

SPEED CONTROL AND BIDIRECTIONAL ROTATION CONTROL OF INDUCTION MOTOR

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Abstract: *The project is designed to drive an induction motor for the required application in forward and reverse directions using wireless technology. For an example, an exhaust fan can be used in both the directions to fresh air in and throw hot air out. This can be used in case of conventional exhaust a fan that rotates in one direction only. This proposed system demonstrates a technology to rotate a squirrel cage induction motor in both clockwise and counter clockwise direction. It also has the provision to control the direction of the motor using a wireless technology. The proposed system it acts as multiple access technique. The proposed system simulation is validated under the Keil µvision 4.0 software. It contains power supply, controller, relay, AC motor. The proposed system is simulated with the commands input are given into virtual terminal and the three modes of operation are validated with the output of the controller. Controller executes the load to rotate "FORWARD" and "REVERSE" directions.*

Keywords: *Microcontroller, Relay, Induction Motor, etc.*

I. INTRODUCTION

In the present time, in the most of the applications, AC machines are preferable over DC machines due to their simple and most robust construction without any mechanical commutators. Induction motors are the most widely used motors for appliances like industrial control, and automation; hence, they are often called the workhorse of the motion industry. As far as the machine efficiency, robustness, reliability, durability, power factor, ripples, stable output voltage and torque are concerned, three- phase induction motor stands at the a top of the order. Motor control is a significant, but often ignored portion of embedded applications. Motor control applications span everything from residential washing machines, fans to hand-held power tools, and automotive window lift, traction control systems and various industrial drives. All most in all the applications there is a drastic move away from analog motor control to precision digital control of motors using different processors. Digital control of induction motors results in much more efficient operation of the motor, resulting in longer life, lower power dissipation. Although various induction motor control techniques are in practice today, the most popular control technique is by generating variable frequency supply, which has constant voltage to ratio frequency ratio. The field of wireless communications has been in existence since the first humans learned to communicate. In early days of civilization humans would transmit notices of important events, such as enemy invasions or royal births, through the sounding of horns or the lighting of fires. While simple messages could

be effectively transmitted in this manner, in order to communicate over long distances the manpower expense was great, since watchtowers had to be built within sight of each other and continually manned, and the number of messages was small. The induction motor are extensively used in applications and industrial control. The permanent split capacitor single phase induction motor is the simplest and widely used motor of this type. The classification this topic can be used in case of conventional exhaust of fan that rotate in one directional only. This proposed system demonstrates a technology to rotate a squirrel cage induction motor in both clockwise and anticlockwise direction. It also has provision to control the direction of motor using a remote control.

When we require operation of induction motor in both direction as well as speed variation then this system (remote control device using bidirectional rotation and also speed variation) is easily installed.

Example: Electric train system, rolling mills.

II. PROBLEM IDENTIFICATION AND LITERATURE REVIEW

The project is designed to drive an induction motor for the required application in forward and reverse directions using wireless technology. For an example, an exhaust fan can be used in both the directions to fresh air in and throw hot air out. This can be used in case of conventional exhaust a fan that rotates in one direction only. This proposed system demonstrates a technology to rotate a squirrel cage induction motor in both clockwise and counter clockwise direction. It also has the provision to control the direction of the motor using a TV remote. When a TV remote button is pressed, it sends an IR signal in RC5 code which is received by an IR receiver called TSOP-1738. Output from the TSOP is fed to a microcontroller of 8051 family which is interfaced to a relay driver IC. Thereafter, the relay switching is done in by-stable mode for a split-phase induction motor to rotate in forward and reverse directions. In future, it can further be enhanced by controlling the operation of induction motor using thyristors in place of relays for noise free operation.

Now days all home appliances are preferred to control wired and wireless mechanism. In our project we are proposed to control the direction of induction motor high efficiency deliver from input to output supply.

TRANSMITTER:

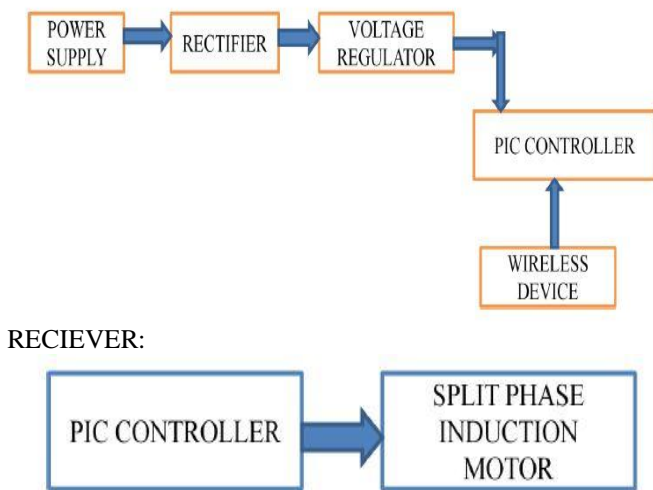


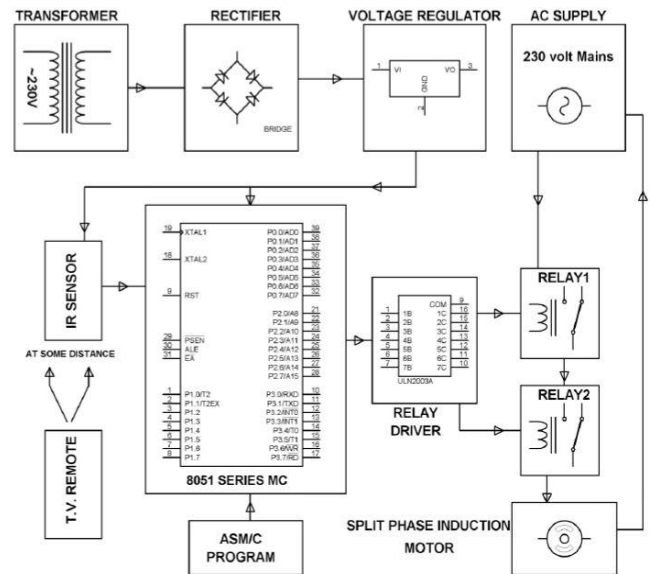
Figure 1. Block diagram of proposed method
 Figure 1 shows the diagram of transmitter and receiver for the proposed method. In this method power supply of 230V is given to rectifier circuit, rectifier is convert the 5v DC and given to voltage regulation it regulates the voltage for controller. Controller is connected with the GSM. It controls the forward and reverse direction.

PLAN OF THE WORK

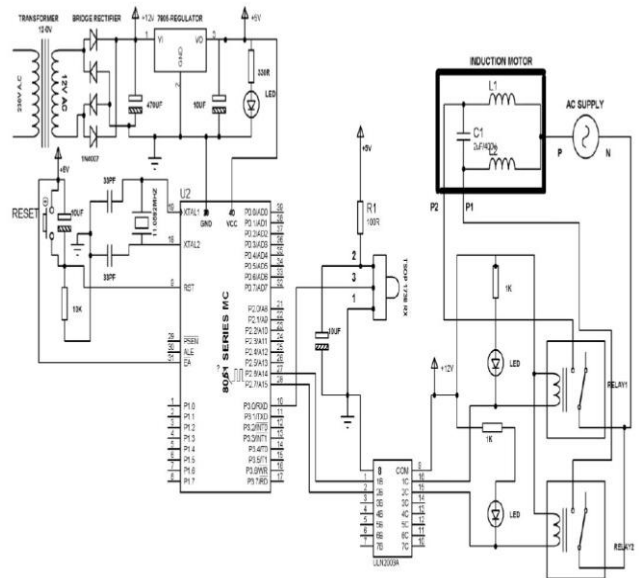


- Material used in their project
- 8051 series Microcontroller
 - Crystal
 - IR Sensor
 - Relay Driver IC
 - Relay
 - Transformer
 - Diodes
 - Voltage Regulator
 - Capacitors
 - LED
 - Resistors
 - TV Remote

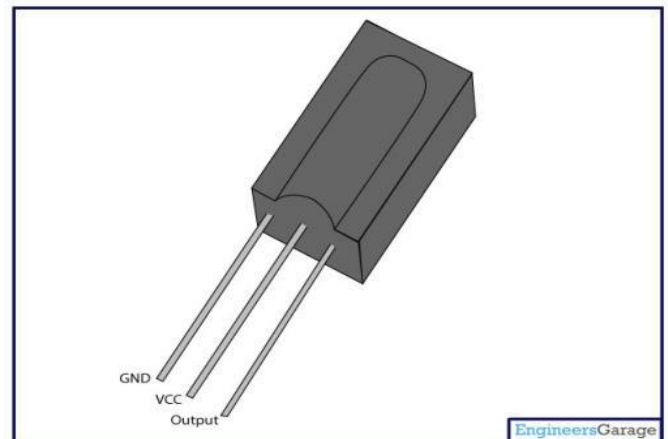
Block diagram of remote control device of induction motor with bidirectional rotation



Circuit diagram



TSOP 1738 RX



The TSOP17... series are miniaturized receivers for infrared remote control systems. PIN diode and preamplifier are

assembled on lead frame, the epoxy package is designed as IR filter. The demodulated output signal can directly be decoded by a microprocessor. TSOP17.. is the standard IR remote control receiver series, supporting all major transmission codes.

Features

- Photo detector and preamplifier in one package
- Internal filter for PCM frequency
- Improved shielding against electrical field disturbance
- TTL and CMOS compatibility
- Output active low
- Low power consumption
- High immunity against ambient light

Power supply:-

Circuit diagram of power supply circuit

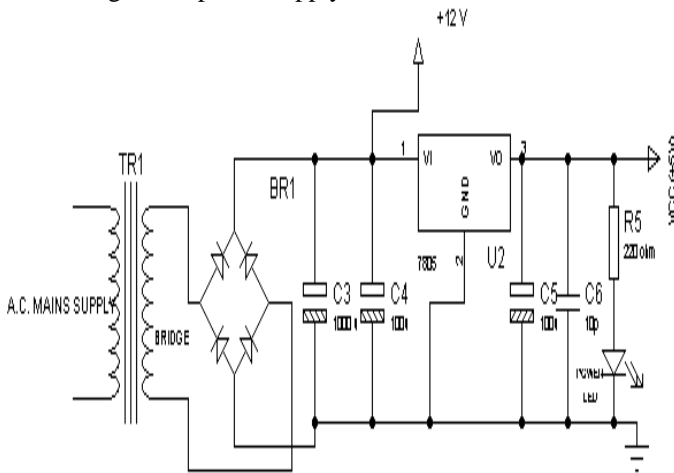


Fig 3 of circuit diagram of power supply circuit

Component of power supply circuit

- 1) Power circuit consists following equipment.
- 2) Step-down transformer of 230/12V
- 3) Bridge rectifier
- 4) IC 7808
- 5) Filter capacitor (Electrolyte capacitor)
- 6) Ceramic Capacitor

The AC supply of 230V is step-downed to 12V by the step-down transformer. And the 12v is now given to bridge rectifier to convert the AC source to DC source. The bridge rectifier consists of four diodes, which two of them comprises forward bias and other two of them reverse bias during the positive half cycle of AC voltage. And vice versa during the negative half cycle of the AC source. After rectification, the 12v DC is given to regulator IC LM7812. The positive voltage regulator IC LM7812, provides a constant 12v DC to the load. This 12v DC supply is used for to drive the motor. Since the output may be pulsating DC, the filters capacitor filters the AC components present in the output to provide a pure DC. And ceramic capacitor used for to reduce the harmonic. Then after another regulated IC LM7805 Is connected which provide 5v DC to the load. 5v DC supply is used for to operate the microcontroller circuit.

Bridge Rectifier: - Rectification is a process of conversion of AC to DC. Here, the AC of transformer output is given to the rectifier input, which converts it to DC output. Basically, bridge rectifiers or diodes arranged in bridge called Diode arrangement are used for power supply design. A bridge rectifier makes use of four diodes in a bridge arrangement to achieve full-wave rectification. This is a widely used configuration, both with individual diodes wired as shown and with single component bridges where the diode bridge is wired internally.

SIMULATION

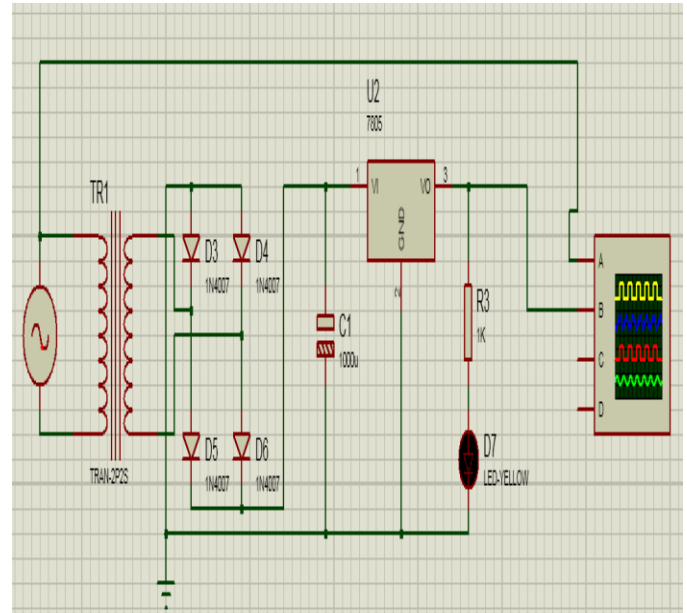


Figure 4. Circuit diagram for Power supply

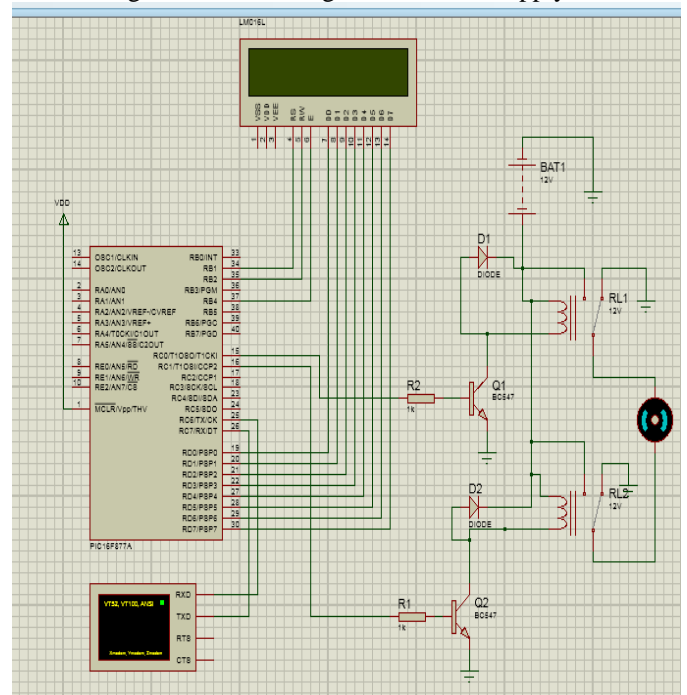


Figure 5. Simulation for Proposed method

Figure 4 represents the purpose of 5V power supply is to provide supply for the microcontroller unit (MCU). Power

supply is supplied with a single step down transformer. In both these power supplies the 230V input supply is stepped down by the step down transformer. In the next stage it is converted in to dc 5V by using a bridge rectifier. The regulator type of 7806 is used to regulate the dc voltage at the output side.

Figure 5 shows the of proposed method in this proposed method In this project, the PIC (Peripheral Interface Controller) series microcontroller has been used .The PIC16F877A device comes in 40-pin controller is associated with An opto-isolator, also called an opto-coupler, photo coupler, or optical isolator, is an electronic device designed to transfer electrical signals by utilizing light waves to provide coupling with electrical isolation between its input and output and relay is connected with AC motor to control the timing. When the proposed converter operates three commands mode in virtual terminal. In virtual terminal is giving the command motor operates for both forward and reverse direction

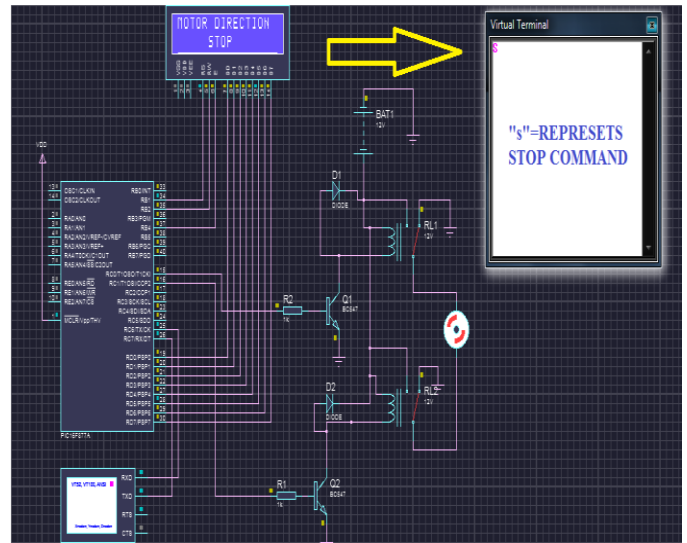


Figure 8. Output for Stop command

Figure 6, 7, 8 shows the diagram of output of the forward, reverse, and stop commands which typed in the virtual terminal and the induction motor rotation for simultaneous response for virtual terminal input.

III. MATLAB SIMULATION FOR SINGLE PHASE INDUCTION MOTOR

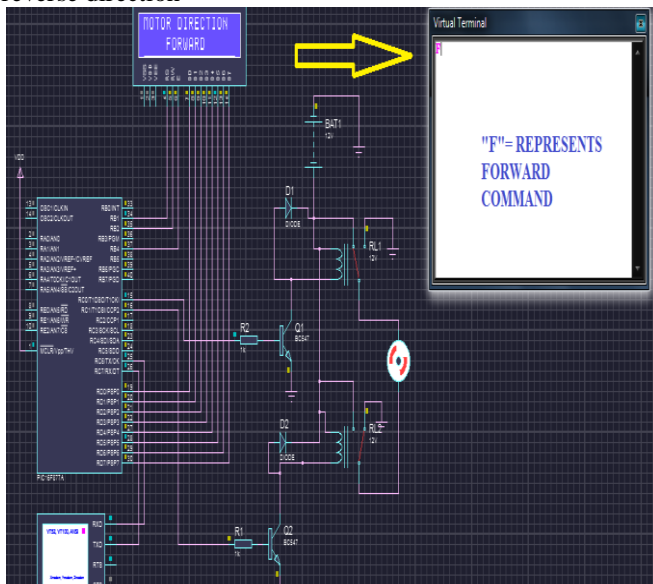


Figure 6. Output for forward direction

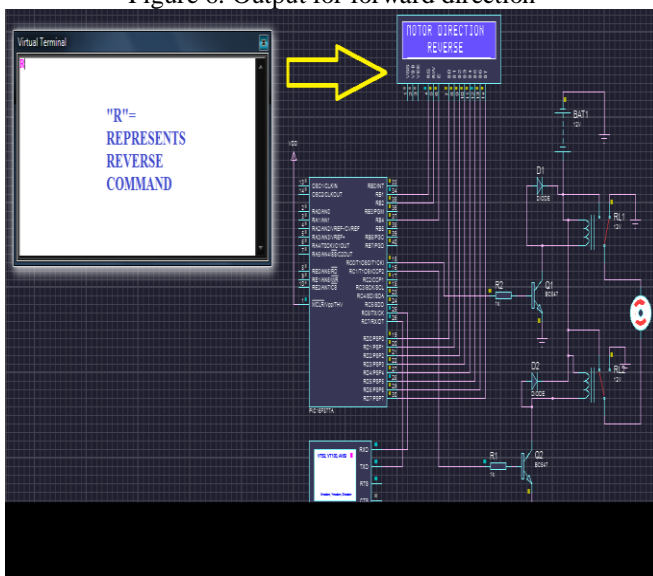


Figure 7. Output for Reverse direction

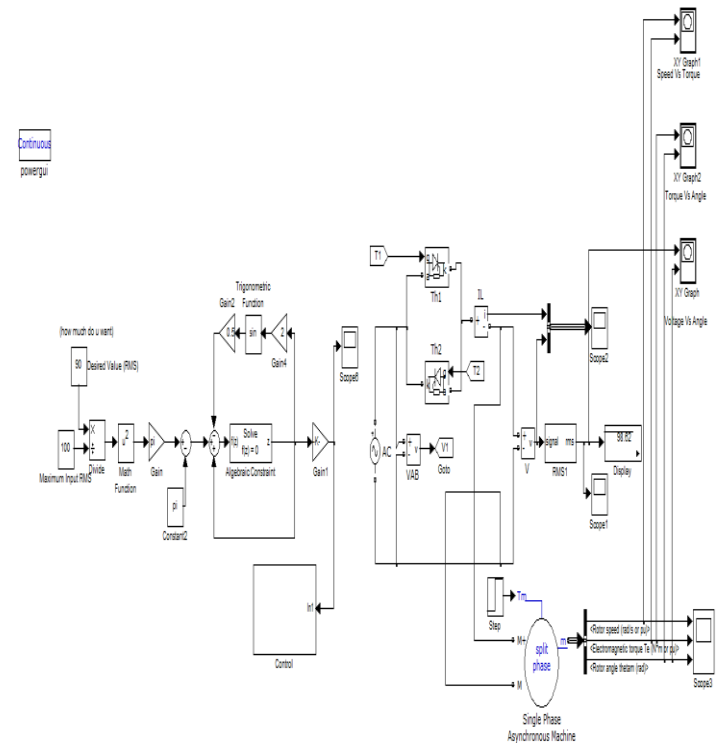


Fig.9 simulation model

The figure show the Simulink modelling of thyristor controlled power for induction motor. In the model of thyristor control the power of induction model , hardware is different to Simulink because hardware have rectifier voltage regulator, opto isolators and 8051 micro controller to generate the pulse bit in Simulink we use the pulse generator to generate the pulse.

Result and Discussion

Result and discussion the modelled circuit was simulated and the results were obtained. The input waveform obtained from the alternating current (AC) signal 220v single phase power line is shown in the figure.

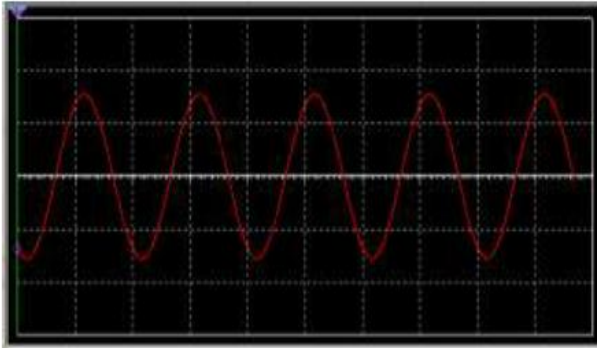


Fig.10 Input AC Signal Voltage 220V

The above signal is fed into the relaxation oscillation circuit to generate an "on" and "off" signal which turns the thyristor "on" and "off" at a present value of potentiometer.

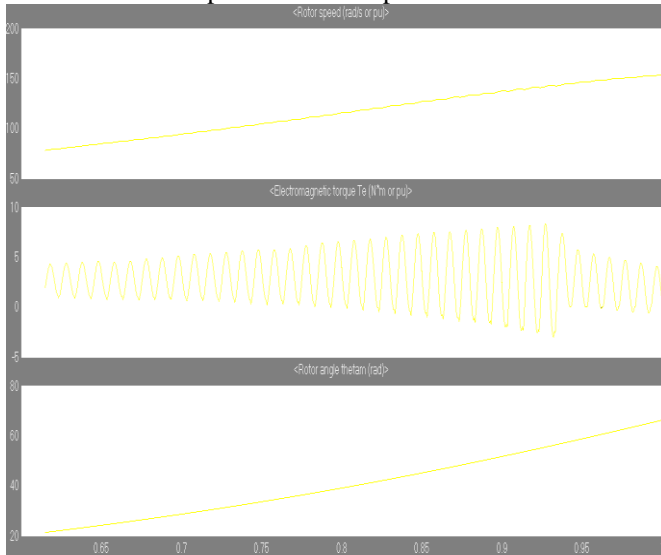


Fig.11 waveform of simulation

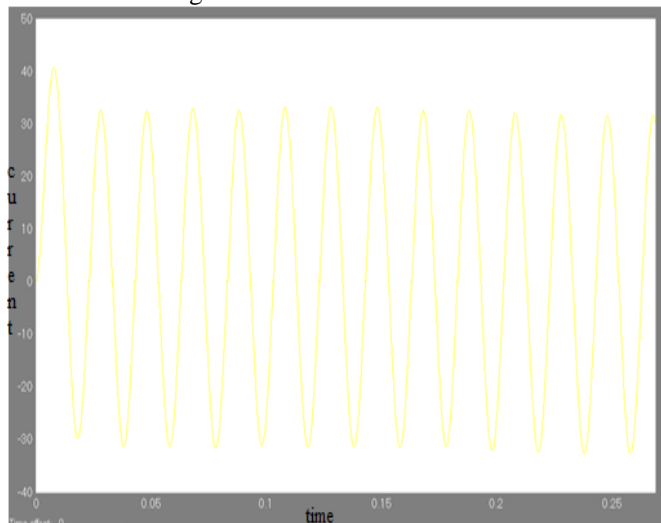


Fig.12 Current Vs Time

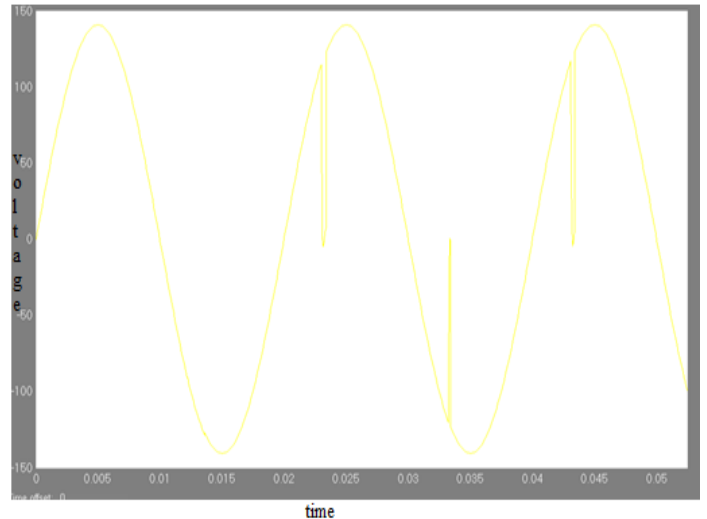


Fig.13 Output voltage Vs Time



Fig.14 RMS Voltage Vs Time

IV. CONCLUSION

This presents a modeling and simulation of single phase AC voltage control for single phase induction motor the simulation results from multisim software have been found in correlation with their counterpart from MATLAB. The speed control of induction motor is achieved by controlling the firing angle. In the bidirectional rotation of induction motor was implemented with proteous software. The proposed system is simulated with the commands input are given into virtual terminal and the three modes of operation are validated with the output of the controller. Controller executes the load to rotate "FORWARD" and "REVERSE" direction depending upon the input we are giving the virtual terminal. In virtual terminal giving the input of "S" the induction Motor stopped. Bidirectional control of induction motor using wireless control for output frequency variations ensure high efficiency to the output system.

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