so as to maintain the air-gap flux constant. The magnitude of the stator flux is proportional to the ratio of the stator voltage and the frequency. Hence, if the ratio of voltage to frequency is kept constant, the flux remains constant. Also, by keeping V/F constant, the developed torque remains approximately constant. This method gives higher run-time efficiency. Therefore, majority of AC speed drives employ constant V/F method for the speed control.

4. Changing the Number of Stator Poles

This method is generally used for squirrel cage induction motors, as squirrel cage rotor adapts itself for any number of stator poles. Change in stator poles is achieved by two or more independent stator windings wound for different number of poles in same slots. For example, a stator is wound with two 3phase windings, one for 4 poles and other for 6 poles for supply frequency of 50 Hz

i) synchronous speed when 4 pole winding is connected, Ns = 120*50/4 = 1500 RPM.

ii) synchronous speed when 6 pole winding is connected, Ns = 120*50/6 = 1000 RPM

Speed Control from Rotor Side:

1. Rotor Rheostat Control: This method is similar to that of armature rheostat control of DC shunt motor. But this method is only applicable to slip ring motors, as addition of external resistance in the rotor of squirrel cage motors is not possible.

2. Cascade Operation: In this method of speed control, two motors are used. Both are mounted on a same shaft so that both run at same speed. One motor is fed from a 3phase supply and the other motor is fed from the induced emf in first motor via slip-rings. The arrangement is as shown in following figure.

3.

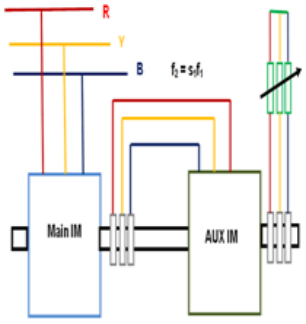

Fig: Block diagram – Speed control of IM from rotor side

Motor A is called the main motor and motor B is called the auxiliary motor.

Let, N_{S1} = frequency of motor A

N_{S2} = frequency of motor B

P_1 = number of poles stator of motor A

P_2 = number of stator poles of motor B

N = speed of the set and same for both motorsf

= frequency of the supply

With this method, four different speeds can be obtained

1. when only motor A works, corresponding speed = .Ns1 = 120f / P1

2. when only motor B works, corresponding speed = Ns2 = 120f / P2
3. if cumulative cascading is done, speed of the set = N = 120f / (P1 + P2)
4. if differential cascading is done, speed of the set = N = 120f (P1 - P2)

3. By Injecting EMF In Rotor Circuit

In this method, speed of an induction motor is controlled by injecting a voltage in rotor circuit. Itis necessary that voltage (emf) being injected must have same frequency as of the slip frequency. However, there is no restriction to the phase of injected emf. If we inject emf which is in opposite phase with the rotor induced emf, rotor resistance will be increased. If we inject emf which is in phase with the rotor induced emf, rotor resistance will decrease. Thus, by changing the phase of injected emf, speed can be controlled.

Drawbacks:

1. Small change in speed requires large change in voltage.
2. Increase core losses.
3. Poor power factor
4. Low efficiency.

Proposed Method: IoT and BLYNK Cloud

Internet of Things: Internet of things(IOT) is the network of physical devices, software, sensors, actuators connectivity which enables these things to connect, collect an exchange data. The concept of a network of smart devices was discussed as early as 1982, with a modified coke machine at Carriage Mellon University becoming the first internet connected appliance, able to report its inventory and whether newly loaded drinks were cold. Radio frequency identification is as essential to the internet of things, which would allow computers to manage all individual things.

Blynk Cloud:

Blynk was designed for the Internet of Things. It can control hardware remotely, it can display sensor data, it can store data, visualize it and do many other cool things. Fig:4.1 shows the overview of Blynk app. Blynk is a platform with IOS and Android apps to control Arduino, Raspberry Pi and the likes over the Internet. It's a digital dashboard where you can build a graphic interface for your paper by simply dragging and dropping widgets. It's really simple toset everything up and you'll start tinkering in less than 5 mins. Blynk is not tied to some specific board or shield. Instead, it's supporting hardware of your choice. Whether your Arduino or Raspberry Pi is linked to the Internet over Wi-Fi, Ethernet or this new ESP8266 chip, Blynk will get you online and ready for the Internet of Things.

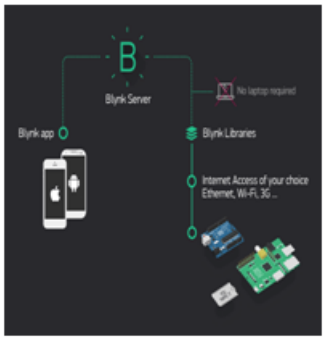

Fig: Blynk app Overview

The three major components in the platform:

1. Blynk App - **All**ows to you create amazing interfaces for papers using various widgets we provide.

2. Blynk Server - Responsible for all the communications between the Smartphone and hardware. You can use our Blynk Cloud or run your private Blynk server locally. It's open-source, could easily handle thousands of devices and can even be launched on a Raspberry Pi.

3. Blynk Libraries - For all the popular hardware platforms - enable communication with the server and process all the incoming and out coming commands.

Result:

This paper is used to control the speed of single phase induction motor by using IoT and ATMEGA-328P microcontroller. 230V AC voltage regulator is required for the control of induction motors and temperature sensors are required to find excessive thermal stress. Thereforea drive system without sensors is required. This paper presents a tender for sensor less variable speed SPIM drive based on IoT.

Conclusion:

The proposed system based on PIC microcontroller is found to be more compact, user friendly and less complex, which can readily be used in order to perform several tedious and repetitive task. Though it is designed keeping in mind about the need for industry, it can extended for other purposes such as commercial and research applications. Due to the probability of high technology used this "IOT BASED SENSORLESS SPEED CONTROL OF INDUCTION MOTOR" is fully software controlled with less hardware circuit. The feature makes this system is base for future system. We are not only controlling the speed of the induction motor, using feedback network we can also detect the over temperature. So, this paper will be very helpful in industries, house hold, shopping malls etc. The principle of the development if science is that "nothing is impossible". So we all look forward to a bright and sophisticated world.

Future Scope:

The future scope will be controlling the speed of three phase induction motor likewise that of the single phase induction motor using android application. Also we can use GSM module instead Wi-Fi module to control the speed of induction motor. The speed can also be controlled automatically using temperature sensor LM35. The speed control of three phase induction motor can be used for agriculture, industrial, domestic, commercial applications. In this system we are monitoring and controlling the speed of induction motor and can be controlled easily.

References:

1) "Robust speed Tracking of Induction Motors, An Arduino-Implemented Intelligent Control approach", IEEE Transactions on Industry applications, Tan-Jan HO ID et al 2018 vol.8pp.159.
2) "Speed control of 3-phase induction motor by v/f method with Arduino uno", Journal of Engineering Research and Application, Ali Abdul razzak et al 2017 vol., no.12,pp.159.
3) "Fault detection and protection of induction motors using sensors", IEEE Transactions on energy conversion, Ramazan Bayindir, Ibrahim Sefallhamicolak, vol.23, no.3, sep 2008.
4) International Journal of Scientific Research Engineering & Technology(IJSRET) VOL.2, feb 2014, "Speed Monitoring an Protection of Motor using communication", P.E.Elavenill, Dr.R.Kalaivani2 1M.E, Rajalakshmi Engineering college in Chennai.
5) Young-Seol Lim et al year:2019, "Advanced Speed control for a five leg Inverter driving a dual-induction motor system", IEEE Transactions on Industrial Electronics, vol.66,pp.707-716.