Review of Single Phase Induction Motor Controlling

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Abstract: AC motors are predominant in the field of industrial Drives. They are widely used because of their efficiency, less maintenance, construction. Speed control is a vital requirement of industries today. The parameter which takes the features of the induction motor away from the DC motor is its speed control. The speed control of AC Motors by conventional method of pole changing, voltage and frequency are very complicated and require more time and are less efficient or expensive techniques. So in industrial applications where variable speed is required, an easy and quick speed control method has to be employed. Here we are going to make use of 89C51 microcontrollers along with electronic circuitry to regulate the speed and retrieve the real time speed on the digital display screen. The speed measurement will be employed by means of infrared transmitter and receiver. Depending on rotation a pulse will be generated and measured by the microcontroller. This ensures quick speed regulation as per the requirement of the user the firing angle is changed to regulate the speed. This would give the use of real time data of running motor; this will prevent the operator from reaching the maximum speed. Thus overall technique will provide reliable and flexible control on the motor.

Keywords: At89C51, Triac, Single phase Induction Motor, LCD etc.

I. INTRODUCTION

For the improvement of quality product many industrial application requires adjustable speed and constant speed. Due to rapid advance in automation and process control the field of adjustable speed drives continuously. In recent technology, various alternate techniques are available for the selection of speed of drive system. Motor speed control is in huge requirement and we definitely can find their applications in many industrial and commercial sectors. Speed control of the AC motor is a very important parameter in the performance of these motors, the conventional methods of speed control like the Pole changing, Resistance control are time consuming and lack reliability of operation, the size of the circuitry also increases and the efficiency decreases. The aim of this project is to control the AC motor speed with a gentle press of key on a keypad. The speed control of such a motor with the use of Micro-controller and keypad overcomes the above difficulties. For implementation of the system here AT89C51 is used for the purpose of speed monitoring and controlling. The size of the circuit is small along with easy replacement of the electronic components.
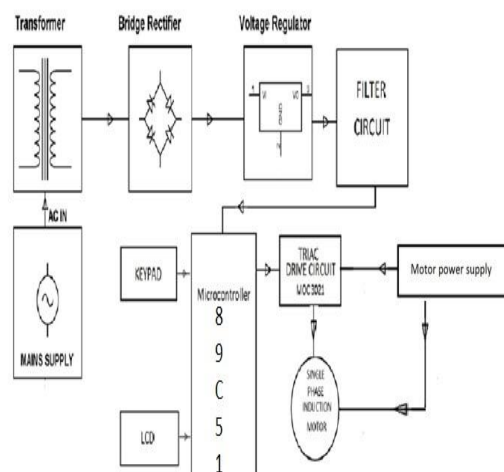
II. BLOCK DIAGRAM

FIG.1.BLOCK DIAGRAM

III. WORKING

When single phase ac supply is given to the stator winding of single phase induction motor, the alternating current starts flowing through the stator or main winding. This alternating current produces an alternating flux called main flux. This main flux also links with the rotor conductors and hence cut the rotor conductors. According to the Faraday's law of electromagnetic induction, emf gets induced in the rotor. As the rotor circuit is closed one soothe current starts flowing in the rotor. This current is called the rotor current. This rotor current produces its own flux called rotor flux. Since this flux is produced due to induction principle so, the motor working on this principle got its name as induction motor. Now there are two fluxes one is main flux and another is called rotor flux. These two fluxes produce the desired torque which is required by the motor to rotate.

A. Triac

Triac is a power electronic component that conducts in both directions when triggered through gate. Figure below shows a generic working of triac. As it can be seen that at time t1,angle of sinusoid is 45'which means that if we triggered triac at this angle i-e at 45',only shaded blue area will pass through the triac and hence through the load. Observe that shaded blue are has RMS Voltage less than the pure sinusoid. This is the basic principle by which RMS Voltage control is accomplished. Firing needs a small pulse at gate that can be give through microcontroller also. Similarly at firing angle 90'(firing angle is an angle with reference zero crossing at which the triac is triggered using gate pulse),only red part of sinusoid will pass through the triac giving us the RMS 110V for 220V.
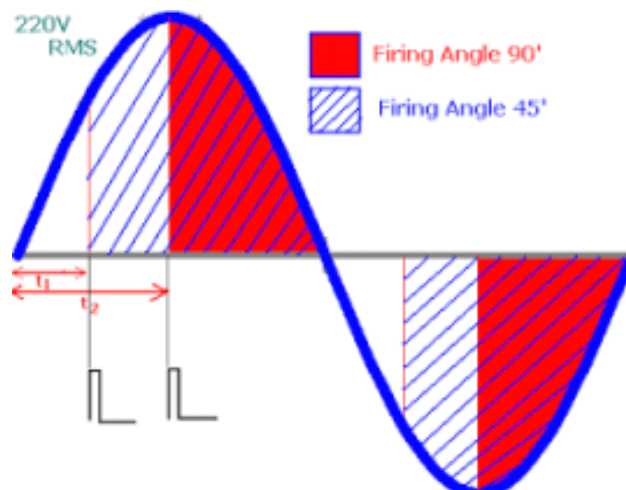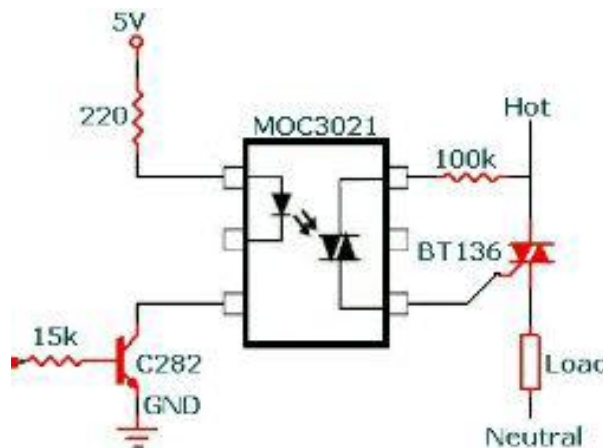

Fig. 2 – Firing angle waveform

There is need of a zero-crossing detector that will give us the reference for providing delay for desired firing angle. The below circuit is mainly used as a dimmer and is often used speed controlling of AC motors.

Fig. 3 – MOC3021 TRIAC driver

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It should be noted here that by using above arrangement we can control the RMS voltage in both directions. What needs to be taken care of, is the triggering time or firing angle.

B. Liquid Crystal Display:

A standout amongst the most widely recognized gadgets joined to a small scale controller is a LCD show. Probably the most widely recognized LCD's associated with the numerous microcontrollers are 16x2 and 20x2 showcases. This implies 16 characters for every line by 2 lines and 20 characters for each line by 2 lines, individually.
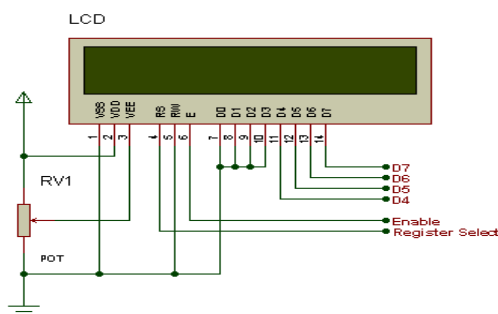

Fig.4LCD

C. SINGLE PHASE INDUCTION MOTOR

Single phase power system is widely used as compared to three phase system for domestic, commercial and industrial purpose .the single phase system is more economical and the power requirement in most of the houses, shops, offices are small, which can be easily met by single phase system. The single phase motors are simple in construction, cheap in cost, reliable and easy to repair and maintain. Due to all these advantages the single phase motor finds its application in vacuum cleaner, fans, washing machine, centrifugal pump, blowers, washing machine, small toys etc.

CONSTRUCTION

Like any other asynchronous motor, induction motors also have two main parts namely rotor and stator.
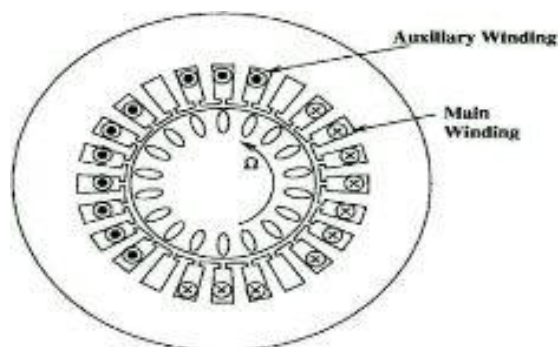
STATOR:

Fig. 5- Stator of Induction motor

As its name indicates stator is a stationary part of induction motor A single phase ac supply is given to the stator of single phase induction motor. The stator of the single phase induction motor has laminated stamping to reduce eddy current losses on its periphery. The slots are provided on its stamping to carry stator or main winding. In order to reduce the hysteresis losses, stamping are made up of silicon steel. When the stator winding is given a single phase ac supply, the magnetic field is produced and the motor rotates at a speed slightly less than the synchronous speed Ns which is given by **: Ns = 120f/p**

Where, f = supply voltage frequency, P = No. of poles of the motor. The construction of the stator of asynchronous motor is similar to that of three phase induction motor except there are two dissimilarity in the winding part of the single phase induction motor.

ROTOR:

The construction of the rotor of the single phase induction motor is similar to the squirrel cage three phase induction motor. The rotor is cylindrical in shape and has slots all over its periphery.
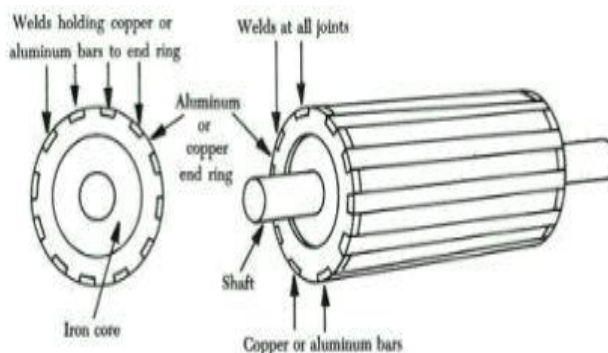
Fig. 6- Rotor of Induction motor

The slots are not made parallel to each other but are bit skewed as the skewing prevents magnetic locking of stator and rotor teeth and makes the working of induction motor more smooth and quieter i.e less noise. The squirrel cage rotor consists of aluminum, brass or copper bars. These aluminum or copper bars are called rotor conductors and are placed in the slots on the periphery of the rotor. The rotor conductors are permanently shorted by the copper or aluminum rings called the end rings. In order to provide mechanical strength these rotor conductor are braced to the end ring and hence form a complete closed circuit resembling like a cage and hence got its name as squirrel cage induction motor. As the bars are permanently shorted by end rings, the rotor electrical resistance is very small and it is not possible to add external resistance as the bars are permanently shorted. The absence of slip ring and brushes make the construction of single phase induction motor very simple and robust.

D.APPLICATIONS
Many industrial applications need adjustable speed and constant speed for the quality of the product can be applied to belt drives applications such as small conveyors, large blowers, pumps as well as many direct drives or geared applications. Wood working machinery, air compressor, high processors, water pumps, vacuum pumps and high torque applications. Quick and more reliable technique is used which increases overall quality of the product Thus it increases the overall efficiency of the system and acts to be more users friendly and cost effective in the procurement of these systems.

IV. CONCLUSION

The project has been designed using Embedded C for microcontroller and LCD with the added advantage of flexibility and ease in working. The implementation of project is also very easy and understandable. This is a user friendly project in which proper care has been taken to keep the circuit arrangement as required by the user.

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