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WIRELESS SPEED CONTROL OF SINGLE PHASE INDUCTION MOTOR BY RF

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Abstract

1. ***The main objective of this paper is automation of home loads using the radiofrequency technology. And we all know that we all rely on induction motor for our daily use. for general lighting purpose in shops, offices, houses, schools, etc. single phase AC supply is commonly used. Hence, instead of DC motor the motors which work on single phase AC supply are popular use. The numerous domestic application use single phase induction motors the power rating of such motor is very small. Some of them are even fractional horse power motors which are used in applications like small toys, small fans, hair dryer etc. here are numerous practical application like recording instruments, clocks, tele-printers, timing devices, computer peripherals which need special motors. The power rating of such motor also very small. This paper to achieve the automation uses the programmable microcontroller of 8051 family. It consist of two sections transmitter and receiver. The transmitter sections consists of switches to ON / OFF motor and also speed control. This signal is encoded and transmitted using RF transmitter. These signals are received by the receiver and decoder decodes the signal. And this data is feed to microcontroller which gives signal to the Opto-isolator and TRIAC to ON/OFF motor and also speed control.***

2. **Keywords:** ***Induction Motor, Transmitter, WRIM, VFD, EMF Receiver, RF, wireless***

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I.INTRODUCTION: The stator of the induction motor creates the magnetic field with the supply of AC power and rotates in synchronism with AC oscillations. The magnetic field of Induction motors are changing and rotating, the magnetic flux which is rotating continuously produces the torque and current in the windings of the motor. This phenomenon is same as that of the induction of secondary winding of transformer. The difference or slip between actual and the synchronous speed of induction motor varies from about 0.5% to 5.0% for standard design torque curve. There are various speed control methods of induction motor but they are difficult since the conventional system uses large conductors and wires for the speed control application. DC and WRIM drives are displaced by VFD fade cage induction motors To vary its speed. And the most common efficient way was **utilization of VFDs.** But they are having barriers of cost and reliability considerations. We were controlling the speed of induction motor by varying the supply frequency. But if the frequency is decreased, there is a decrease in speed along with the flux which maximize the core losses. And the temperature of the induction motor rises with the decrease in low efficiency. At the same time there is a heavy reduction in torque and a new problem of separate costlier auxillary equipment arises so these becomes hard for us in practical use. Another method was **pole changing method.** Independent stator winding were used to change that means either increase of decrease the number of poles. Different speeds are given by windings since, they have different poles. Not more than two arrangement of poles is possible in practical application due to its limited and complex switching. And another drawback is the method is applicable only to the squirrel cage induction motor with unwound rotor. **Speed control by varying supply voltage** develops the torque proportional to the square of supply voltage. This is the cheapest and easier method, but it is rarely used because of the below reasons. A small change in speed requires a large change in voltage. This large change in voltage will result in a large change in flux density. **Speed control by injected EMF** instead oF adding the resistance in the rotor circuit of the motor we can apply EMFs into the circuit to regulate the speed of motor. These EMFs are introduced at the rotor by a proper source whose frequency must be equal to the slip frequency. the conditions are if EMF

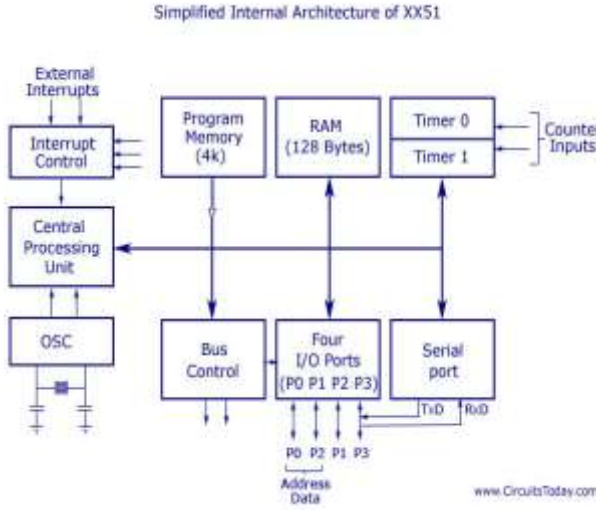
is inserted in phase with the rotor induced EMF produced is equivalent to decrease the rotor resistance and if the inserted EMF is in phase opposition to rotor induced EMF is equivalent to increase in its resistance.in such as way the speed is controlled. As we see there are so many drawbacks there is a need of changing the speed control methods and introduce a new method in the world of industrialization for the growth factor and less complications to employees working there and the name *WIRELESS SPEED CONTROL OF SINGLE PHASE INDUCTION MOTOR BY RF.*

II.EQUIPMENTS USED IN WIRELESS SPEED CONTROL:

1. 8051 Microcontroller
2. Opto- isolator
3. Phase angle control
4. RF
5. Snubber circuit
6. TRIAC switching

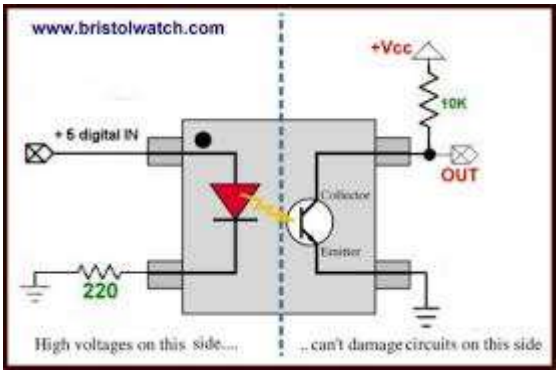
1.8051 MICROCONTROLLER

Microcontroller can be instructed to perform speed control task by a single circuit without changing any hardware circuitry of the project. the microcontroller 8051 have four input output ports. each port composed of eight pins which are configured as input outputs and are based on logic states. microcontroller pin works as an output pin if logic'0' is applied .voltage at that pin will be zero the microcontroller pin work as an input pin if logic one is applied and the voltage at that pin will be 5 volts. microcontrollers are widely used in speed control applications of induction motor by arduino.



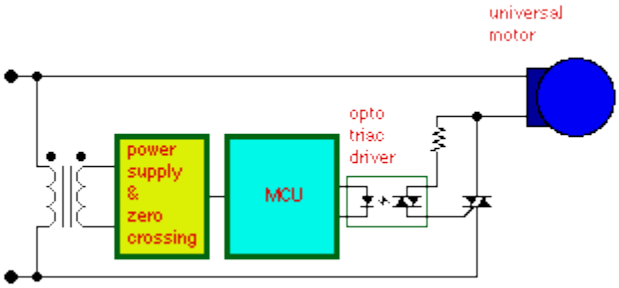
2.OPTO-ISOLATOR

the equipment used in the process of transferring electrical signals from one circuit to another circuit using light is called optical- isolator or optocoupler. They are also known as photocoupler. Opto-isolator IC is made up of single opaque package which consist of combination of LED and photo-transistor. opto-isolators are used in the fields such as switching microprocessor input/output, AC or DC power control, computer communications and regulation of the power supply.



3.PHASE ANGLE CONTROL

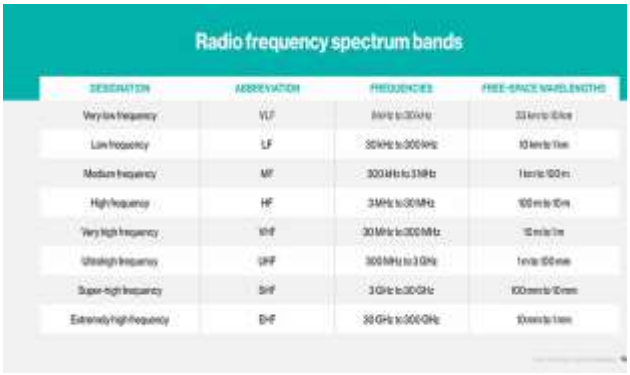
Low frequency switch is used in phase angle control to chop an AC sine wave. voltage is proportional to the area occupy by sine wave. thus, average voltage is the integral from the firing angle to the zero crossing, the cosine of the firing angle. the method to control the average voltage of an AC source provided by phase angle control . To create the torque ripple an acoustic noise the low frequency AC waveform is given to the motor.



4.RF

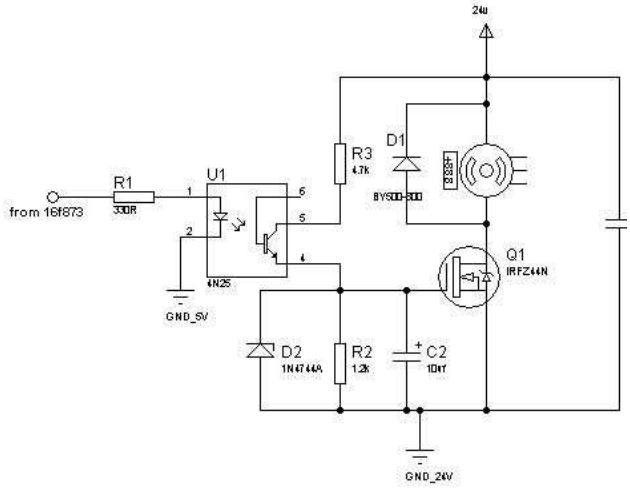
The oscillation rate of electromagnetic radiation spectrum or electromagnetic radio waves are being measured by radio frequency (RF). Frequency ranging from 300 GHz to 9 KHz i.e. both high and low. When radio wave is transmitted radio frequency is measured in number of cycles per second.

1 Hertz=one cycle/second the wireless RF spectrum divided into several ranges or bands is applied in the devices such as cellphones and cordless, radio and television broadcast stations, WIFI and Bluetooth, satellite communication system and two way radios.



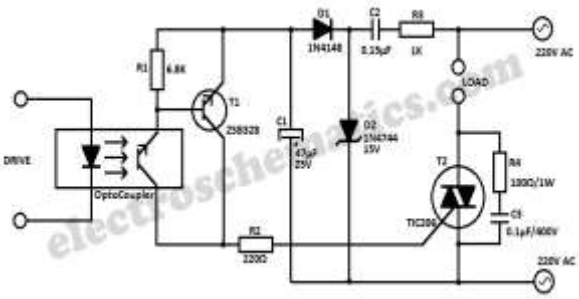
5. SNUBBER CIRCUIT

The main purpose of the snubber circuit is the protection to the unwanted triggering of TRIAC or thyristor due to high rate of rise of voltage that is dv/dt. The condition of rate of rise of anode to cathode voltage of TRIAC is high then it may result to false triggering which is known as dv/dt triggering for the protection of TRIAC we can use undesirable turning arrangement thus to stop the spurious triggering of TRIAC is its main advantage.



6. TRIAC SWITCHING

TRIAC has a unique property and are widely used where sinusoidal AC supply is involved. TRIAC stands for TRIODE for Alternating Current and can conduct in both the directions as it is constructed by combining two SCR in antiparallel state. when TRIACs are used as light dimmers or phase control applications the gate pulse of gate pin is to be controlled by the microcontroller .During this time the gate pin will also be isolated using an opto-coupler. TRIAC switching circuit is likely to experience a particular problem more often than is usual to radio frequency interference because when the load is turned ON, the current gets increased from 0a to maximum value all of a sudden thus creating a burst of electric pulses which causes radio frequency interface.



WORKING

This is designed to control the speed of an single phase induction motor by RF technology. For remote operation using an 8051 series microcontroller. Speed of the AC motor is directly proportional to the voltage applied across its terminal. Hence, if the voltage across motor terminal is varied then the speed can also be vary. We use above principle to control the speed of the motor by varying the trigger pulse applied to it. At the transmitting end, using push buttons commands are send to the receiver to control the speed. The RF transmitter acts as an RF remote control that has the advantage of adequate range (upto200 m) with proper antenna. While the receiver decodes before decodes the command before feeding it to another microcontroller to drive AC motor via a TRIAC through an opto- isolator trigger pulse is generated at the output by the microcontroller as per the program and command received. The program can be written in the assembly language or in Embedded C. the average voltage given or the average current flowing through the motor will change depending on the firing angle of TRIAC. thus, the speed of the motor will change. Further more, it can be enhance by using power electronic devices such as SCRs or IGBTs to achieve speed control, higher capacity industrial motors an the operation can

be switched to Bluetooth for a flexible operation using any android smartphone.

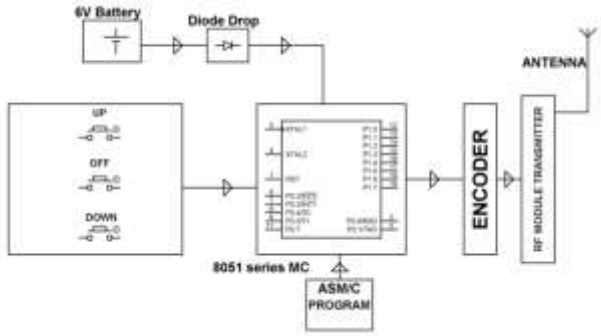


Fig. transmitter section

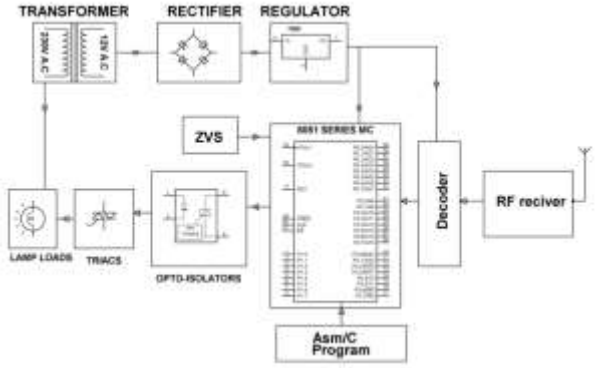


Fig. receiver section

FERATURES OF RF

1. Range in open space (standard conditions):100 meters.
2. RX receiver frequency: 433 MHz.
3. RX typical sensitivity: 105Dbm.
4. RX supply current: 3.5mA.
5. RX IF frequency: 1 MHz.
6. Low power consumption.
7. Easy for application.
8. RX operating voltage: 5V.
9. TX frequency range: 433.92MHz.
10. TX supply voltage: 3V to 6V.
11. TX output power: 4 to 12 Dbm.

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