

Automatic Phase Changer Using Microcontroller

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ABSTRACT

In case of three phase system if any one phase is absent and if we want to run all system properly and without interruption then it should help us to run entire system to work properly by using automatic phase changer method. Proper rating of fuses needs to be used in three phase system that are in series with R, Y, B input lines. Where the correct voltage is available, then other low voltage phase is shifted to correct voltage phase to run all equipment on the single phase in the building. The PIC microcontroller PIC16F877a is one of the most useful microcontrollers in industry. When the difference between phase voltage and reference voltage is low then relay will trip the circuit and shifts the load to other phase. Due to power instability issue we designed such system which overcome problem and help to reduce human efforts. The circuit is design with a transformer, comparator, transistor and relay, three individual set of circuit is connected to each phase of three phases.

Keywords- Phase changer, comparator, relay, voltage.

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I. INTRODUCTION

In 21st century, entire world is automation and it is time we must think of microcontroller to control all devices because the microcontroller is compact in size, easy to control.

This is the microcontroller based project. The use of microcontroller in this project is used to store the data, process the data and change the data according to the user requirement. The microcontroller has inbuilt ADC so it will reduce the cost of hardware. No need to connect external RAM for memory storage.[1]

Now a days, in three phases of one phase is cut off or trip by circuit breaker because of any fault is occurs at that time MSEB operator. It also overcome the various phase issues and avoid damages in automation area, industries, hospitals and airports.[2]

The design of this system to detect and interrupt power system fault is the main objective of power system protection. The protective devices are used in power system to detect the fault condition and operate circuit breaker and other devices to limit the loss of service due to failure.

Industrial, Commercial, Domestic supply is depend on public power supply which is interrupted due to phase failure, phase imbalance and power failure or technical problems. Therefore it is need to be for automation of phase change which is safe guard to consumer and provide uninterrupted power supply. [4]

In case of where consumer using single phase power system and there is if any phase failure then power supply gets interrupted.

II. BLOCK DIAGRAM

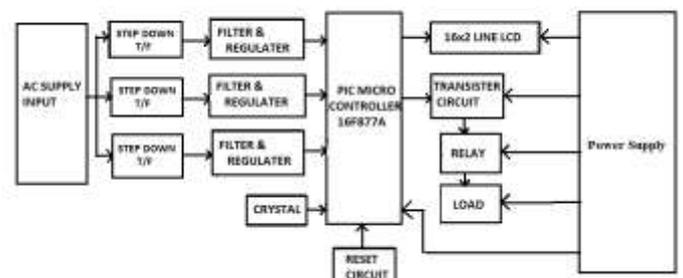


Fig 1. Block diagram of automatic phase changer

Block diagram description:**1. Step down transformer:**

The main three phase supply is stepped down to 12v by three single phases' transformers that are attached to each phase. Step-down transformer consists of two windings, namely primary and secondary windings where primary can be designed using a less-gauge wire with more number of turns as it is used for carrying low-current high-voltage power, and the secondary winding using a high-gauge wire with less number of turns as it is used for carrying high-current low-voltage power.

Step down transformer convert 230V into 6V AC. Because Microcontroller senses the voltage between 0-5V so for that purpose Step down transformer is used in our system.

Transformers works on the principle of Faraday's laws of electromagnetic induction, 230V AC power is converted into 12V AC (12V RMS value wherein the peak value is around 17V), but the required power is 5V DC; for this purpose, 17V AC power must be primarily converted into DC power then it can be stepped down to the 5V DC.

Due to the advantages of the bridge rectifier over the half and full wave rectifier, the bridge rectifier is frequently used for converting AC to DC.

2. Filter and Regulator:

Capacitor is used as a filter. This is used to remove ripple content in the input supply voltage. 7805 regulator IC is used to regulate the voltage. This is used for voltage regulation. A regulated power supply essentially consists of an ordinary power supply and a voltage regulating device.

Bridge circuit gives the pulsating dc voltage to the regulator IC 7805 this will regulate the dc voltage and gives the constant dc voltage at output.

The output from an ordinary power supply is fed to the voltage regulating device that provides the final output. The output voltage remains constant irrespective of variations in the ac input voltage or variations in output (or load) current. Figure given below shows the complete circuit of a regulated power supply with a transistor series regulator as a regulating device.

The ac voltage, typically 230 Vrms is connected to a transformer which transforms that ac voltage to the level for the desired dc output. The regulated dc supply is available across a voltage divider. Often more than one dc voltage is required for the operation of electronic circuits

3. Microcontroller:

PIC16f877A microcontroller is used because it has inbuilt ADC. This controller continuously checks for live condition of all phases connected to it and controller connect the load to that live phase using a relay.

4. Relay:

In our system multiplex Single pole 6V relay are used. Also for switching purpose. Relay is electrically operated switch. It is used to relay circuitry to complete electrical isolation between input and output and control low power signal.

The output of system is in form of electric bulb which glows for correct output.

Relays are the primary protection as well as switching devices in most of the control processes or equipment regardless of whether they are electronic or electromechanical.

All the relays respond to one or more electrical quantities like voltage or current such that open or close the contacts or circuits. A relay is a switching device as it works to isolate or change the state of an electric circuit from one state to another. These are found in all sorts of devices.

Relays allow one circuit to switch over to a second circuit that can be completely separated from the first. There is no electrical connection inside the relay between the two circuits – the link is magnetic and mechanical only.

Application of Relay:

- Control a high-voltage circuit with a low-voltage signal, as in some types of modems or audio amplifiers.
- Control a high-current circuit with a low-current signal, as in the starter solenoid of an automobile.
- Detect and isolate faults on transmission and distribution lines by opening and closing the circuit breakers.
- Time delay functions. Relays can be modified to delay opening or delay closing set of contacts. A very-short delay uses a copper disk between the armature and moving blade assembly.
- Typical applications of relays include computer interfaces, telecommunication systems, traffic control, automotive electrical systems, home appliances, lighting control systems,
- Electric motor controllers, tools and machines, air-conditioning and heating systems, and so on.

5. Power supply:

In our system power supply plays an important role for proper operation of Microcontroller, LCD, Transistor circuit, Relay & Load. Power supply has nominal 3 phase or phase voltage 415 ac voltage under normal conditions, single to neutral voltage 240.

6. LCD:

LCD given for contrast control. It is used to provide display status of condition. LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits.

These modules are preferred over seven segments and other multi segment LEDs. The reasons being: LCDs are economical; easily programmable; have no limitation of displaying special & even custom characters (unlike in seven segments), animations and so on.

A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data.

The command register stores the command instructions given to the LCD. A command is an instruction given to LCD to do a predefined task like initializing it,

clearing its screen, setting the cursor position, controlling display etc.

The data register stores the data to be displayed on the LCD. The data is the ASCII value of the character to be displayed on the LCD. Click to learn more about internal structure of a LCD.

7. Crystal & Reset circuit:

Crystal generates continuously clock frequency and Reset circuit restart the controller to run programming from starting.

Methodology:

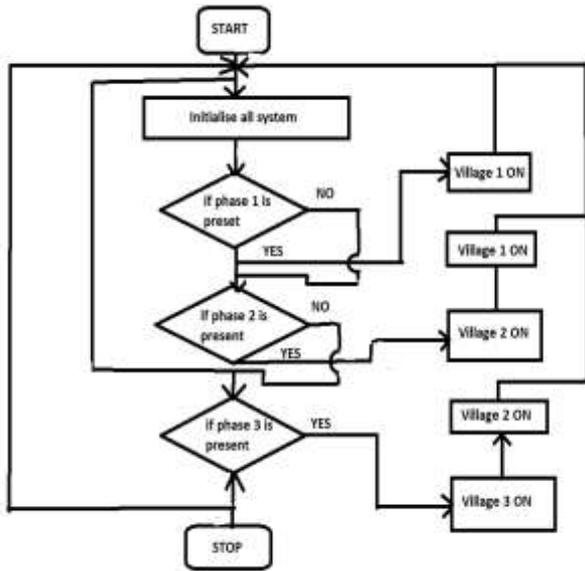


Fig 6. Flowchart of system

Initialize all the system, checking the condition of all phases connected to the system.

1. If phase 1 is present then village 1 is ON, if phase 1 is absent it will connected to phase 2.
2. If phase 2 is present then village 2 is ON, if phase 2 is absent it will connected to phase 3.
3. If phase 3 is present then village 3 is ON, if phase 3 is absent it will connected to phase 1.

Result and discussion:

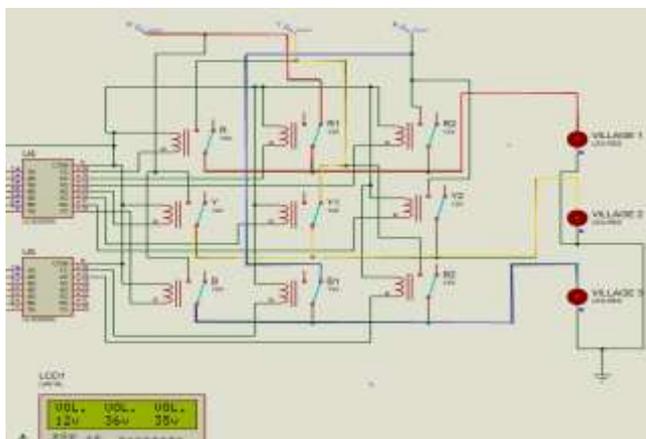


Fig 2. Normal condition

It shows that when system works in normal condition, all three phases are present.

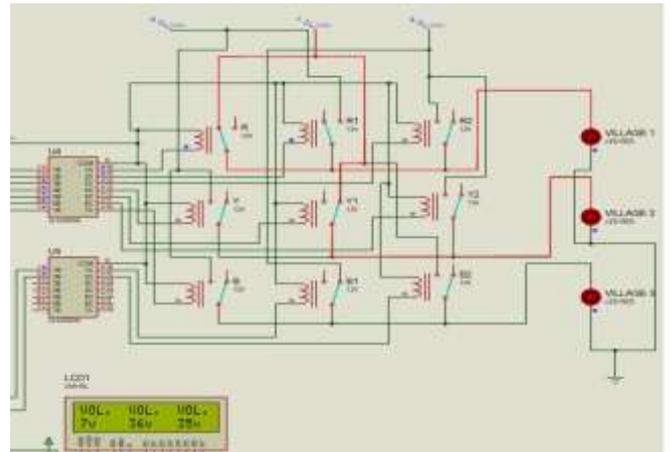


Fig 3. R Phase absent

It shows that when R phase is absent and next phase is automatically connected next available Y phase.

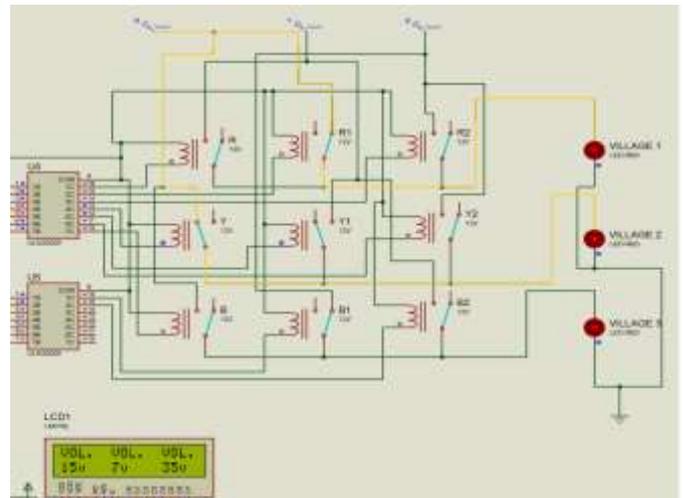


Fig 4. Y phase absent

It shows when Y phase is absent then next phase is automatically connected to next available B phase.

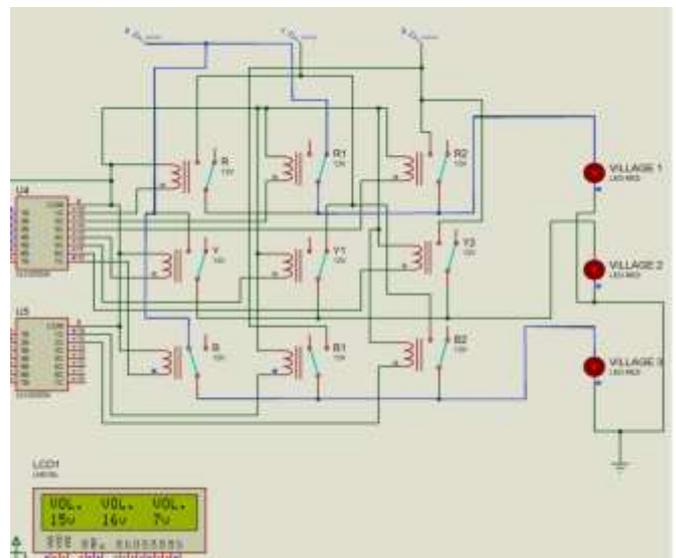


fig 5. B phase absent

It shows that when B phase is absent then next phase is automatically connected to next available phase.

III. CONCLUSION

Hence using this project correct voltage level at output using same power lines through relay is achieved.

This circuit also provides and automatic phase change in circuitry (R, Y, and B). Hence using these circuitry human efforts are reduced and the motive of phase change is achieved automatically with the help of microcontroller.

Circuit break up issues are also avoided in this project. This system has ability to monitor, control and switch the system between phases.

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