International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 07 Issue: 08 | Aug 2020 www.irjet.net p-ISSN: 2395-0072

Speed monitoring of AC motor using GSM modem

Mrs. Hemalatha B K[1], Mr. Sandeep S R [2], Chinthan. H.B [3], Deepak S S[4], Keerthana. R.G[5], Vijay. K.L[6]

[1]*Assistant Professor, Dept. Electrical and Electronics Engineering, S J B Institute of Technology, Karnataka, India*
[2]*Assistant Professor, Dept. Electrical and Electronics Engineering, S J B Institute of Technology, Karnataka, India*
[3,4,5,6]*Students, Dept. Electrical and Electronics Engineering, S J B Institute of Technology, Karnataka, India*

Abstract - *Wireless monitoring and control is new technology that most of nations are interested. Since majority of the people are now using the cellular phone. Mobile phone can control many of the electrical appliances and also the speed of the AC at factories or workshops. The mobile phone can also be used to monitor the values of most of electrical or mechanical variables. This technology is based on an automatic electronic and programming switch that can be built at a receiving end circuit connected to motor, which receive the wireless transmitted signal and translate it into an operating signal. The transmitted signal is generated from the mobile phone by SMS (Short Messaging Service). This circuit consists of GSM board (Global System for Mobile Communications) and Arduino board and other components such as resistances, diodes relays, SCR's transformer, and converters. This technology is only use mobile functions, not the internet features, but depends on the mobile networks which allow the objects to be controlled globally. Unlike the other technology which works at small distance such as remote infrared Bluetooth, Wi-Fi, or line communication. In this paper, the GSM technology will be highlighted showing the hardware circuits of speed control of AC motors.*

Key Words: **Cyclo-converter, Arduino, Opto-coupler, Zero Crossing Detector, Relay**.

1. INTRODUCTION

The growth of science and technology has increased its applications in various fields. The AC motors with enhanced performance are most widely required in most of the industrial applications. Some of the applications include elevators, Electric trains, heavy metal rolling mills, automobiles, machine tools, textile mills, printing presses etc. With advent in machinery there is more and more demand on power and accuracy in speed control of motors. Furthermore many applications demand remote speed monitoring and control. With vast variety of applications, the speed control of the dc motor is of great importance. There is also a need for monitoring the speed control system of the AC motor. In earlier days, the mechanical switches were used to control the electrical appliances which were operated manually. In such conditions, while operating the mechanical switches, person may feel shock and while switching on or off spark may take place. This may cause damage to the appliances. The improved version of wireless technologies such as remote control, Bluetooth and touch screen is used to control the electrical appliances and these technologies are not flexible.

The Global System for Mobile communication (GSM) is a wide area wireless communication system. The voice, data and multimedia communication services can be provided by using digital radio transmission system. In these days, the growing GSM technology has found many applications in various fields. Under certain operating conditions, the GSM technology provides the best way of monitoring and controlling the speed of AC motor. The main advantage of using GSM technology is that it is possible to control the speed of the AC motor from any place around the world provided the GSM network should be supported.

The microcontrollers are the main controllers in all the embedded applications. Microcontrollers are used in automatically controlled products and devices in the fields such as automobile industry, medical electronics, automation and power industry etc. The speed of ac motor is controlled by varying the input frequency through cyclo converter. Provided. The formatter will need to create these components, incorporating the applicable criteria that follow.

2. BLOCK DIAGRAM

Fig-1 shows the block diagram of speed control of AC motor using GSM modem. Operator sends a message from the smartphone this message is received by the GSM modem. This message is passed to Arduino1. Arduino1 decodes the message and which chooses necessary operations to be performed according to the commands written in message and it is acknowledged by sending back message to the operator of the operation.

If the message is to change the speed of motor the required speed is fed to Arduino2 through serial communication. Then Arduino2 generates the control signals for the cyclo converter according to the speed required. Here the relay is used to switch ON the Ac supply for motor. DC Power supply is connected to Arduio and other peripherals.

The output of opto coupler is connected to the cyclo converter, opto-coupler is used to isolate power circuit from control circuit. Speed and status of motor is displayed on LCD display.

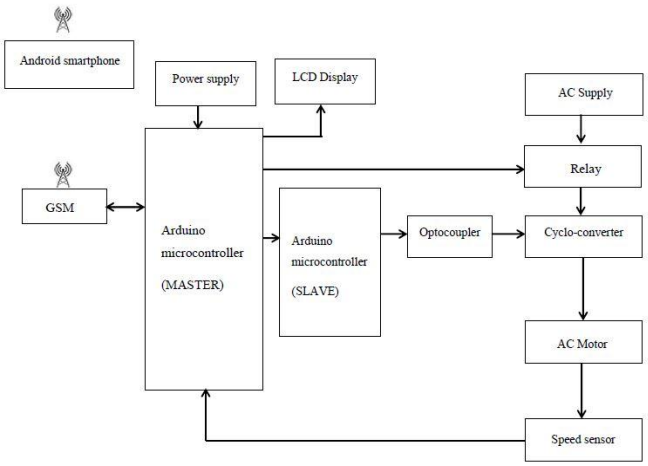

Fig -1: Block Diagram

2.1 Zero Crossing Detector

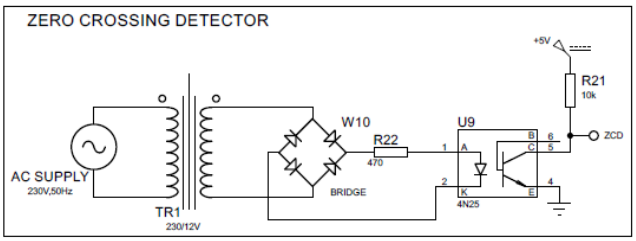

Fig -2: Zero Cross Detector

We are using an opto-coupler for the Zero Crossing Detection. By observing the output waveform you can see that the output waveform is getting HIGH only when the input AC wave crosses zero every time. The zero-crossing pulse output is getting HIGH at 0^0, 180^0 and 360^0 or we can say after every 180^0.

In this circuit the transformer is used to step down the ac voltage to lower value. This voltage is converted into pulsating DC by bridge rectifier Output of bridge rectifier is fed to opto-coupler. Led inside the opto-coupler requires minimum of 1V to turn on when ac wave goes near to the zero crossing line, i.e. below 1V led will turn off. As a result output transistor will turn of and pulled up to 5v.

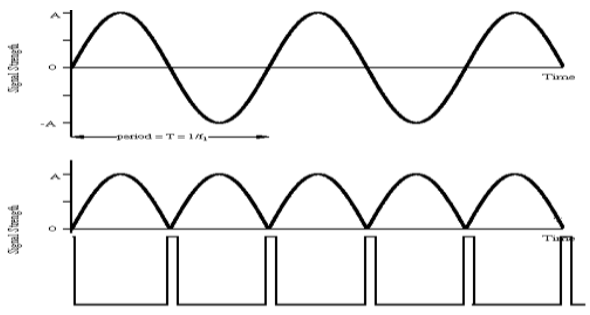

Fig - 3: Input and output Wave form for ZCD

2.2 CYCLO CONVERTER

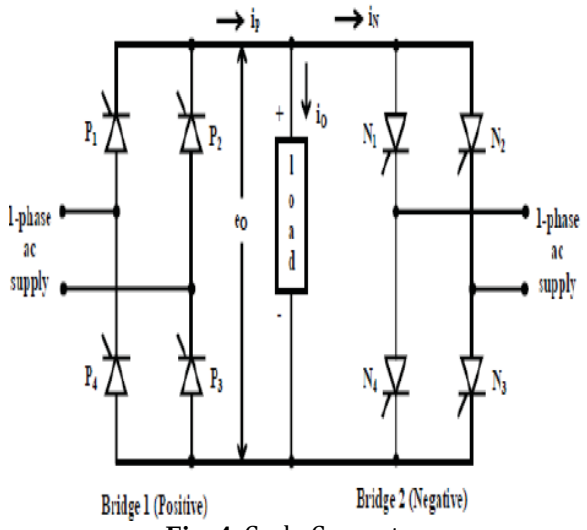

Fig -4: Cyclo Converter.

The cyclo-converter is a device that converts AC power of certain frequency to AC power of another frequency (usually lower frequency).It converts the frequency without help of any intermediate DC link. The output voltage and frequency of a cyclo-converter can be varied continuously and independently using a control circuit. Therefore, unlike other converters, it is a single stage frequency converter.

Cyclo-converters are constructed using naturally commutated thyristors with inherent capability of bidirectional power flow. These can be single phase to single phase, single phase to three- phase and three-phase to three phase converters.

2.3 GSM TECHNOLOGY.

Global system for Mobile communication is a wide area mobile communication system that uses digital radio transmission to provide voice, data and multimedia communication services. A GSM system coordinates the communication between mobile telephone (mobile station), base stations (cell sites) and switching systems. The GSM network can be divided into four main parts as – Mobile station (MS), Base station subsystem (BSS), Network and switching subsystem (NSS), Operation and support subsystem (OSS). The mobile station includes mobile phones with SIM which makes the equipment to access the services. The base station subsystem connects mobile station and the NSS. It is in charge of transmission and reception. The radio towers are the base stations. The NSS manages the communication between mobile users and other users. It includes data bases needed in order to store information about the subscribers and to manage their mobility. A GSM modem is a wireless modem that sends and receives the data through radio waves. Like a mobile phone, it also requires a SIM card to operate. The SMS received by GSM Modem is sent to Arduino Here, the Arduino uses AT commands to control the modem. There is no need to design any extra equipment for networking due to GSM technology. The GSM itself is a system and is available around the world.

3. Design

For 1 HP load,

The maximum voltage across SCR = 240 x √2= 340V

The rated current of SCR for 1HP

$$\frac{1HP}{(\sqrt{2} \times V \times cos\emptyset)}$$

$$= \frac{746}{(\sqrt{2} \times 240 \times 0.8)} = 2.8A$$

At the starting the motor current increases 5 times of rated current.

Therefore, the maximum current of SCR = 5 × = 14A

TYN616 SCR can selected for cyclo-converter circuit because the anode-cathode voltage is 600V and current is 16A. Both are more than the required rating.

According to the datasheet of TYN616 SCR, minimum gate current is 2 mA and maximum gate current is 25mA.

1N4007 (1A, 1000V) is selected for all diodes in the power circuit.

According to the optocoupler (MOC 3021) datasheet, 470Ω, 1W resisters is selected for all SCR. 220Ω 1W resisters is selected for input of Opto-coupler.

4. Simulation circuit

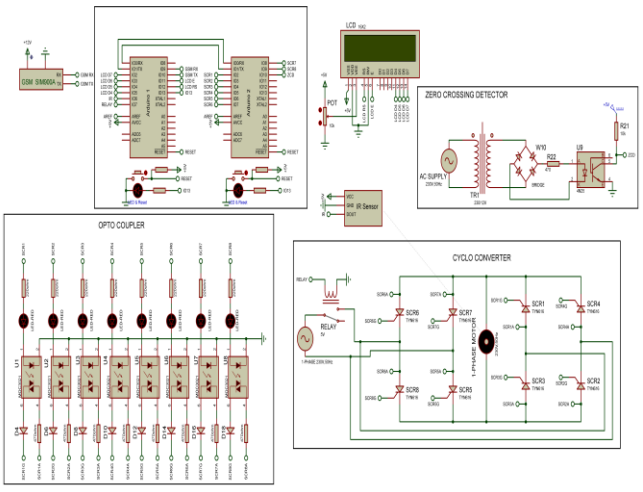

Fig -5: Simulation Circuit.

5. OUTPUT

The each figure shown below shows the different levels of output frequency obtained from the proteus software which is used for simulation of speed monitoring of ac motor using gsm modem.

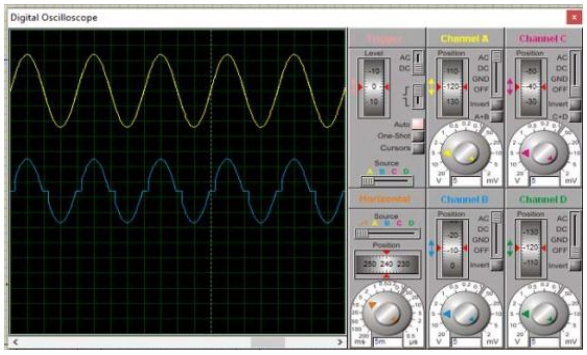

Fig- 6: Frequency variation of 50 HZ using cyclo-converter

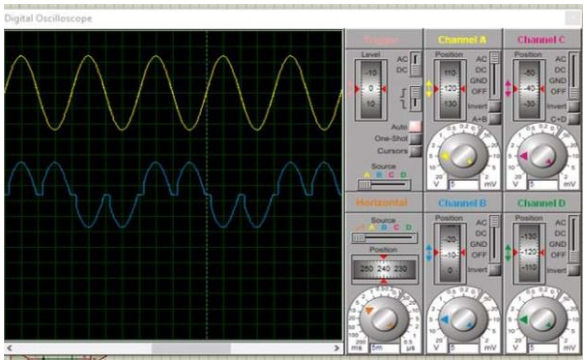

Fig-7: Frequency variation of 16 HZ using cyclo-converter

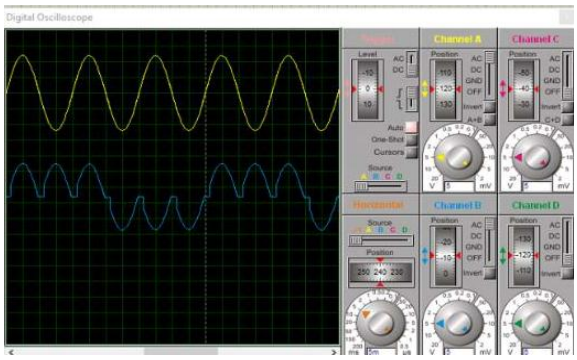

Fig- 8: Frequency variation of 25 HZ using cyclo-converter

Table -1: Different speed for different output frequency

Output frequency	Speed of motor
16 HZ	480 RPM
25HZ	750 RPM
50 HZ	1500 RPM

Similarly the output frequency from the cyclo-converter can be obtained at any different levels. Thus the speed of the ac motor will change according to the output from cyclo-converter frequency supplied to the ac motor.

Where the table shows the different speed obtained at different frequency levels.

6. CONCLUSIONS

The hardware is configured with cyclo-converter where output frequency is varied to control the ac motor. Thus different frequency is obtained using cyclo- converter. Speed monitoring of AC motor using GSM modem requires the user message to operate the ac motor at different speed. The system need the IR sensor to read the speed of motor simultaneously in order to run the motor according to user requirement. The control signal is automatically adjusted by the SCR according to the speed error. When the running speed becomes equal to the user commended speed, then the ac motor is said to be running at the speed commended by user.

REFERENCES

[1] Damini Gharat, Chetna Patil, Harshal Ghude3, Sandeep Gaikwad, "Speed Control of AC Motor Using Frequency Control Method", IJRESM Volume-1, Issue-10, October-2018

[2] "Development of Light Control and Motor Speed Control by Smart Phone" Electrical and Electronics Engineering, University of Sabah, Kota Kinabalu, Malaysia

[3] Viren Patel, Dipak Makawana, Vishal Rangpara, Jaydipsinh Zala, "Ac to Ac step down cycloconverter" IJRESM, Volume: 04, Issue: 03, Mar -2017

[4] Mr.Burali Y. N., Assistant Prof. Patil R. T., "Speed Control and Monitoring of an AC Motor by Wireless Communication Using DTMF Decoder Technique", IJRESM, Vol. 1, Issue 7 (November 2012), PP 10-18

[5] T. Mathurri Sai, S. Keerthi Kumar, "Speed control of dc motor using voice commands", ICCPEIC, St. Joseph's College of Engineering, Chennai, India.