

# Microcontroller based Speed Control of Single Phase Induction Motor using Zigbee Technology

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**Abstract:** In modern world we attract toward the automation due to advantages like accuracy, speed of work, saving in time more efficiency and many more and it becomes a basic need of industry. In this project we are controlling the speed of the single phase induction motor by using Zigbee technology. Simply these project is the part of wireless automation. In industry induction motor is the nerves of many industries. So for the proper operation of the machine controlling and monitoring of the various parameter of the machine is essential for precious and accurate operation of the induction motor. This paper suggests a wireless control and monitoring the single phase induction motor based on Zigbee communication to transfer the data to the field where wired communication is restricted. The design of the system is not only protecting from the many types of the faults but also maintains security, provide high reliability. The project has two sections which are transmitter and receiver and are controlled by microcontroller. Microcontroller can collect and store the data and generate controlling single to control the speed of induction motor. The speed control of induction motor is implemented by using software program and hardware system.

**Keywords:** Induction motor, Zigbee, microcontroller, AC Drives.

## I. INTRODUCTION

Now we are living in the Morden world. In Morden world we want fast and smart work with high efficiency, high reliability, cheaper in cost and saving in time. Means we want automation. Our project is the part of wireless automation. We are controlling the speed of induction motor wirelessly. Induction motor is very popular motor in industry because of their vast application and their advantages like simple construction, cheaper in cost, less maintenance. Therefore for the smooth performance of the motor it is necessary to control some parameters of the motor like voltage, current ,temperature etc. in this project we are controlling the speed of the induction motor by using Zigbee technology. There are many traditional methods of controlling speed of single phase induction motor like frequency control, by changing stator pole, by controlling supply voltage etc. due to limitations like poor efficiency, lower speed etc. they cannot be economical.

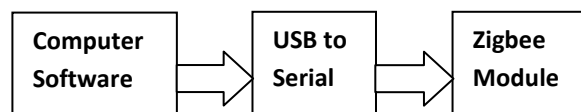


Fig1. Transmitter

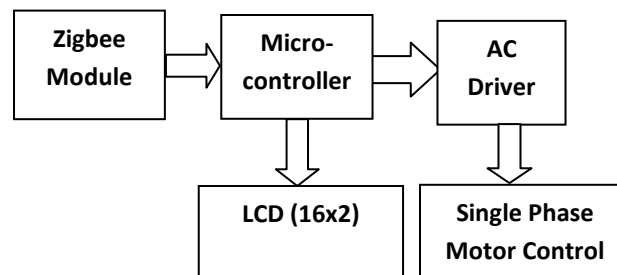


Fig2. Receiver

Now a days power electronics based controller changed the scene completely due to their smaller size, high efficiency and high reliability. In this project there are two parts first is transmitter and another is receiver .In transmitter part transmitter is connected to the computer through USB. The command can be given by computer application which received by Zigbee receiver at another end. This signal stored in microcontroller and microcontroller is then creating another signal for controlling the speed of induction motor.

## II. ZIGBEE

Zigbee is an IEEE 802.15.4 based wireless technology suited for top level communication protocol used to create Wireless Personal Area Network (WPAN) with low cost, low power consumption. Zigbee technology is very simpler and cheaper than other Wireless Personal Area Networks (WPANs) such as Bluetooth and Wi-Fi. The Zigbee WPANs operates on 2.4 GHz, 900 MHz and 868 MHz frequencies. Zigbee supports low data rates and commonly used a mesh network for transmitting the data over long distance.

- **Zigbee protocol**

The most commonly used Zigbee topologies are star, mesh and cluster-tree topologies

**1. Star:** in star topology for Zigbee in which all the device are called as end devices are individually connected to a coordinators which is responsible for initiating and managing a devices over a network .this type of connection mainly used in industries where all the end devices are needed to communicating with control devices. It is a very simple form of topology and easy to utilize.

**2. Cluster-tree:** it is a special type of tree topology in these parents with his children is called as cluster as shown in fig.3 all the cluster have unique cluster id.

**3. Mesh:** this is the most commonly used technology in a mesh topology all the end devices and communicating devices are connected to each other. And allowing for most transmission to be distributed, even if any of the connection goes down. Routers are used to extend the network. Router control data flow by using classified routing strategies in the network. As multiple devices can transmit data simultaneously, it can handle high amount of traffic.

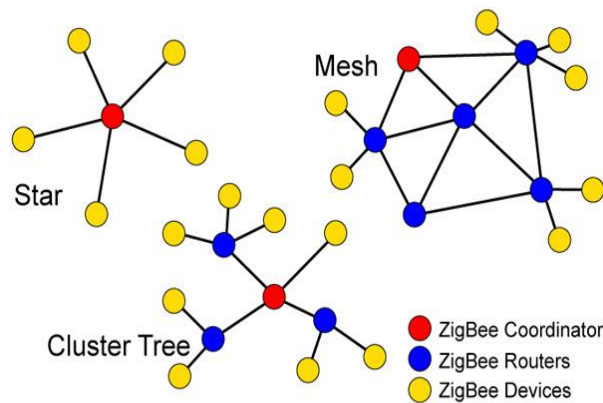


Fig3 Zigbee protocol

## III. SPEED CONTROL OF THE MOTOR

Synchronous speed and rated speed are two speed related to the motor. Rated speed is the maximum speed at which motor (rotor) rotates and synchronous speed is the maximum speed at which magnetic field rotates and is mathematically given by  $N_s = 120f/p$ . where  $N_s$ = synch speed,  $f$ = frequency,  $p$ =no of poles. The difference bet two speed i.e. synchronous speed and actual/rated speed is given by the slip (S) and shows as  $S = N_s - N_r / N_s$ . Where  $N_s$  = synch speed and  $N_r$  = rotor speed. From above two equation actual/ rotor speed of the motor is given by  $N_r = 120f/p (1 - S)$ . Thus the speed of an induction motor depends on slip "S", stator frequency "f" and the no of poles "P" for which the windings are wound. The speed of the induction motor can be controlled by followings method: Stator Voltage Control Method, Frequency Control Method, Stator Voltage and Frequency Control i.e. Volts Hertz Control and Rotor Voltage Control

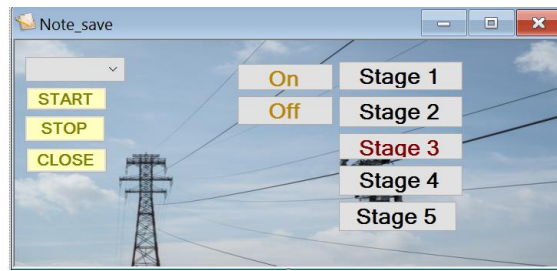


Fig4. Computer Application

There are two parts in our projects 1<sup>st</sup> is transmitter and another is receiver. In transmitter parts Zigbee transmitter is connected to the computer through the USB port and command can be given by computer to the transmitter. In computer applications there are keys which assign the speed and the firing angle. The receiver section consists of microcontroller the single from transmitter is received in receiver and it can be saved in the microcontroller. Now Microcontroller reads the command or data and analyse it and choose appropriate firing angle ( $\alpha$ ) for triggering the triac circuit to control the speed of induction motor. Various firing angles are used to provide voltage to the microcontroller. Triac is triggered at accurate firing angle. By controlling firing angle the gate terminal of the triac can be triggered at different voltages and hence by varying the stator terminal voltages the speed of the induction motor can be controlled.



Fig5. Receiver part

#### IV. RESULTS AND DISCUSSION

This paper a study on speed controlling and monitoring of single phase induction motor using Zigbee technology .by placing the motor at distance about 60-80 meters the experiment is conducted and tested the motor to obtain the various speed by pressing different keys on computer application.

Thus by pressing different keys we can obtain different speed of induction motor.

Sr No.	No. of keys pressed	Status/speed in rpm
1	Key1	ON
2	Key 2	100
3	Key 3	300
4	Key 4	600
5	Key 5	900
6	Key 6	1200
7	Key 7	OFF

#### V. CONCLUSION

In this study a speed control of single phase induction motor can be tested and done by using Zigbee technology. The system developed by using microcontroller is capable of controlling speed of single phase induction motor and ON or OFF the single phase induction motor. The system has high accuracy and long life at compact size and at cheaper cost. The experimental result are evaluated and it is found that the speed of induction motor is controlled in normal, step up and step down speed requirement smoothly by using wireless technology by keeping transmitter and receiver 61 meter away from each other.



## VI. ACKNOWLEDGEMENT

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