

WIRELESS SPEED CONTROL OF SINGLE PHASE AC MOTOR

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ABSTRACT

The main aim of conducting this project is to speed control of a single phase ac motor using ASK modulation and demodulation technique by means of wireless with PC based which is implemented through micro-controller and Arduino 1.6.5 software. In this we are using ASK module unit for wireless communication. To meet this requirement we have connected a five pole Rheostat to the single phase ac motor to achieve different speed of control. This is smooth and safe to control and easily accessible and reliable.

Keywords: Amplitude-shift keying (ASK), HT12D, Rheostat, Arduino 1.6.5 software, HT12E, microcontroller, Ac motor

1. INTRODUCTION

In this study, speed control of a single phase ac motor has been implemented by using a standard five pole rheostat and ASK module for wireless communication. To drive the motor a digitally controlled drive system has been designed. Then a HT12D [3] decoder circuit, relays and rheostat have been added between output of a ASK demodulator and the drive system of the motor. This system is flexible to be controlled with ASK module and PC based. With the developed drive and control system the speed control of the motor has been achieved. The system has been tested for different speed, position and direction conditions successfully. The experimental results verify that the ASK [2] module and Rheostat with relays [7] controlled drive system is highly effective, reliable, proper and applicable to achieve different state of speed control of the motor. It overcome the wire with more dissipation of power and complexity of connection. Also, there is no hazardous element is used in the circuitry hence it is reliable and easily accessible in hazardous area.

Single-phase Ac motors [8] are widely used in home appliances like fans, cooler etc. and industrial control. The multi speed operation are provided by controlling the speed of these motors. This paper is variable speed drive of single phase shaded pole induction motor using ASK. It is to develop the solid state control system to be reliable and economically feasible to use with fractional horse power motors.

2. WORKING

In this project, there are two circuit transmitter and receiver.

In transmitter side, circuit consists Arduino board with micro controller, HT12E encoder and ASK modulator.

Program is executed in Arduino 1.6.5 software and uploaded to micro controller in input port side through USB cable and four output is taken from output port namely 3, 4, 5 and 6. Further data is transferring to the HT12E [1] encoder which encode the data and converts the parallel inputs into serial output and given to the ASK modulator.

ASK means Amplitude Shift Keying (also known as ON-OFF keying) [2]. It's one of the Modulation Scheme used to transmit Digital Data using High Frequency carrier signal.

It's very simple and popular method. It transmits 1's and 0's of Digital Data by transmitting carrier or no carrier like

- Bit 1 (logic high) is Transmitted with carrier frequency F_c
- Bit 0 (logic low) is Transmitted with no carrier

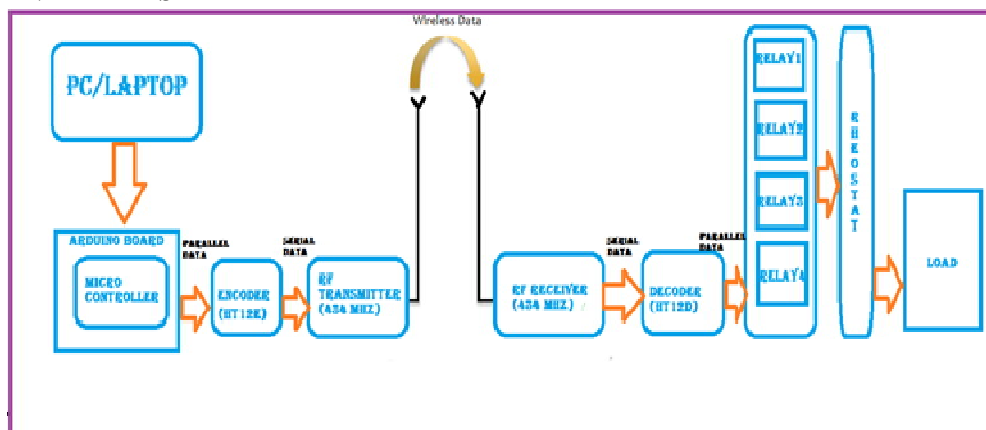
Means series of bits – bit stream is transmitted as carrier ON and carrier OFF. That’s why it is also known as ON-OFF keying.

In receiver side, ASK module receives the signal and decoded by HT12D IC decoder i.e., HT12D [3] converts the serial input into parallel outputs. It decodes the serial addresses and data received by, say, an RF receiver, into parallel data and sends them to output data pins. The serial input data is compared with the local addresses three times continuously. The input data code is decoded when no error or unmatched codes are found. A valid transmission is indicated by a high signal at VT pin. HT12D is capable of decoding 12 bits, of which 8 are address bits and 4 are data bits. The data on 4 bit latch type output pins remain unchanged until new is received. The data again goes to one of the Relay via Resistor of 1.5k and N-P-N transistor (BC547) which ON/excited the Relay .and at the same time Diode (IM4007) is connected in parallel to set proper polarity. Further it connected to the single phase shaded pole ac motor via 5 pole Rheostat.

The 12 V power supply is used for Relay control. The 5 V power supply is used for transmitter circuit and HT12E IC. In transmitter circuit, ASK modulator IC is used as a form of amplitude modulation that represents digital data as variations in the amplitude of a carrier wave of frequency 434 MHZ. In receiver side, ASK receives and demodulate the signal and decode through HT12D decoder and send to rheostat via relays is further connected to four points of 5 pole of rheostat which is used to achieve four different speed of single phase shaded pole ac motor. In this paper, we can achieve with four steps with different speed by pressing key from keyboard of pc.

In this way, we achieve four different speed by passing different pole of rheostat.

3. FIGURES AND TABLES



3.1 BLOCK DIAGRAM

3.2 CIRCUIT DIAGRAM

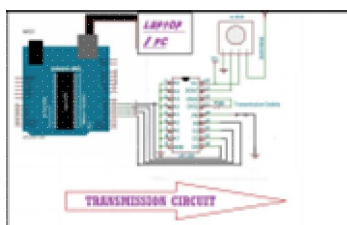


Figure 1 Transmitter circuit diagram

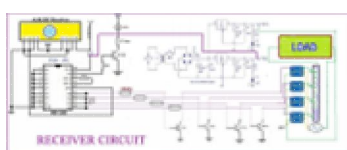


Figure 2 Receiver circuit diagram



Figure 3 wireless speed control of single phase ac motor

4. RESULT

If we press “1” on keyboard, output pin of micro controller[5] pin no.# 3 will HIGH and Others 4,5,6 will be LOW and corresponding first relay[7]will be ON and passes through very high resistance pole in relay and we achieve minimum speed say VERY LOW SPEED.

If we press “2” on keyboard, output pin of micro controller pin no. # 4 will HIGH and Others 3, 5, 6 will be LOW and corresponding second relay will be ON and passes through very high resistance pole in relay and we achieve MEDIUM SPEED.

If we press “3” on keyboard, output pin of micro controller pin no. #5 will HIGH and Others PIN NO. 3, 4, 6 will be LOW and corresponding third relay will be ON and passes through high resistance pole in relay and we achieve HIGH SPEED.

If we press “4” on keyboard, output pin of micro controller pin no. #6 will HIGH and Others PIN NO. 3, 4, 5 will be LOW and corresponding fourth relay will be ON and passes through MINIMUM resistance pole in relay and we achieve VERY HIGH SPEED.

If we press “s” or “S” on keyboard, output pin of micro controller pin no. 3,4,5,6 will be LOW and STOP the motor.

Table 1 wireless speed control of single phase ac motor

Input command	Output pin 3	Output pin 4	Output pin 5	Output pin 6	SPEED OF MOTOR
Press #1	HIGH	LOW	LOW	LOW	VERY LOW
Press# 2	LOW	HIGH	LOW	LOW	LOW
Press# 3	LOW	LOW	HIGH	LOW	HIGH
Press# 4	LOW	LOW	LOW	HIGH	VERY HIGH
Press# S or s	LOW	LOW	LOW	LOW	STOP

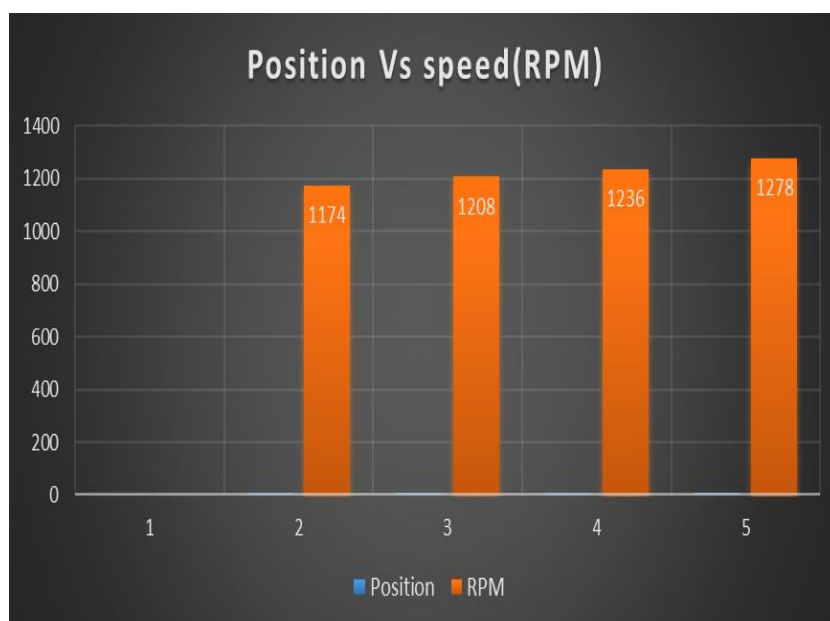


Figure 4 Position vs. speed (RPM) graph

5. FUTURE MODIFICATION

Adding of number of load control by using programming.

Adding of number of step at different speed.

Power consumption may be reduced further by using perfectly matched components.

6. ADVANTAGE

Wireless Control for domestic and industrial use.

Can be operated at inaccessible locations.

Easy of operation

Circuit is more protective due to using of relays [7].

By using any PC or laptop possible to on/off motor.

Speed of motor varies simple pressing remote PC/Laptop keyboard buttons.

7. DISADVANTAGE

If receiver module range not available then does not possible to communication between them.

8. APPLICATION

In home automation application, convinced of remotely controlling the speed of fan is achieved. Many industrial applications require adjustable speed and constant speed for improvement of quality product.

Intensity of light can also be controlled with the help of android application.

Bell drive application like small conveyors, large blowers, pumps as well as many direct drive or geared application.

Wood working machinery air compressors, high processors, water pumps, vacuum pump and high torque application

9. CONCLUSION

To control the speed of an AC motor [8] by wireless communication using ASK decoder technique. The applications for ASK signalling are tremendous. It's one of the Modulation Scheme used to transmit Digital Data using High Frequency carrier signal. It's very simple and popular method. It transmits 1's and 0's of Digital Data by transmitting carrier or no carrier. ASK offers highly reliable, cost effective signalling solutions which require no development effort on the user's part. This signalling technique has been applied to a multitude of control and data communications systems. Wireless Control from Remote places, Easy of operation by using any PC/Laptop possible to achieve different speed of motor. Man mistake has been reduced Speed of motor varies simple pressing keyboard buttons. Reduce maintenance. Fault detection is easy.

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