PC Based Speed Control of Induction Motor

Ms. Preeti Dhiman, Deepankar Anand, Ekta Singh and Komal Grover

Abstract—**In industrial surroundings induction motors are gaining popularity due to their performing proficiency. Mostly hardware manual control system is used for controlling the various parameters of induction motor such as speed, torque, direction and frequency. In the present paper, we are controlling the speed of an induction motor by controlling the voltage required to drive the motor by using Thyristor. The whole procedure for controlling the speed of an induction motor is being done by coding in MATLAB. This method of controlling speed of induction motor is advantageous as compared to other conventional methods using techniques which require wires for their proper implementation.**

Keywords—MATLAB, optocoupler, HT12E(12-bit encoder), HT12D(12-bit decoder), Microcontroller, M9MZ60G4Y 4P 60 W 200 V / 220 V (induction motor).

1. INTRODUCTION

A simplest method to control the rotation speed of an Induction motor is to control its driving voltage. The higher the voltage is, the higher speed the motor tries to reach. An induction or asynchronous motor is a type of AC motor where power is supplied to the rotor by means of electromagnetic induction, rather than by slip rings and commentators as in slip-ring AC motors. These motors are widely used in industrial drives, particularly poly phase induction motors, because they are robust, have no friction caused by brushes, and their speed can be easily controlled. Various other methods are also been used like fuzzy logic approach which makes use of Simulink. Another method called ANFIS (Adaptive Neuro-Fuzzy Inference System) is also used in some approaches of speed control of induction motor.

In this research paper we are going to introduce speed control of induction motor. In this paper we are using MATLAB to generate code for controlling induction motor connected at the parallel port. At the pc parallel port we have connected RF transmitter, to transmit code to the remote location. At the remote location we have RF receiver microcontroller and Induction motor. The microcontroller receives decoded binary signal and performs programmed logical operation on motor.

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2. WORKING METHODOLOGY

In recent years, speed control of induction motor drive is widely used in high performance drive system because of its advantages like high efficiency, very simple , extremely rugged, good power factor and it does not require starting motor. Induction motors are used in many applications such as HVAC, Industrial drives control, automotive control, etc... In recent years there has been a great demand in industry for adjustable speed drives [1].

Fuzzy logic control has found many applications in the past decade. The simulation work in fuzzy logic controller is to be done by varying the change of mutual inductance and rotor resistance which in itself is a major problem. Fuzzy Logic, deals with problems that have vagueness, uncertainty and use membership functions with values varying between 0 and 1 [2]. This means that if a reliable expert knowledge is not available or if the controlled system is too complex to derive the required decision rules, development of a fuzzy logic controller become time consuming and tedious or sometimes impossible.

The advantage of coding in MATLAB is that it control the speed of induction motor using low cost PC based platform. The code generated will be sent to the parallel port of PC from where it will be converted into digital form.

Pin number on connector	**I/O Direction**	**Active Polarity**	**Signal Description**
1	Output	0	Strobe (data available signal).
2-9	Output	-	Data lines (bit 0 is pin 2, bit 7 is pin 9).
10	Input	0	Acknowledge line (active when remote system has taken data).
11	Input	0	Busy line (when active, remote system is busy and cannot accept data).
12	Input	1	Out of paper (when active, printer is out of paper).
13	Input	1	Select. When active, printer is selected.
14	Output	0	Auto feed. When active, the printer automatically inserts a line feed after

			every carriage return it receives.
15	Input	0	Error. When active, there is a printer error.
16	Output	0	Init. When held active for at least 50 µsec, this signal causes the printer to initialize itself.
17	Output	0	Select input. This signal, when inactive, forces the printer off-line.
18-25	-	-	Signal ground.

Table 2.1: Parallel port signal

Table 2.1 shows pin details of the standard parallel port (SPP) and their traditional usage. The base address of the first parallel port (LPT1) is 378 (hex) or 888 (decimal). The data port of the parallel port can be accessed at its base address. The status port can be accessed at base address+ 1, i.e., 0379 hex (or 889 decimal). The control port can be accessed at base address+ 2, i.e., 037A hex (or 890 decimal). In case you are using LPT2 port, then substitute the base address of LPT2 as 0278 (hex) in place of 0378 (hex).

The circuit for interfacing the PC's parallel port to the devices to be controlled. The parallel port outputs the control signals generated by the software. The control signals are not continuous but a single clock pulse. For every 'on' or 'off' control, only a single clock pulse is sent from the parallel port to the circuit.

A. TRANSMITTER SECTION:

1. The transmitting site checks the busy line to see if the receiving is busy. If the busy line is active, the transmitter waits in a loop until the busy line becomes inactive.
2. The transmitting site places its data on the data lines.
3. The transmitting site activates the strobe line.
4. The transmitting site waits in a loop for the acknowledge line to become active.
5. The transmitting site sets the strobe inactive.
6. The transmitting site waits in a loop for the acknowledge line to become inactive.
7. The transmitting site repeats steps one through six for each byte it must transmit.

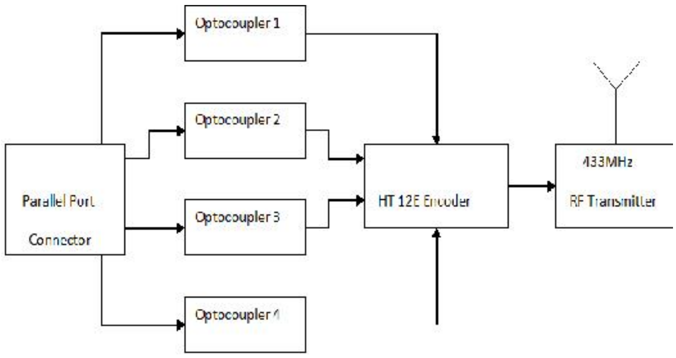

Figure 2.1 Transmitter section block diagram

There are many situations where signals data need to be transferred from one subsystem to another within a piece of electronics equipment, or from one piece of equipment to another, without making a direct ohmic electrical connection. Often this is because the source and destination are (or may be at times) at very different voltage levels like a microprocessor which is operating from 5V DC but being used to control a triac which is switching 240V AC. In such situations the link between the two must be an isolated one, to protect the microprocessor from overvoltage damage. Relays can of course provide this kind of isolation, but even small relays tend to be fairly bulky compared with ICs and many of today's other miniature circuit components because they are electro-mechanical, relays are also not as reliable and only capable of relatively low speed operation. When there is a need of small size, higher speed and greater reliability, a much better alternative is to use an optocoupler. These use a beam of light to transmit the signals or data across an electrical barrier, and achieve excellent isolation. Optocouplers typically come in a small 6-pin or 8-pin IC package, but are essentially a combination of two distinct devices: an optical transmitter, typically a gallium arsenide LED (light-emitting diode) and an optical receiver such as a phototransistor or light-triggered diac. The two are separated by a transparent barrier which blocks any electrical current flow between the two, but does allow the passage of light. The basic idea is shown in Fig.1, along with the usual circuit symbol. HT 12E (Encoder).

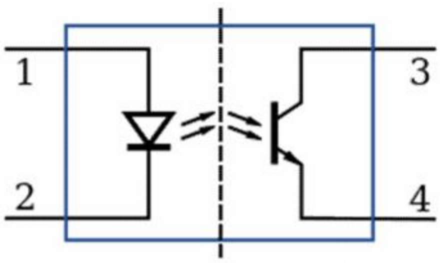

Figure 2.2: Optocoupler

The 212 encoders are a series of CMOS LSIs for remote control system applications. They are capable of encoding information which consists of N address bits and 12_N data bits. Each address/ data input can be set to one of the two logic states. The programmed addresses/data are transmitted together with the header bits via an RF or an infrared transmission medium upon receipt of a trigger signal. The capability to select a TE trigger on the HT12E or a DATA Trigger on the HT12A further enhances the application flexibility of the 212 series of encoders. The HT12A additionally provides a 38 kHz carrier for infrared systems.

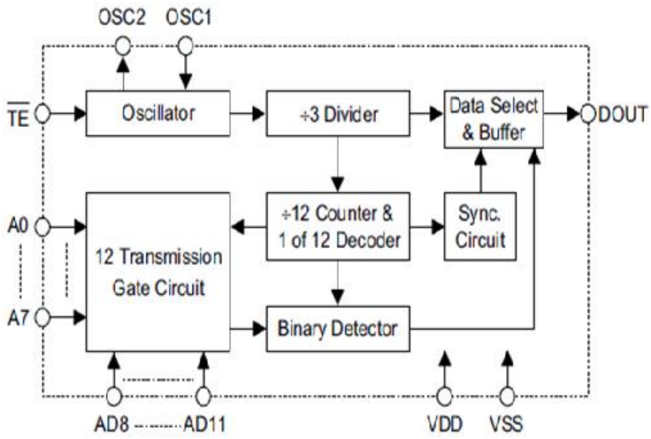

Figure 2.3: Block diagram of HT12E

A. RECEIVER SECTION:

1. The receiving site sets the busy line inactive (assuming it is ready to accept data)
2. The receiving site waits in a loop until the strobe line becomes active.
3. The receiving site reads the data from the data lines (and processes the data, if necessary).
4. The receiving site activates the acknowledge line.
5. The receiving site waits in a loop until the strobe line goes inactive.
6. The receiving site sets the acknowledge line inactive.
7. The receiving site repeats steps one through six for each additional byte it must receive.

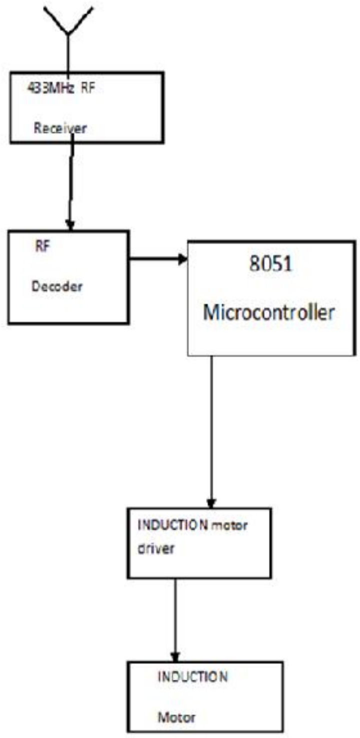

Figure 2.4: Block diagram of Receiver section

B. RF Receiver:

HT 12D Receive and decode 12 bit encoded data transmitted by HT12E, for further processing. The HT12D is 12 bit decoders are a series of CMOS LSIs for remote control system applications. They are paired with Holtek's 2^12 series of encoders. For proper operation, a pair of encoder/decoder with the same number of addresses and data format should be chosen. The decoders receive serial addresses and data from a programmed 2^12 series of encoders that are transmitted by a carrier using an RF transmission medium. They compare the serial input data three times continuously with their local addresses. If no error or unmatched codes are found, the input data codes are decoded and then transferred to the output pins. The VT pin also goes high to indicate a valid transmission. The 2^12 series of decoders are capable of decoding information that consist of N bits of address and 12_N bits of data. Of this series, the HT12D is arranged to provide 8 address bits and 4 data bits.

The decoded data is used to control the speed of induction motor in various ways. Here we using pulse width modulation technique with microcontroller logic [3], [4].

C. MICROCONTROLLER LOGIC:

The function of microcontroller is to control input output based on the programmed embedded hex logic. The microcontroller continuously scans input logic. The input logic is 4BCD data from HT12D one from fire sensor and one from light sensor. If any one of them changes their logic level microcontroller goes to particular subroutine and perform particular task.

Let us consider a case when key '2' is pressed on the keyboard of PC, thus at receiver side HT12D generate corresponding BCD logic 0010. The microcontroller receives 0010 at pin no 1,2,3,4. The microcontroller is programmed if input is 0010, move to motor left. The motor will move left. This moment is done by microcontroller using pulse width modulation. Thus when we press 2 key microcontroller provide different pulses to the induction motor. In the same way all microcontroller subroutine gets executed and perform corresponding task.

2. EASE OF USE

One of the problems with the ANFIS design is that a large amount of training data might be required to develop an accurate system, depending always on the research study. Another disadvantage, which has been discussed, is the fact that there is only one output from an ANFIS. Thus, ANFIS can only be applied to prediction tasks or the approximation of nonlinear function where there is only one output. Furthermore, another drawback has to do with the optimization algorithm used in this study. More specifically, the error back-propagation algorithm is based on gradient descent method which according to the error surface tries to find the best weight and bias composition in order to minimize the network error, but there are some disadvantages like slow converges, lack of robustness and inefficiency[5-8].

In our approach, we are using thyristor to generate different set of voltages for controlling the speed of an induction motor and this is being achieved by controlling its firing angle. So, out main focus is to control their speed of motor using the easiest way.

3. CONCLUSION

In this paper, we presented a system for speed control of induction motor using easy n less tedious circuitry. Microcontroller that has been used will make the control more effective. Since induction motor is widely used in industries, thus its speed control will be a great asset.

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