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Speed Control of Single Phase Induction Motor by Using Wireless Technology

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Abstract
Single phase induction motors are widely used in home appliances and Industrial control because of their low cost and rugged construction. Many industrial processes require variable speed drives for various applications. Many applications need variable speed operation and one of them is a simple fan load. The RF generator which generates the analog output signal for the corresponding button pressed using PCB. This analogue output is fed to the RF Transmitter and sent through the antenna. At the other end, the RF Receiver picks up the signal and feeds it to the signal decoder, there the decoding takes place and this decoding data is given to the Micro controller 89S51. The software in the Micro controller receives the signal and accordingly drives the TRIAC Circuit, which in turn is connected to load serially which is used to generate the PWM pulses for speed control of the single phase induction motor. The main aim of the this paper is to design an real time electronic control system that can be used to control the speed of motors kept at remote locations using an embedded technology.

1. Introduction

Many industrial applications require adjustable speed and constant speed for improvement of quality product. Induction motors are relatively cheap, simple in construction and can be used in hostile environment. The rapid advances in automation and process control, the field adjustable speed drives continue growing. Modern Technology offers various alternators in the selection of speed drive system. Speed control of induction motor is a crying need in industrial application. By changing the frequency, speed of induction motor can be controlled precisely. The Microcontroller provides the pulse width variation signal which is given to the TRIAC circuit, which in turn provides the required frequency for the desired speed. Pulse Width Modulation (PWM) is a common technique for speed control which can overcome the problem of the poor starting performance of a motor. It combines the technique of PWM generation and the control of speed of motor by variable Voltage method using microcontroller (89S51). The basic principle involved in this paper is variable Voltage where, the speed can be controlled by using PWM waves generated by Microcontroller (89S51). The input of the single phase induction motor is 2500rpm, 230V, 2.3A, 200 watt. This has lot of domestic and industrial applications in our daily life. The wireless technology also helps the disables; handicapped, paralyzed people and also the elder people used these technology further betterments. The main objective of this paper is to control the speed of the single phase induction motor by variable Voltage method using wireless technology by microcontroller (89S51).

2. Functional block diagram description

When the user presses a specific key the RF Generator generates the Corresponding analogue output.

This analogue output is fed to the RF Transmitter. The RF Transmitter is initially tuned either to work in the RF range 315MHz to 434 MHz. The options are provided to vary the frequency depending on the RF Receiver. Parameter such has amplitude and frequency can be varied by varying the corresponding potential meters. The RF provides an output that is combination of two different Frequencies of the specific key pressed. So the output from the RF Transmitter will be the Combination of the carrier frequency and analogue frequency generated by the HT12E IC. At the other end the RF Receiver picks up the signals by tuning in to the carrier frequency Of the RF Transmitter. The output of the RF Receiver is fed to the HT12D Receiver; the Receiver accordingly generates the BCD (Binary coded Decimal) output from this IC. The Output that is digital is fed to the Microcontroller (89S51).

The Micro controller (89S51) is initially programmed with the help of the PIC programmer. This PIC Programmer is connected to the PC through the parallel port. The software is developed using the assembly language of the PIC. This programming is done using the software Called MPLAB. The chips come in variety of packages and are very flexible. The main advantages of Micro Controller is it has the data retaining capacity of almost 100 years and secondly all the micro controller are flash micro controller and also occupies very less space and easy to program. Hence the software in the Micro Controller identifies the BCD output from the HT12D Receiver. This output is fed to the Induction Motor which is given in serial through the power supply. Depending on the button pressed by the user the Micro Controller generated PWM (Pulse Width Modulation) that helps to drive the circuit and hence the motor. The small of the pulse width faster the speed of the Induction Motor. It depends on the user requirement any different speed can be set and trigger accordingly. This has lot of domestic and industrial applications in our daily life. The wireless technology also helps the disables, handicaps, and paralyzed people and also the elder people used these technology further betterments. Thus it increases the overall

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efficiency of the system and acts to be more users friendly and cost effective in the procurement of these systems.

Transmitter Module

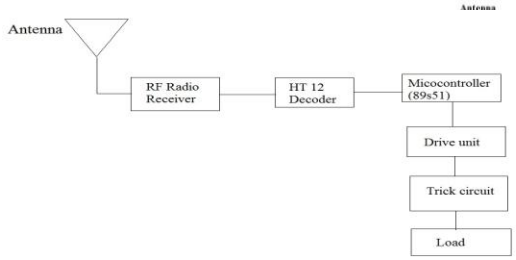
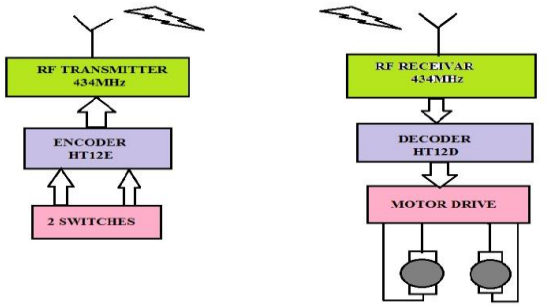


Fig: 1. Receiver module

3. RF Tranmitter and RF Receiver

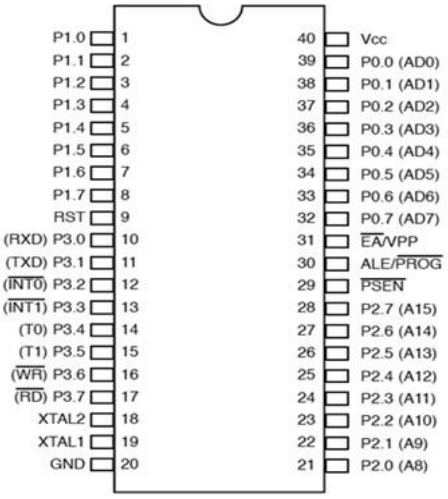
Here I have constructed a simple 434MHz ASK based wireless remote control capable of transmitting 4-bits of information i.e. you can directly interface this data with your motor driver to control your bot. First of all you need suitable transmitter and receiver modules. The one that I found suitable are 434MHz Transmitter And 434MHz Receiver. The frequency of operation of these modules is in UHF band from 315MHz to 434MHz. They work well at 5V. The transmitter accepts serial data at a maximum speed of 4800 bauds/sec. Bauds /second means symbols per second and a symbol may consist of varying number of bits, generally, 8-bits. You would be thinking that why I used only these TX-RX modules. This is because, they are easy to use. They can be interfaced to a Microcontroller or can be directly interfaced with the encoder and decoder ICs at the transmitter and receiver side respectively.



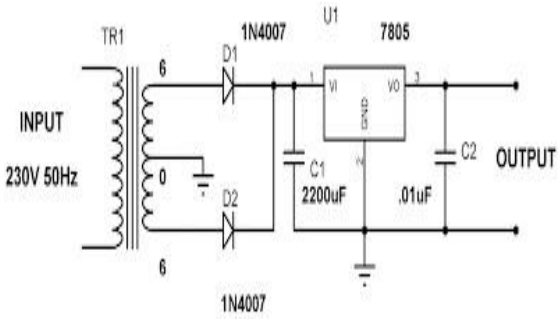
4. Micro Controller IC 89S51

The AT 89S52 is a low-power, high-performance CMOS 8-bit microcontroller with 8K bytes of in-system programmable Flash memory. The de vice is manufactured using Atmel's high-density nonvolatile memory technology and is compatible with the industry-standard 8051 instruction set and pin out. The on-chip Flash allows the program memory to be reprogrammed in-system or by a conventional nonvolatile memory programmer. By combining a versatile 8-bit CPU with in-system programmable Flash on a monolithic chip, the Atmel AT89S51 is a powerful microcontroller which provides a highly-flexible and cost-effective solution to many embedded control applications. The AT89S51 provides the following standard features: 8K bytes of Flash, 256 bytes of RAM, 32 I/O lines, Watchdog timer, two data pointers, three 16-bit timer/counters, a six-vector two-level interrupt architecture, a full duplex serial port, on-chip oscillator, and clock circuitry. In addition, the AT 89S51 is designed with static logic for operation down to zero frequency and supports two software selectable power saving modes. The Idle Mode stops the CPU while allowing the RAM, timer/counters, serial port, and interrupt system to continue functioning. The Power-down mode saves the RAM contents but freezes the oscillator, disabling all other chip functions until the next interrupt or hardware reset.

5. Power Supply Circuit



The correct voltage supply is most important for the proper functioning of the micro controller system. For a proper function of Microcontroller (89S51), it is necessary to provide a stable source of supply when you turn it on. The power supply circuit for powering the Microcontroller is shown Fig. In order to function properly, or in order to have stable 5V at the output, the input voltage on pin-1 of LM7805 should be between 7V to 24V. Output voltage Pin-3 fixed 5Volt and Pin-2 GND. Depending on current consumption of device we will use the appropriate type of voltage stabilizer LM7805. There are several versions of LM7805 for current consumption of up to 1A.



6. Control Circuit

The connection diagram of Induction Motor control circuit from the Microcontroller (89S51) is shown in Fig. The Micro- controller (89S51), according to the key pressed in the PCB, generates the PWM signals. This PWM signals are fed to the transistor base for switching action. When

pulse is given to the transistor from the micro controller +5V is coupled to the gate of the TRIAC through MOC3021 and hence the firing angle is varied depending on the ON of the pulse fed to the transistor base. By varying the ON and OFF of the pulse fed from the Microcontroller to the transistor the firing angle of the TRIAC is varied and hence the speed variation of the Induction Motor. The MOC3021 is used to isolate the 230V supply, so as to protect the Microcontroller (89S51). The software in the Microcontroller will decode the Analog data obtained from the RF Receiver. After decoding the data it will check for the password. If it found to be correct, it will give a short beep. Once the password is correct it takes the command from the user and depending on the command received by the user the Microcontroller will according generate a Pulse Width Modulation output at a fixed known frequency. As the user presses buttons the PC decodes the same and generates the frequencies as required by the user. This PWM Output is connected to the signal conditioning circuit and to the load.

7. Experimental Validation

This paper concerned on the experimental studies on Single phase Induction motor load for speed control using wireless Technology through the microcontroller. The experiment is conducted by placing motor at a distance of about 15-20 meters and tested the motor to obtain various speeds by pressing the keys in the keypad.

Sr. No.	Duty Cycle	Voltage (Volt)	Speed (RPM)
1.	0.09	62	1210
2.	0.18	66	1248
3.	0.26	69	1366
4.	0.34	76	1402
5.	0.55	84	1488
6.	0.60	92	1520
7.	0.72	98	1632
8.	0.78	102	1708
9.	0.86	113	1788
10.	1.0	119	1900

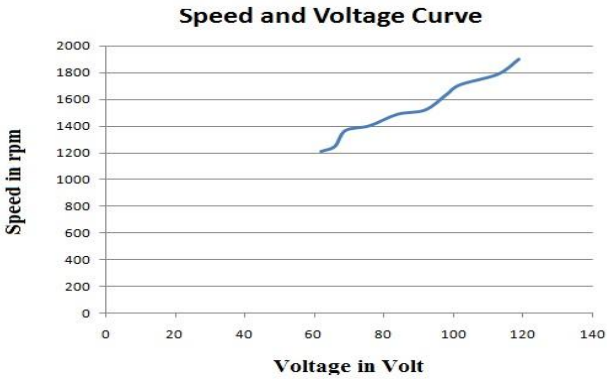


Fig: 1. Graph between Speed and Voltage

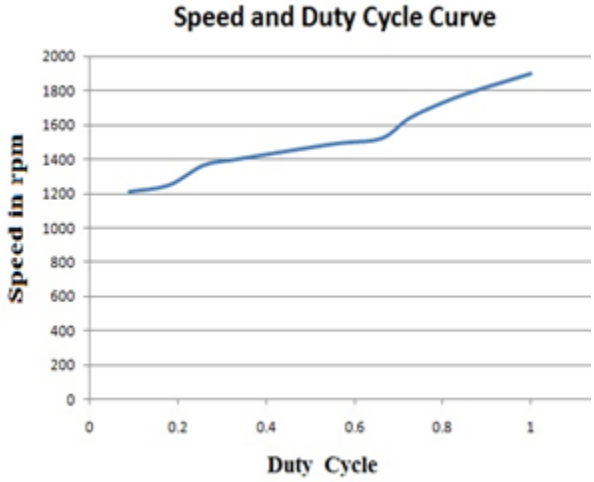


Fig: 2. Graph between Speed and Duty Cycle

8. Conclusion

This is the method in controlling of the Induction Motor speed. The speed control of Induction Motor is performed using wireless technology by the Micro controller (89S51). It has high reliability and long life at low cost and easily control. The experimental results are analyzed and, it's found that the speed of the induction motor is controlled in Normal, step up, step down speed requirement smoothly using wireless technology keeping 15-20 meters as the distance between transmitter and receiver section.

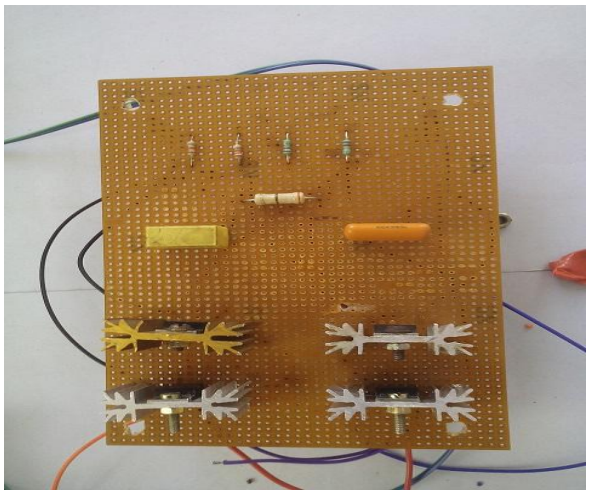


Fig: 3. Drive Control for Induction Motor

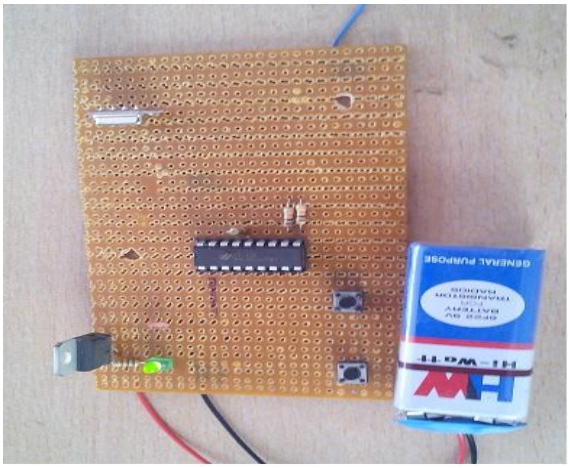


Fig: 4. Transmitter Section

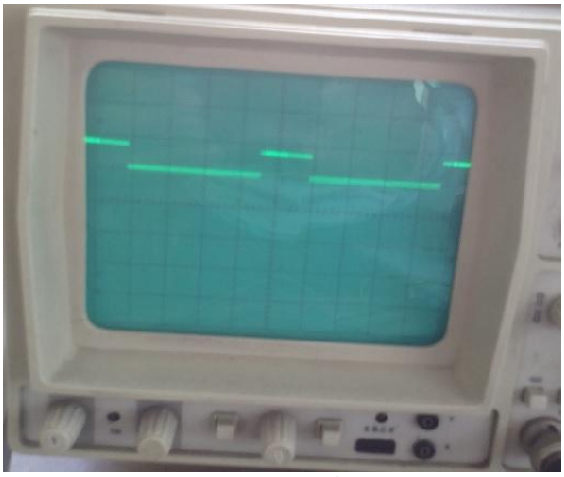


Fig: 5. Pulse Pattern for a Speed

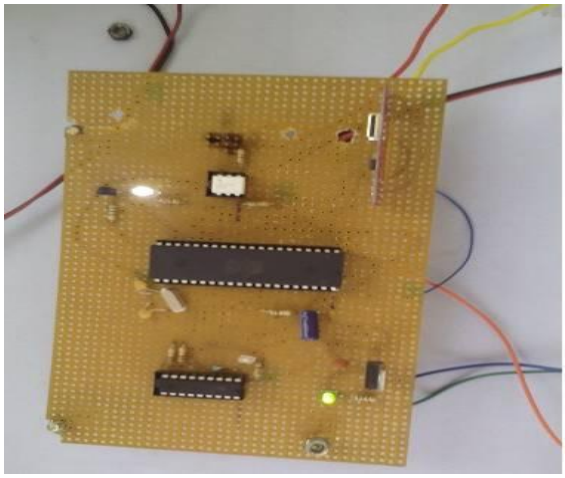


Fig: 6. Receiver Section

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