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Speed Control of Single Phase Induction Motor Using Android Bluetooth Module

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Abstract

This project is developed to control the speed of induction motor wirelessly. Now-a-days about 70% of load in industries are induction motor, and are used in application where production purpose industries require variable speed drive. Android operating systems being widely used in smart phone and tablet, is an easy application system to incorporate. Here we are using android application system for interfacing it with microcontroller for wireless operation. So, our project concentrates on controlling the speed of induction motor using android phone remotely with the help of Bluetooth technology. An Android application is used to connect Bluetooth modem of control circuit which is connected to motor via Bluetooth feature present in smart phone. Bluetooth modem is interfaced with microcontroller. The Bluetooth slave modem receives the command from smart phone and sends the signal to microcontroller. The microcontroller decodes the signal received and activates opto-coupler then respective opto-coupler triggers the triac with respect to change in firing angle and results in varying speed of induction motor.

Keywords: Android application, Bluetooth technology, Wireless operation, and PIC microcontroller.

I. Introduction

The objective of this project is to build a system that enables users of Android smartphones to regulate the speed of 230V AC motors. Using the Bluetooth capability on an Android smartphone, the motor's speed may be wirelessly controlled. The

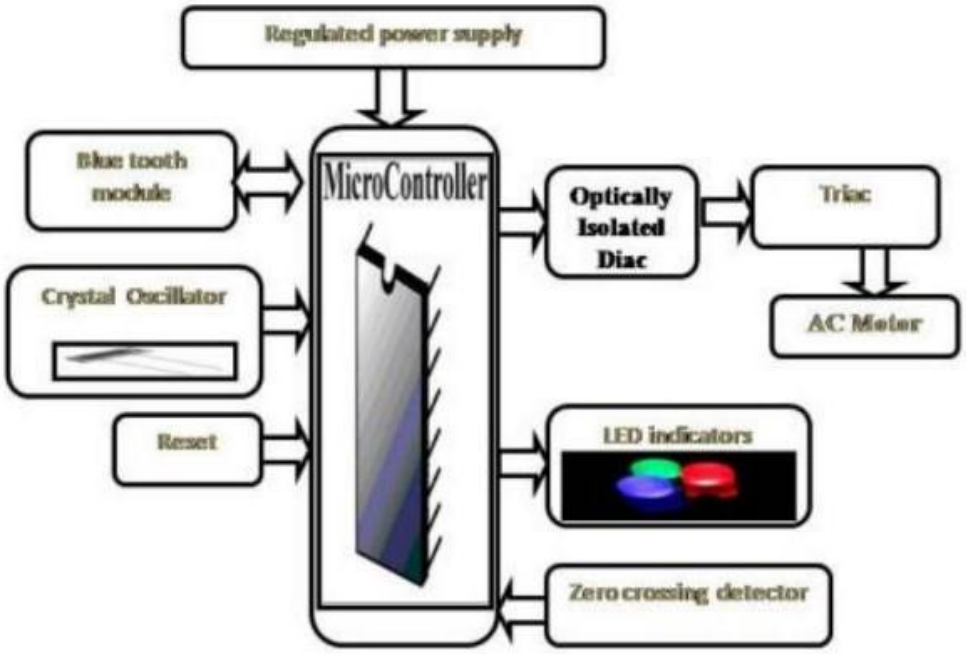
Android smart device utilized for this experiment helps in Controlling the speed of a motor by using a phone as a remote. For mobile devices, the Android software stack consists of an operating system, middleware, and important applications. The radio frequency (RF)-based short-range connectivity technology known as Bluetooth is an open standard specification. All sorts of portable devices, including laptops, PDAs (personal digital assistants), and mobile phones, can connect to them remotely and inexpensively. It makes wireless connections eliminating the need for cables to connect displays, printers, key boards, and the CPU.

A microcontroller is the system's main controlling component. The microcontroller is interfaced with a Bluetooth module, a triac, a zero-crossing detector, and an AC motor. Android smartphone data received by the Bluetooth module is given as input to the microcontroller. The microcontroller controls the AC motor as appropriate with respect to the signal received from the Bluetooth module. The 230-volt AC motor's speed is managed by a circuit that uses a triac and an optocoupler. This system employs a zero-crossing detector for smooth implementation of pulse width modulation. For performing the objective of motor speed control, the controller is loaded with programs developed using Embedded 'C' language.

II. Block Diagram

The Main components of the project are:

- Microcontroller
- Bluetooth Module
- Triac



Block diagram of AC induction motor speed controlling using smart phone

I. PIC Microcontroller

Upward compatibility exists between the PIC16F73 CMOS FLASH-based 8-bit microcontroller and the PIC16C73B/74B/76/77 and PIC16F873/874/876/877 devices. It has self- programming, in-circuit debugging, two comparators, channels of an 8-bit Analog-to-Digital (A/D) converter, two capture/compare/pulse width modulation (PWM) functions, 200 nanosecond instruction execution, a synchronous serial port that can be set up as either a 3-wire serial peripheral interface (SPI) or a 2-wire inter-integrated circuit (I2C) bus, a USART, and a parallel slave port.
Specifications of PIC microcontroller includes learning only 35 single-word instructions, eight-level deep hardware stack; Direct, Indirect, and Relative Addressing modes for data and instructions; Operating speed of up to 20 MHz clock speed; 200 ns instruction cycle time; 4K x 14 words of Flash programme Memory; and 192 x 8 bits of RAM memory; 28 input- output pins.

Microcontroller

Major blocks of PIC microcontrollers are discussed below to know their usage and importance.
Program memory (FLASH): This is where a written program is kept.
This microcontroller is appropriate for device development since FLASH memory may be programmed and cleared multiple times.

EEPROM: Data memory that must be retained in the absence of power.
It is typically used to store crucial information that must be protected against loss in the event of an unexpected power outage. An assigned temperature in temperature regulators is an example of such data. If this data was lost during a power outage, we would have to adjust everything once more when the power came back on. In turn, the device becomes less independent.

RAM: Data memory a programme uses while running. During runtime, all intermediate results and temporary data are stored in RAM.

PORTS: The microcontroller's physical interface with the outside world is through ports.
The PIC16F73 has 28 I/O. On the PIC microcontroller, there are 5 input/output ports: ports A, B, C, D, and E. Every port serves a unique purpose. The majority of them have I/O ports.

Crystal oscillator: The PIC microcontroller can link to crystal oscillators with speeds ranging from DC to 20 MHz. Commonly, a 20 MHz oscillator will be connected with about 22pF capacitor.

Microcontroller Features

- High performance RISC CPU
- All single-cycle instructions except for program branches which are two cycles
- Watchdog timer (WDT) with its own on-chip RC oscillator for reliable operation
- Programmable code protection
- Power saving sleep mode
- In-Circuit Serial Programming via two pins

III. Bluetooth module

Bluetooth is a wireless technology standard for exchanging data over short distances. There are different types of Bluetooth modules such as HC-03, HC-04, HC- 05, HC-06. HC-05 Bluetooth module is used in the project. It is an easy-to-use Bluetooth SPP module design for transparent wireless connection set up. The Bluetooth module HC-05 is a MASTER/SLAVE module. For factory setting slave module are use it cannot initiate a connection between other Bluetooth devices. But can accept connections. Master module can initiate a connection to other devices. The user can use it simply for serial port replacement to establish connection. Between MCU and GPS, PC. Due to 80 dBm sensitivity and up to +4dBm RF transmit power with PIO control, we use HC-05 Bluetooth module.

IV. BT136 Triac

The electronic component known as BT136 is a triac. It is a four-layer, three-PN junction high-power semiconductor device that is often created by connecting two thyristors in reverse. It can rectify, be used as a non- contact switch to fast turn on or off the circuit, invert direct current alternating current, convert one frequency of alternating current into another frequency of alternating current, and perform other operations. Like other semiconductor devices, the thyristor benefits from being compact, highly efficient, stable, and reliable.

BT136 Triac

BT136 Features:

- Direct triggering from logic ICs and low power drivers.
- High blocking voltage capability.
- Lowest electromagnetic interference (EMI) at commutation and low holding current for low current loads.
- Planar passivated for voltage reliability and robustness.
- Sensitive gate.
- All four quadrants triggering.

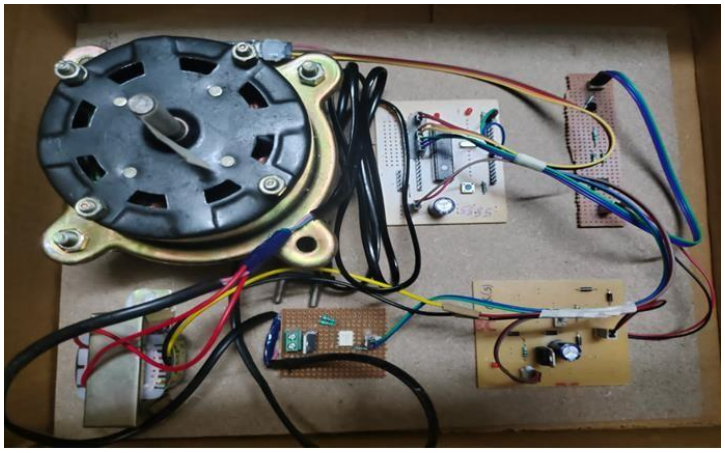
V. Working

On giving 230 V single phase AC supply, LED indicators of the boards glow, indicating the circuit is in working condition. Mobile phone should be paired with Bluetooth module using "Bluetooth terminal HC- 05" application. On receiving the 'Character' ranging from 0-4 through mobile phone, Bluetooth sends signal to microcontroller. Input from Bluetooth is stored in microcontroller. ZCD on receiving supply detects the "zero" of AC waveform and ZCD sends pulse to microcontroller. On receiving pulses from ZCD circuit, microcontroller triggers TRIAC. TRIAC triggers using pulse width modulation technique and sends voltage respective to the character entered to induction motor. Induction motor's speed is either increased or decreased based on the amount of voltage received.

Hence speed of induction motor is controlled**.**

VI. Results

The speed of the AC motor is measured using tachometer. Speed control is done using Zero crossing detection method along with triac controlling. User can increase/decrease the speed of the AC motor through smart android mobile phone. The controlling device of the whole system, microcontroller, which is programmed using Embedded C language, gets input from android mobile and acts accordingly on the AC motor speed.



Project final structure

VII. Conclusion

All the hardware components for implementing speed control of single-phase induction motor using android mobile phone are chosen and integrated. Usage of microcontroller, triac control and zero crossing detection technique provides an opportunity for sensitive operation of the motor at varying speeds. With the help of growing technology, highly advanced IC's are included and the project has been successfully implemented. The project has been successfully designed and tested.

VIII. References

[1] A Review on Speed Control Techniques of Single Phase Induction Motor Atul M. Gajare1, Nitin R. Bhasme2

[2] Microcontroller based speed control of three phase induction motor using v/f method Mrs.DeepaliS.Shirke, Prof. Mrs.Haripriya, H.Kulkarni Electrical Dept. PES's Modern College of Engg. Pune.

[3] "Speed control of single phase induction motor using AC chopper by asymmetrical PWM method" from IJAREEIE by R. Suneeth and P. Usha.

[4] "Speed control of induction motor using TRIAC" by Prachi M. Palpankar, Sanraj Harle, Tushar Karade, Suraj Lekurwale. "Speed control of single phase AC induction motor using microcontroller" from IJERA by Chaitanya N. Jibhakate, Asst. Prof. Vijaya Huchhe.