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Automatic Active Phase Selector for Single Phase Load from Three Phase Supply

Nirbhay Singh
nirbhaysingh080@gmail.com

Nitesh Kumar
nkkarn.kumar@gmail.com

Amrish Kumar
amrish1514@gmail.com

Abstract

Phase absence is a very common and severe problem in any industry, home or office. Many times one or two phases may not be live in three phase supply. Because of this, many times, some electrical appliances will be on in one room and OFF in another room. This creates a big disturbance to our routine work. This project is designed to check the availability of any live phase, and the load will be connected to the particular live phase only. Even a single phase is available, and then also, the load will be in ON condition. This controller continuously checks for live condition of all phases connected to it, and the controller connects the load to the active phase using a Relay. This relay is driven with a transistor. If two or three phases are live, the load will be connected to phase I only. An LCD is provided to display the status of the phase condition. Contrast control preset is given for LCD contrast control.

*Index Terms—**Active phase selector, ARM 7 microcontroller, single phase supply, etc.***

INTRODUCTION

The project is designed to provide uninterrupted AC mains supply i.e., 230 volt to a single phase load. This is achieved by automatic changeover of the load from the missing phase to the next available phase in a 3 phase system. It is often noticed that power interruption in distribution system is about 70% for single phase faults while other two phases are in normal condition. Thus, in any commercial or domestic power supply system where 3 phase is available, it is advisable to have an automatic changeover system for uninterrupted power to critical loads in the event of missing phase. In this system auto selection is achieved by using a set of relays interconnected in such a way that if one of the relay feeding to the load remains energized always. Under the phase failure condition the corresponding step down transformer secondary delivers zero voltage which is duly rectified to DC and then fed to the logic gates comprising of AND & OR to switch on the next relay that delivers the power to the load. It also has a provision of connecting to an inverter source which delivers uninterrupted power to the load incase all the 3 phases go missing. The project is supplied with three transformers connected to the 3 phases supply.

Further the project can be enhanced by incorporating power semiconductor devices such as thyristors/IGBTs for instantaneous changeover to the next available phase. This overcomes the drawback of the changeover time generally witnessed by relay switching operations.

LITRATURE REVIEW

F. U. Nweke et.al. says in the paper “Design and Construction of Automatic Three Phase Power System Selector” that the automatic three phase power system selector was designed and constructed. The device automatically switches over to the alternative phase that has current when there is power outage or extremely low current in the phase which the load is connected without the power being off. The selector links the load and the other phases and relay switches allowing the usage of the remaining phases where there is outage on the mains source without disturbing or interrupting the load. It maintains constant power supply to the load by automatically activating the phases when the need arises.

This safeguards the electronics system from being damaged and burnout as a result of voltage instability, collapse, insistent outages which are paramount in under developed and developing countries.

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Oduobuk, E. J. et.al. says in the paper "Design and Implementation of Automatic Three Phase Changer Using LM324 Quad Integrated Circuit" that Design and implementation of an automatic three phase changer using LM324 quad integrated circuit was carried out. The system was designed and simulated using (Multisim). The circuit components were mounted a Vero board. LM324 integrated circuit (comparator) and 2N2222 transistors were used as active components alongside other passive components. Result shows that, when the three phase a.c inputs: Red phase ( ), yellow phase ( ) and blue phase ( ) from public utility supply was fed to the system, the system compared the inputs with regard to phase imbalances, and the input with the highest voltage appears across the output. It also changes over from one phase to another immediately the circuit senses further phase imbalance.

Ayan Ghosh et.al. Says in the paper "Design of Automatic Phase Selector from Any Available Three Phase Supply" Power failure is a common problem. It hampers the production of industry, construction work of new plants and buildings. It can be overcome by using a backup power supply such as a generator. The main aim of this paper is to present the real idea of an automatic phase switch for 220V to 240V alternating current. Although, there are many designs that can perform almost similar functions like, single phase change-over switches, two phase automatic transfer switch and three phase automatic change-over switch, but this model is about an automatic phase switchover (phase selector) which is designed for only three phase A.C input power to single phase output applications.

Mbaocha Christian says in the paper "Smart Phase Change-over system with AT89C52 Microcontroller" that this project is designed to check the availability of any live phase, and the load will be connected to the live phase only.

This feat is achieved with AT89C52 MCU. This controller continuously checks for live condition of all the phases connected to it, and the controller connects the load the load to the active phase Relay, live phase, controller, rectifier, using a relay. The relay is driven with a transistor. If two or three phases are live, the phase will be connected to the phase that is ON only and automatically transferred to the phase that is ON in the event of a main outage or from generator back to main when restored. An LCD is provided to display the status of the phase condition.

Contrast control preset is given for LCD contrast control.. Furthermore the project uses a regulated 12V, 500mA power supply. Bridge type full-wave rectifier was used to rectify the A.C. output of the secondary 230/12V step –down transformer.

SYSTEM ARCHITECTURE

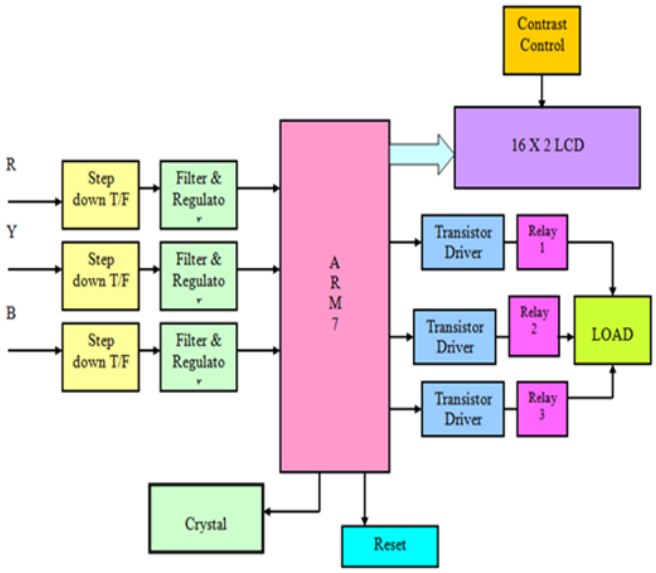

Figure. 1 Block Diagram of the system

1. Display "ACTIVE PHASE SELECTOR SYSTEM" On LCD.
2. When Phase I is active at that time relay 1 Active To ON the Load, Wait for the message Phase I is active to be displayed on the LCD.
3. When Phase II is active at that time relay 2 active to ON the Load, Wait for the message Phase II is active to be displayed on the LCD.

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4. When Phase III is active at that time relay 3 active to ON the Load, Wait for the message Phase III is active to be displayed on the LCD.
5. So Phase I is selected from the 3 phases by default in order to run the single phase load when all phase will active.
6. In the absence of Phase I, Phase II is selected and the same message is displayed on the LCD.
7. If the phase II is absent then the phase III is selected to run the single phase loads.
8. In the presence of the first phase the phase selection will be switched to the first phase though it is being presently run by the second or third phase.
9. The phase on which the single phase load is being run will be displayed on the LCD.
10. All the Process repeat continuously by the Present Condition Respectively.

SYSTEM REQUIREMENT

ARM 7:

The LPC2148 depend on a 16/32 bit ARM7TDMl-S CPU with constant imitating and implanted follow bolster, together with 128/512 kilobytes of installed rapid glimmer memory. A 128-piece wide memory interface and an interesting quickening agent design empower 32-bit code execution at most extreme clock rate. For basic code estimate applications, the option 16-bit Thumb Mode decreases code by more than 30% with negligible execution punishment. With their minimal 64 stick bundle, low power utilization, different 32-bit clocks, 4-channel 10-bit ADC, USB POBT, PWM channels and 46 GPIO lines with up to 9 outer intrude on pins these microcontrollers are especially reasonable for mechanical control, restorative frameworks, get to control and purpose of-offer.

LCD (LIQUID CRYSTAL DISPLAY)

LCD stands for Liquid Crystal Display. LCD is finding wide spread use replacing LEDs (seven segment LEDs or other multi segment LEDs) because of the following reasons:
1. The declining prices of LCDs.
2. The ability to display numbers, characters and graphics. This is in contrast to LEDs, which are limited to numbers and a few characters.
3. Incorporation of a refreshing controller into the LCD, thereby relieving the CPU of the task of refreshing the LCD. In contrast, the LED must be refreshed by the CPU to keep displaying the data.
4. Ease of programming for characters and graphics.

These components are “specialized” for being used with the microcontrollers, which means that they cannot be activated by standard IC circuits. They are used for writing different messages on a miniature LCD.

Simulation results

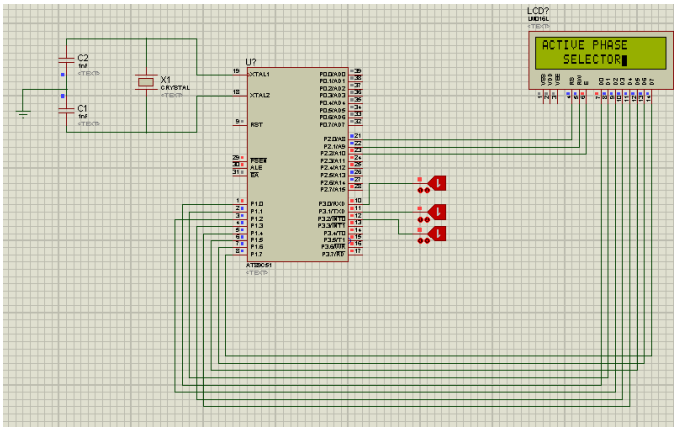

Figure. 2 Proteus simulation

Applications

1. Used in Industrial applications
2. Used in corporate offices
3. Used in shopping malls
4. Used in Agricultural fields

Conclusion

Unfortunately though the poor availability of public utility power in the developing countries has pushed her citizens to seek alternatives and dependent means of electricity .This has resulted in individuals buying wind turbines, solar panels, generating sets and so on. Unavoidably this requires careful selection of the one to be ON to their use – alternative power or public power utility. According to the result it is seen that we get the

desired output from the auto phase selector. Automatically it is selecting the active phase when the connected phase is absent. But our main objective is to select an active phase automatically to save the time and without hampering the work. This objective is satisfied successfully here.

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