FINAL YEAR PROJECT REPORT

“SPEED CONTROL OF INDUCTION MOTOR USING MICROCONTROLLER”

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“SPEED CONTROL OF INDUCTION MOTOR USING MICROCONTROLLER”

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Abstract

The control of induction machines is now moving almost completely from analogue electronic to digital. Therefore the very first reason which motivated us toward this project is that we wanted some digital control (Microcontroller Based) for controlling different speed level of induction motor. Thus it is necessary to develop a digital circuit that control the speed in close loop base. In this project Motor parameters like speed of Motor, line Voltage, Motor load Current, Temperature of Motor body are sensed by Slotted Optocoupler, Potential Transformer, Current transformer, Temperature sensor (LM35) and internal interrupt of micro controller respectively . Then these parameters are monitored by applying limitations and using LED's to show system status and LCD is used for the Digital Display of above parameter.

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Chapter 01
Introduction

1.1-History of Induction Motor

In 1824, the French physicist François Arago formulated the existence of rotating magnetic fields, termed Arago's rotations, which, by manually turning switches on and off, Walter Baily demonstrated in 1879 as in effect the first primitive induction motor. Practical alternating current induction motors seem to have been independently invented by Galileo Ferraris and Nikola Tesla, a working motor model having been demonstrated by the former in 1885 and by the latter in 1887. Tesla applied for U.S. patents in October and November 1887 and was granted some of these patents in May 1888. In April of 1888, the Royal Academy of Science of Turin published Ferraris's research on his AC polyphase motor detailing the foundations of motor operation. In May 1888 Tesla presented the technical paper A New System for Alternating Current Motors and Transformers to the American Institute of Electrical Engineers (AIEE) describing three four-stator-pole motor types: one with a four-pole rotor forming a non-self-starting reluctance motor, another with a wound rotor forming a self-starting induction motor, and the third a true synchronous motor with separately excited DC supply to rotor winding. George Westinghouse, who was developing an alternating current power system at that time, licensed Tesla's patents in 1888 and purchased a US patent option on Ferraris' induction motor concept. Tesla was also employed for one year as a consultant. Westinghouse employee C. F. Scott was assigned to assist Tesla and later took over development of the induction motor at Westinghouse.Steadfast in his promotion of three-phase development, Mikhail Dolivo-Dobrovolsky's invented the cage-rotor induction motor in 1889 and the three-limb transformer in 1890. However, he claimed that Tesla's motor was not practical because of two-phase pulsations, which prompted him to persist in his three-phase work. Although Westinghouse achieved its first practical induction motor in 1892 and developed a line of poly phase 60 hertz induction motors in 1893, these early Westinghouse motors were two-phase motors with wound rotors until B. G. Lamme developed a rotating bar winding rotor.The General Electric Company (GE) began developing three-phase induction motors in 1891. By 1896, General Electric and Westinghouse signed a cross-licensing agreement for the bar-winding-rotor design, later called the squirrel-cage rotor.

1.2-Induction Motor

Induction motors are the most widely used motors in domestic appliances, industrial control, and automation. Hence they are often called the workhorse of the motion industry. They are robust, reliable, and durable. When power is supplied to an induction motor, it runs at its rated speed. However, many applications need variable speed operations. For example, a washing machine may use different speeds for each wash cycle. Historically, mechanical gear systems were used to obtained variable speed. Recently, power electronics and control systems have matured to allow these components to be used for motor control in place of mechanical gears.

DC machines have the disadvantages of higher cost and maintenance problems with commutators and brushes. Commutators and brushes do not permit a machine to operate in dirty and explosive environment. An AC machine overcomes the draw back of DC machines. Although currently, the majority of variable speed drive applications use DC machines, they are progressively being replaced by AC drives.

Single-phase induction motors are used extensively for smaller loads, such as household appliances like fans. Squirrel cage induction motors are very widely used in both fixed-speed and variable speed applications.

1.3-Analog to Digital Control

In a world of change, new technologies replace old ones ever more quickly. In the early years, change was slow with the transition process from the electro-mechanical voltage controller with motor-driven rheostats to high gain rotating exciters.

In recent years, another major technology change has taken place with a move away from the analog control to digital control. This has been made possible due to the rapid developments of electronic devices and technologies such as high performance micro-processors and high intensity integrated circuits. The controller is now reduced to integrated assembly. This had greatly increased it reliability as multiple components are implemented with just Microcontroller. The digital controllers are not simply a digital version of the analog version, but can realize sophisticated control functions that will difficult with the analog circuit thus making it possible to enhance the stability of the motor speed control.

1.3.1-Features

The digital Controlling of speed of induction motor has following features:

- Sensing the system parameters:
- Speed of Motor in revelation per minute (RPM) and adjusting it by up-down button to a specific speed
- Line Voltage
- Motor load Current
- Temperature of Motor
- Digital display of above mention parameter using LCD

1.4-Basic Requirements

Monitoring and controlling the speed of induction motor is hardware as well as a software project. As this project is based on microcontrollers, it is important to check whether codes work well as required. So, for development of this project, it can be said that this project is both software and hardware based. Hence the requirements of the project are of two types.

Software Requirements

Hardware Requirements

1.5-Software Requirements

Following software's are used in our project:

- MPLAB IDE (CCS COMPILER)
- Proteus ISIS
- PIC Flash

1.6-MPLAB IDE

MPLAB IDE is a software program that runs on a PC to develop applications for Microchip microcontrollers and digital signal controllers. It is called an Integrated Development Environment (IDE), because it provides a single integrated "environment" to develop code for embedded microcontrollers.

MPLAB Integrated Development Environment brings many changes to the PIC microcontroller development tool chain. Unlike previous versions of MPLAB which were developed completely in-house, MPLAB is based on the open source NetBeans IDE from Oracle. Taking this path has allowed us to add many frequently requested features very quickly and easily while also providing us with a much more extensible architecture to bring you even more new features in the future.

1.7-Proteus ISIS

This is very important software in the field of electrical engineering to implement the circuit before developing its hardware design. It supports many electronics components like resistors, regulators, capacitors, etc. Many different ICs and Motors are also available as one of its amazing feature of its built-in library. This software is used for hardware circuit implementation not for programming.

1.7.1-Features

Some key features of ISIS are highlighted below. Supports large number of Microcontroller Units including PIC18F452.It generates the proper DC, AC signals for experiments. Huge gallery of circuit components. Electromechanical components like Servo and DC motors can be simulated. Circuit can be transformed to design a Layout in Proteus ARES software Hex file can be loaded directly to the MCU and observe the result. Circuit can be simulating for serial communication also.

1.8-PicFlash

The PIC FLASH Programmer is are liable and fast production grade programmer for PIC 12, 16 & 18 series Flash. The PIC FLASH programmer communicates to the microchip throughputs cable which is also used for powering the programmer. It's a very easy and simple to understand. The project code is burned to the microcontroller using Easy PIC trainer module and PIC Flash software.

1.9-Hardware Requirements

- Circuit Designing for Excitation circuit .
- Programming of PIC microcontroller.
- Making circuit hardware of modules.
- Assembly of all parts on a single board.
- Finalize checking of the working of all circuit modules.

Following are the hardware requirements for project:

- Motor (0.25HP)
- PIC Microcontroller
- Temperature sensor LM 35
- Nor gate 4093
- TRIAC BTA41
- Optocoupler MOC 3021
- Optocoupler PC 817
- LCD (20x4 character)
- Step-down Center taped transformer (220V-12V)
- CT/PT
- Button
- Voltage Regulator LM7805
- Transistor 945
- PCB Boards
- Crystal Oscillators (20MHz)
- Slotted coupler
- Round Bridge
- Capacitors
- Variable Resistors