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Induction Motor Speed Control Using Android Application

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Abstract: **Android is open source software, manufacturers can modify the operating system to suit their respective needs and phones. This becomes a cheap and feasible alternative for the manufacturer, as opposed to developing an operating system in-house or hiring a software company to do it. The Android platform includes support for the Bluetooth network stack, which allows a device to wirelessly exchange data with other Bluetooth devices. The application framework provides access to the Bluetooth functionality through the Android Bluetooth .Here the proposed system is designed to controlling the speed of induction motor using android application where the remotely controlling speed of induction motor is achieved. Android mobile act as a transmitter and the received by Bluetooth receiver interfaced to AVR microcontroller of 8051 family. AVR is an advanced version of 8051 microcontroller. Each time data is sent by android application as per code written is executed by AVR to deliver supply signal to triac through optical isolation. Hence the power to load connected in series with triac is controlled based on received signal and speed control of induction motor is achieved.**

Keywords: **triac, zero crossing detector, AVR microcontroller, optocoupler.**

I. INTRODUCTION

For the improvement of quality product many industrial application requires adjustable speed and constant speed. Due to rapid advance in automation and process control the field of adjustable speed drives continuously. In recent technology, various alternate techniques are available for the selection of speed of drive system. Up to the 1980 the dc motor was the choice for variable speed drive application. Induction motors are using any application such as Industrial drives control, automotive control, etc. The project has been designed to develop a speed control system for DC motor in all the four-quadrant. Using four-quadrant chopper it is possible to demonstrate forward, instant forward brake, reverse, instant reverse brake control of a DC motor using triac [11] based microcontroller through remotely operated commands to it by touch screen based user friendly GUI on any smart phone with Android applications.

The AC induction motor is the most popular motor used in consumer and industrial applications, and represented the "muscle" behind the industrial revolution. It has since been modified to the more common three phase structure, which results in balanced operation of the motor voltages and currents.. There are various methods for controlling the speed of AC motors [1]. There are several of method is available for speed control of ac motor one of the method is two vary frequency and voltage of motor. Speed modulation of a single-phase motor is usually achieved either by some electrical means, such as reducing supply voltage by auto-transformer, or by switching windings to change the number of motor poles for different operating condition as required.

For changing the speed of capacitor run motor as shown in fig.1 voltage control is best method, but it allows only limited speed range to be obtained. Now frequency acts as interesting alternative to voltage control.

The most appropriator actuators for variable speed drive is seem to be capacitor run drive. In our project the speed of induction motor, control with the help of android apps that comes under wireless technology. Android application use here as a transmitter and remote control in order control the speed of induction motor with the help of Bluetooth as a receiver.

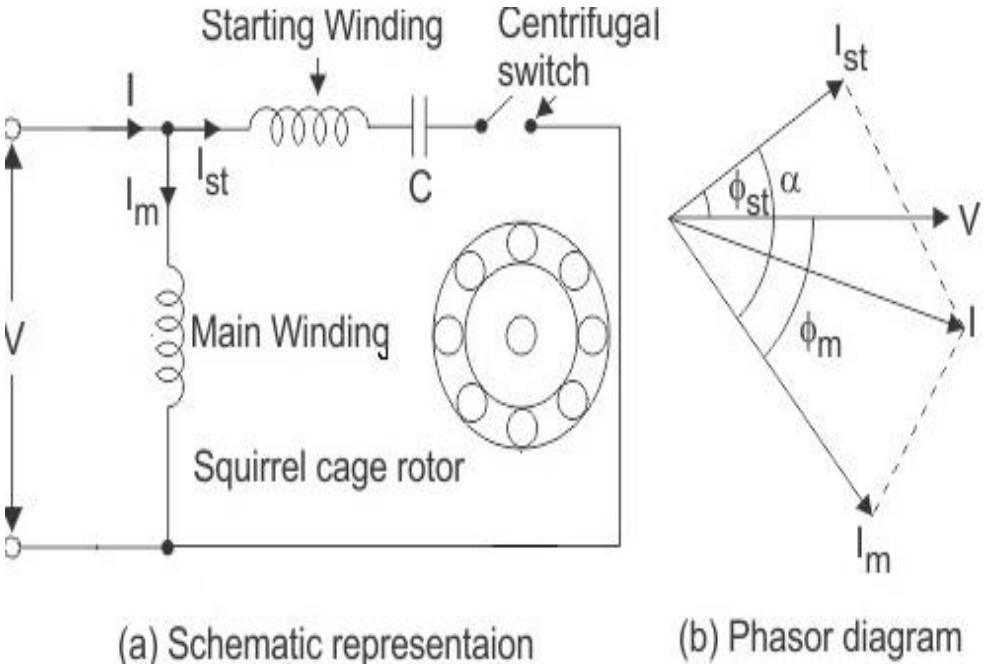

Fig.1. Capacitor run single phase induction motor

II. SYSTEM ARCHITECTURE

In this project, embedded system has been used which is a combination of software and hardware. . An embedded system is a programmed hardware device. These are the controllers, processors, arrays or other hardware using dedicated (embedded) logic or programming (code) called "firmware" or a "microkernel. Figure 2 shows the block diagram representation of the systems to be designed and implemented. The Block diagram consists of: Microcontroller, LCD Display, Bluetooth module, Switching assembly, Power supply, Load (either ac motor or bulb), Android application.

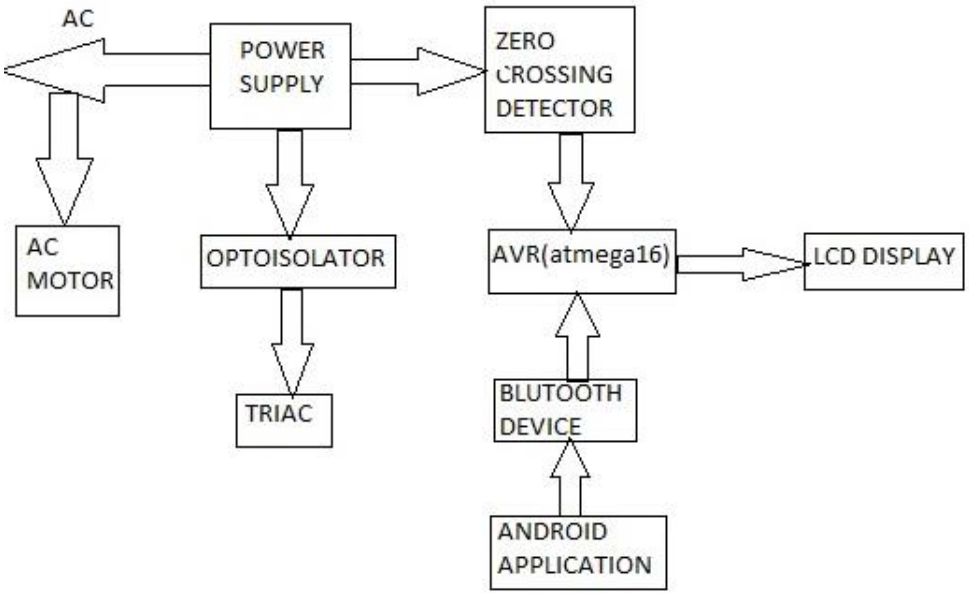

Fig.2. Block Diagram

A. Block Diagram Description:

Microcontroller is the heart of the system. The AT89S52 is a low-power, high-performance CMOS 8-bit microcontroller with 8K bytes of in-system programmable Flash memory. The device is manufactured using Atmel's high-density non volatile memory technology and is compatible with the industry standard 80C51 instruction set and pin out. The on-chip Flash allows the program memory to be reprogrammed in-system or by a conventional non volatile memory programmer.

By combining a versatile 8-bit CPU with in-system programmable Flash on a monolithic 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: 8K bytes of Flash, 256 bytes of RAM, 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[2] is designed with static logic for operation down to zero frequency and supports two software selectable power saving modes. The optoisolator is used to drive the triac which provides complete pulse to the motor in order to rotate and to control the speed of inductor motor via android application.

B. Working:

As shown in above figure transformer T1 step downs 230 V AC into 9 V AC and this is given to bridge rectifier. This rectified output is directly fed to base of Q1 through resistors R1 & R2. Same rectified output is filtered through C1 and given to voltage regulator IC 7805. Output of 7805 is regulated 5 VDC that is given as biasing voltage for both transistors Q1 & Q2 (same regulated 5 V supply is given to main control section also). Both transistors are connected in switch configuration. The final output „C" is given to main control section.

As shown in below figure micro controller ATmega16 along with opto-coupler MOC3011 (for triggering TRIAC) and common Anode type bar graph display (for indicating angle) are used for changing firing angle of TRIAC. Signal 'C' from zero crossing detector circuit is directly given to pin no 13 (INT1) that is external interrupt 1 (PD.3) pin. All port PA pins are connected with cathode of bar graph display It is used to show the status of the motor power and zero cross circuit

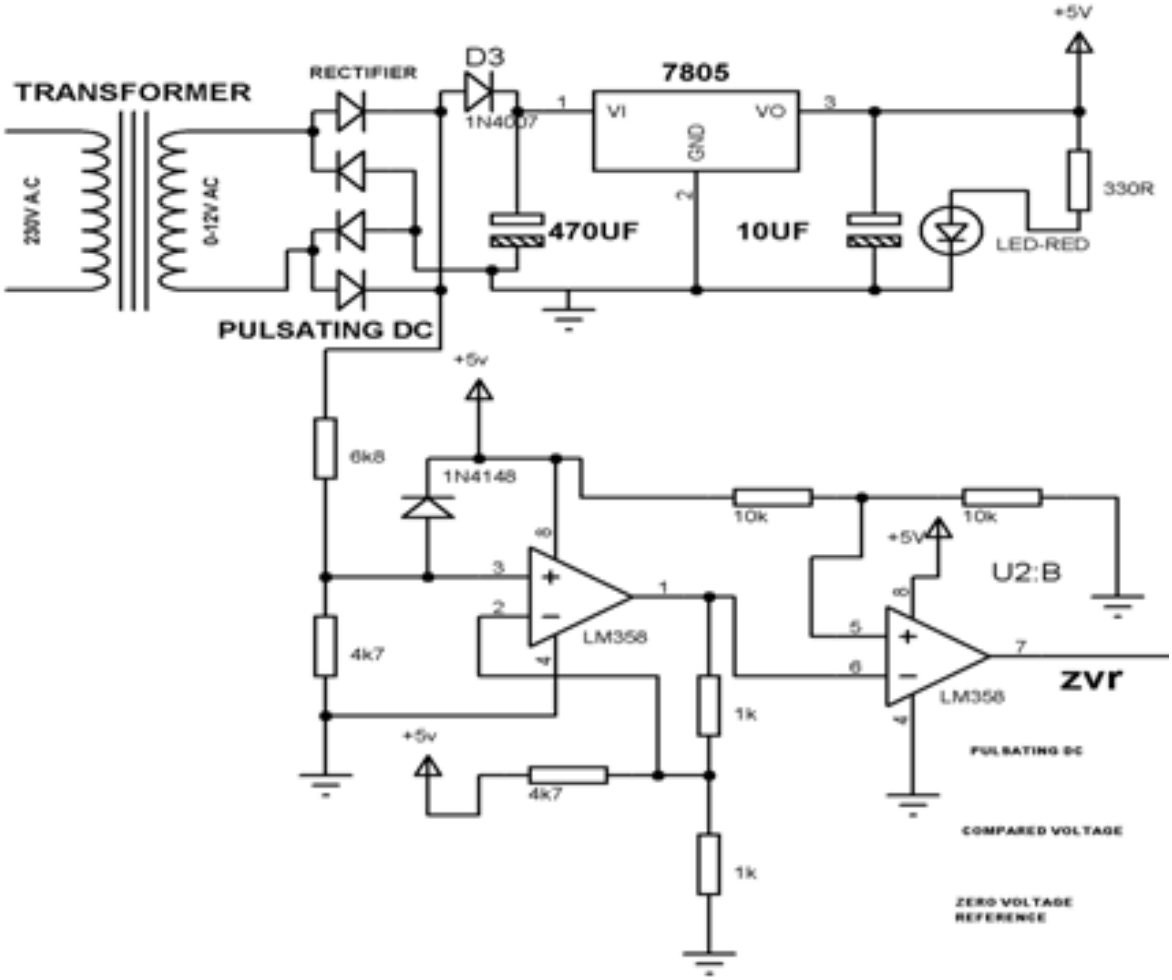

Fig.3. Zero crossing detector

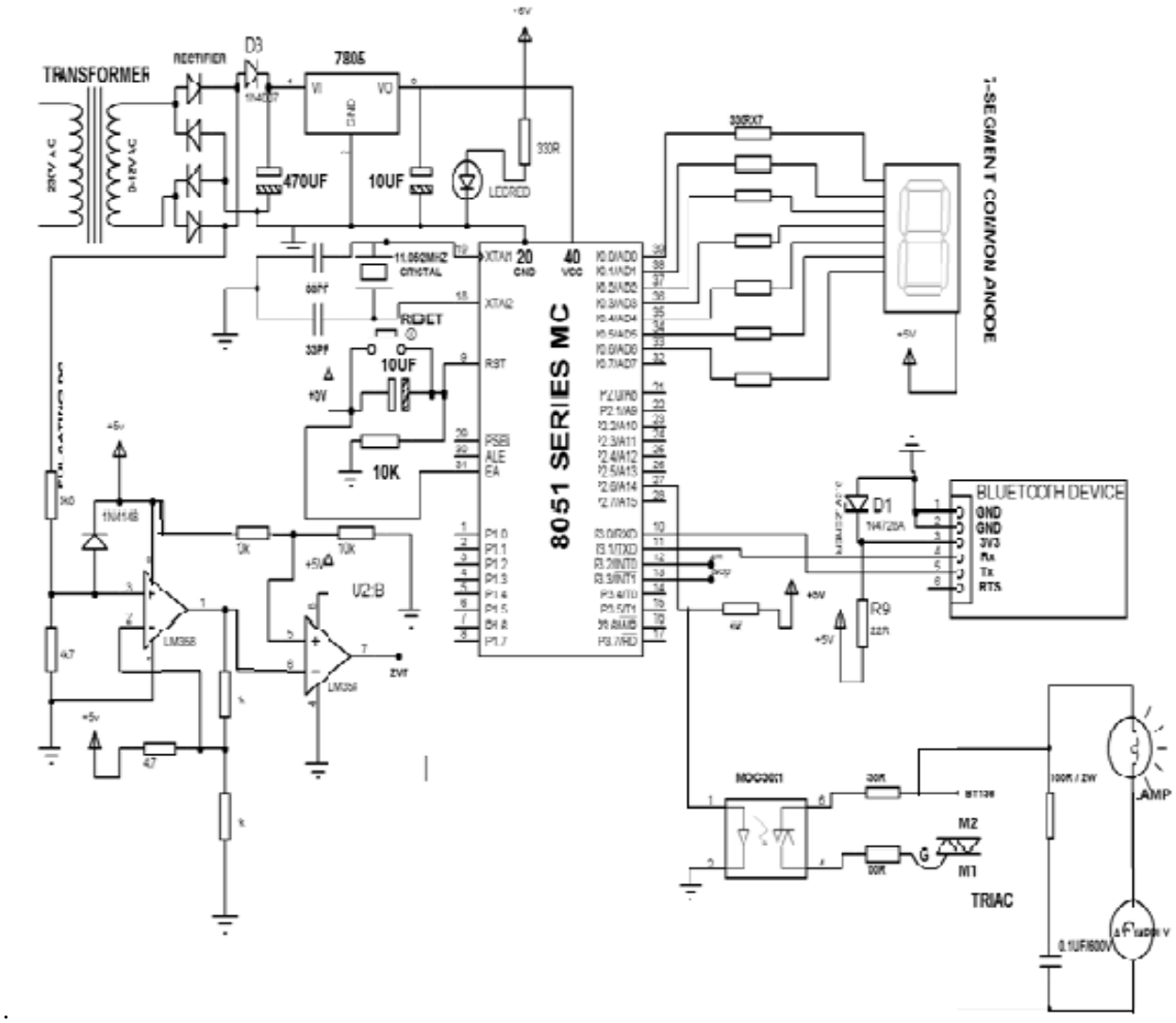

Fig.4. Basic circuit diagram

PD7 is connected with input of opto-coupler[12] MOC3011[3]. Output of MOC3011 is connected with gate of TRIAC. TRIAC is connected in loop with AC motor and 230 VAC supply as shown. RC snubber circuit is connected is connected in parallel with TRIAC.A 16MHz crystal along with two 22pf capacitor is connected with crystal input pins. Capacitor C2 with Resistor R6 performs power on reset.

III. APPLICATIONS

1. Home automation – This project can be used to control various Home Appliances
2. We can control device from a long distance, thus it gives ease of access
3. No need to carry separate remote or any other controlling unit.
4. Useful in applications like small conveyors, large blowers, pumps as well as in geared application.
5. In machinery air compressors, high processors, water pumps, vaccum pump and high torque application.

IV. ADVANTAGES

1. Remote operation is achieved by any smart-phone /tablet etc. with android os.
2. Technically expert controller is not required.
3. Android app is an open source system to develop any programming code.

4. Programming code is not always required to change for different input parameters.

5. Bluetooth consumes less power so more preferable.

6. More useful for the patient and disabled person.

V. DISADVANTAGES

1. It is of short range as we are using Bluetooth as transmitter.

2. Consumption of consumer's battery by Android app.

3. Device and application impact.

VI. CONCLUSION

The objective of a project has been achieved which has been developing the hardware and software for controlling speed of induction motor using android application. The demand for wireless operating device increases, it is more preferable over wired devices. Here we are controlling speed of induction motor using Bluetooth and android application wirelessly.

VII. FUTURE SCOPE

The future scope will be controlling the speed of three phase induction motor likewise that of the single phase induction motor using android application. Also we can use GSM module instead of Bluetooth technology to control the speed of induction motor. The speed can also be controlled automatically using temperature sensor LM 35.

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