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Speed Control of Induction Motor using Embedded System

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Abstract - Induction motors are the widely used in most power driven home appliances, agricultural and industrial applications. Because they are simple and reedy in design, low cost, require low maintenance and direct connection to an ac power source are the main advantages of an induction motor. Lots of applications require variable speed operation and one of them is a fan load. The PLC modem which generates the analogue output signal for corresponding button pressed using key pad and then this analogue output is fed to PLC modem (transmitter) and sent through the power line. At another end, plc receiver picks up the signal and send it to the signal decoder, there the decoding takes place and data is given to the Micro controller. The software in the Controller attain the signal and accordingly drives the MOSFET Circuit, which in turn is connected to load serially. The experimental work prototype model is built precious the ATMEL microcontroller (AT 89S52) which is used to generate the PWM pulses for control the speed of the half HP induction motor. The main objective of this work is to design a real time electronic control system that can be used to control the speed of motors kept at remote locations using an embedded system technology. The PIC is able to store all the commands to generate the required waveforms to control the amplitude and time of such pulses for the inverter.

Key Words: **ATMEL microcontroller, PLCC Technology, PWM pulse, receiver, transmitter**

1. INTRODUCTION

Single-phase induction motors are mostly used in home appliances and Industrial control because of their low cost and reedy construction. Many industrial processes need variable speed drives for lots of applications. This paper investigates the speed control performance of single-phase induction motor using microcontroller18F2520. SPWM technique has been employed in this H-BRIDGE inverter to provide the motor with ac voltage.

Many industrial applications require variable speed and fixed speed for improvement of quality product. The fast advances in automation and process control, the field of variable speed drives continuously growing. Modern Technology offers many alternate techniques in the selection of speed of the drive system. The DC Motor was the select for variable speed drive application until 1980s. Induction motors are used in lots of applications such as HVDC, Industrial drives control, automotive control, etc. In recent years there has been a great need in industry for adjustable speed drives, fan, pump, Compressors, domestic Applications and paper machines etc. Till the initiation of power semiconductor elements and components, the DC Motor had been most popular in the area of adjustable speed motor drives, even though it suffers from many demerits. Due to development of semi-conductor Technology and advent of Microcontroller has transformed the research and development towards control of AC drives. The microcontroller supply the pulse width variation signal which is given to the SCR driver circuit, which in turn provides the required frequency for the instance speed. Pulse Width Modulation (PWM) is a normal technique for control the speed 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 frequency (VF) method by using microcontroller. The basic principle mention in this paper is variable frequency where, the speed can be adjust by using PWM wai ves generated by AT 89S52 Microcontroller. The input given to the motor is 230V, 2.5A (180W). This has many 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 development. The main objective of this paper is to adjust the speed of the single phase induction motor by variable frequency method using Power Line Carrier Communication technology by ATMEL 89S52 microcontroller.

Our main aim is to transmit the data over the AC power lines and to create a user friendly plug and play type device in the form of a transceiver modem which would provide easy to use and cheaper communication. The proposed system is cheaper, portable and user friendly. The data transmission is completely error free. The Power line communication carrier (PLCC) is a very promising technology with many probable applications which would immensely benefit all. Through this work, we look forward to contributing to this technology and search ways to make it more consumer friendly.

2. EXISTING SYSTEM

In the existing system to create user friendly automatic transceiver modem which would provide easy to use and

cheaper communication. The proposed system is cheaper, portable, user friendly. The main objective is to control the speed of motor using power line carrier communication (PLCC) modem.

3. WORKING OF PROPOSED SYSTEM

Fig. shows the block diagram of proposed system which consist of an induction motor, LCD screen, ATMEL microcontroller, 230v AC power line modem. When the user presses the key, the PLCC Generator generates the Consistent digital output. This output is given to the PLCC Transmitter and then PLCC Transmitter is initially tuned to work in the 125 KHz frequency. The option are provided to change the frequency depending on the PLCC Receiver. The parameter such has amplitude and frequency can be changed bye changing the corresponding potential meter. The PLCC provides an output that is combination of two different Frequencies of the specific key pressed.

So the output from the PLCC Transmitter will be the Combination of the carrier frequency which is generated by the PLCC modem. At the other end the PLCC Receiver picks up the signal by tuning in to the carrier frequency of the PLCC Transmitter. The output of the PLCC transmitter is given to the PLCC Receiver accordingly generates the BCD (Binary Coded Decimal) output from this IC. The Output that is digital is given to the ATEML Micro Controller. The ATMEL Programmer is connected to the PC through the parallel port. The software is developed using the assembly language of the ATMEL and this programming is done using the software Called KEIL. This software is provided by the company called Atmel Incorporation, USA. We have chosen ATMEL as the Micro Controller because it is has CISC processer.

Microcontroller based system are generally smaller is size, more reliable, and cheaper in cost. They are perfect for the types of applications described above where cost and unit size are very important consideration. In such applications it is almost always coveted to produce circuits, that require the smallest amount of physical space, requires the least amount of energy, and cost as little as possible.

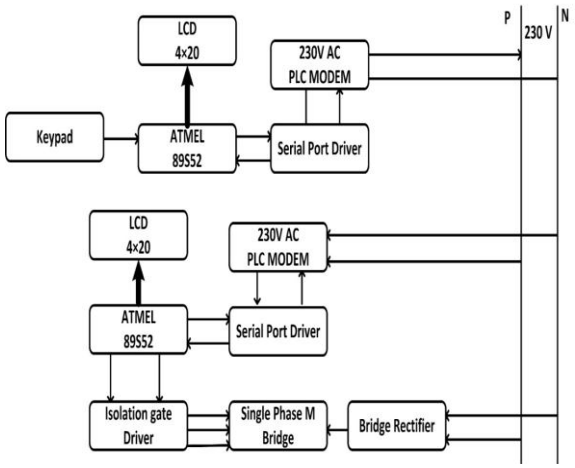

Fig. 2: Block Diagram of Speed Control of Induction Motor

4. CIRCUIT COMPONENTS

4.1: Power Line Communication (PLC) Modem

Power line modem which is use to send and receive the serial data over existing AC mains power lines of the building. It has high immunity to electrical noise perseverance in the power line and built in error checking so it never gives out corrupt data. The modem is in form of a ready to use circuit module and it has a capability of providing 9600 baud rate low rate bi-directional data communication. Because to its small size it can be integrated into and become part of the user's power line data communication system.

4.2: ATMEL 89S52

The AT89S52 is a low-power and high-performance CMOS 8-bit microcontroller with 8K bytes of in-system programmable Flash memory. This device is manufactured using Atmel's high-density nonvolatile memory technology and is compatible with the industry-standard 80C51 instruction set and pinout. The on-chip Flash allows the program memory to be again programmed in-system or by a conventional nonvolatile memory programmer. By combining a versatile 8-bit CPU with in-system programmable Flash on a large chip, the Atmel AT89S52 is a powerful microcontroller which provides a highly-flexible and cost-effective solution to many embedded control applications. The AT89S52 provides the following standard features: It has 8K bytes of Flash with 256 bytes of RAM and 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 AT89S52 is designed with static logic for operation down to zero frequency and supports two software selectable power saving modes and 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.

4.3: Isolated Gate Driver

An IGBT/power MOSFET is a voltage-controlled device which is used as a switching device in power supply circuits and motor drives and amongst other systems. The *gate terminal* is electrically isolated control the terminal for each device and the other terminals of a MOSFET are source and drain, and for an IGBT they are called collector and emitter. To operate a MOSFET/IGBT, mainly a voltage has to be applied to the gate that is relative to the source/emitter of the device. Dedicated drivers are used to apply voltage and it also provide drive current to the gate of the power device.

4.4: Bridge Rectifier

This Rectifier is the device which converts an oscillating sinusoidal AC voltage source into a constant current DC voltage supply by using diodes, thyristors, transistors, or converters. This rectifying process can take on many forms with half-wave, full-wave, uncontrolled and fully-controlled rectifiers transforming a single-phase or three-phase AC supply into a constant DC level.

Rectifiers are those who building blocks of AC power conversion with half-wave or full-wave rectification generally performed by semiconductor diodes. Diodes are allow AC currents to flow through them in the forward direction while blocking current flow in the reverse direction creating a fixed DC voltage level making them ideal for rectification.

However, direct current which has been rectified by using diodes is not as pure as that obtained from say, a battery source, but has voltage changes in the form of ripples superimposed on it as a result of the alternating supply.

5. CONCLUSIONS

The new method of controlling the speed of induction motor using PLCC technology is successfully implemented in this work. This is one of the method use for controlling the speed, which is employed for AC motor drives. The speed controlling of AC motor is performed using PLC technology by the AT 89S52 microcontroller. It has high reliability and long life at low cost and small size. The experimental results are analyzed and it is found that the speed of the induction motor is controlled in Normal and step up, step down speed requirement is done smoothly using PLC technology. The proposed system is most suitable for 90% of industrial applications. Microcontroller based system can be efficiently used for control the speed of induction motor along with pulse width modulation technique. By using PWM technique user can control speed of induction motor according to their requirements.

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