

AUTO SELECTION OF ANY AVAILABLE PHASE IN THREE PHASE SUPPLY SYSTEM

Vikramsingh R. Parihar^{#1}, Rohan V. Thakur^{*2}, Aparna R. Khairkar^{#3},
Kaustubh S. Kalkonde^{#4}, Roshani S. Nage^{#5}

^{#1,2,3,4} Department of Electrical Engineering, Prof Ram Meghe College of Engineering & Management,
Badnera- Amravati
Amravati, Maharashtra, India

¹ vikramparihar05@gmail.com, ² rvt.prmceam@gmail.com, ³ khairkar.aparna@gmail.com,
⁴ kskprnceam@gmail.com, ⁵ roshani.nage@gmail.com

Abstract— This project is designed with an aim to provide uninterrupted AC mains supply that is 230 volts 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 the distribution system is about 70% for single phase faults while the two other phases are in normal condition. Thus, in any commercial or domestic power providing system wherever three phases are offered, it's wise to possess automatic shift system for uninterrupted power to essential loads in the event of missing phase.

In this three-phase supply system, the auto selection is achieved by using a set of relays interconnected in such a way that if one of the relays feeding to the load remains energized always. Under the phase failure condition, the corresponding step-down transformer is turned on using a transistor assembly. Here, we are having three phases namely the R phase, Y phase, and B phase. To control the switching of the phase, there are three switches. Led which is placed on left is used to indicate which phase is on or off, the led and relays placed on the right indicates, which supply is providing power to the load.

Index Terms — Auto Selection of Available Phase, Three Phase Supply System, Arduino UNO, Electrical Safety

I. INTRODUCTION

Most companies, industrial, commercial and even domestic are dependent on public power supply which has erratic supply such as phase failure, phase imbalances or total power failure due to one or more technical problem in power generation, transmission or distribution. If all the three phases are available, there is need for automation of phase change during phase failure or total power failure in any of three phases in order to safe guard consumer appliances from epileptic power supply.

In most cases, many manufacturing companies, whether they are domestic or industrial, which employ single phase equipment for its operation sometimes experience challenges during failures in power supply. Much time would be required in the process of manual change over. This means that time and the process required for the phase change may cause serious damages to machines and even the products. Hence, there is need for automatic phase switching system. A single-phase public

utility prepaid meter is operated with a single-phase power supply unit. If there is a phase failure from the public utility power supply, the prepaid meter will stop working until the phase is manually changed to an active phase. So, a person needs to be present always to make the changes at any point in time. To overcome this problem automatic system is required. The basic idea for the project is to provide uninterrupted supply to the single-phase load. More than 70% of the fault are single phase faults.

For complexes like hospitals, schools, where there is incoming 3phase supply if any of the phases, out of the 3 phases faces fault, then the supply will be automatically shifted to the next available phase from the 3phase supply. Most firms Industrial, commercial and domestic necessities are depending on public power supply which have erratic supply such as phase failure, phase imbalances or total power lapse due to frequent technical problems in power generation, transmission or distribution. Hence, it is highly necessary to make automation in phase change during phase failure or total power failure so as to protect consumer appliances from epileptic supply of power. In most cases, many manufacturing firms, be it domestic or industrial, which employs single phase equipment for its operation might come across challenges during unbalance voltages, overloads and under-voltages in supply of power, where much time would be required in the process of manual change over. This means that time and the process needed for the phase change may cause serious damages to machines and even the products. Hence, there is need for automatic phase switching system and this system will provide a single-phase correct voltage in the same power supply lines through relays from other phase where correct voltage is available.

The system operates by stepping down 220 Volts AC to 12 Volts DC, rectified and fed into the microcontroller through the voltage divider circuit. The microcontroller compares the three phases and switches the relays through the transistor drives. The automatic phase changer is made from some electronics components in which op-amp, diodes relays and fuses are included. Result obtained during test shows that whenever there is failure of phase, under voltage condition then the load gates shifted on another phase instantly.

II. PROPOSED SYSTEM

The human relief stand-by which is designed only to monitor, operate, to maintain power. This operation is based on relays and optocouplers. As of whole the duration of starting and closing the loads should be less than 5sec. Their complexity has increased to a great extent due to addition of new features to make the entire system automatic. Therefore, this automatic process has increased widely in many sectors such as industries, commercial, hospitals, banks and even in the modern residences.

In three phase power supply line voltage can be dropped or risen from the rated voltage supplied in any phase for various causes. The reasons for voltage fluctuation are discussed below in brief. Voltage rise: In case of transmission line is charged on no load- due to its capacitive effect (Ferranti effect) voltage gets rise at receiving end more than that rated voltage. Voltage drops: Due to active power loss or resistance of the line, IR drop occurs which result in getting less voltage at the receiving end which is less than the rated voltage. Another reason for voltage drop is that if heavy load is applied all of a sudden, voltage drop occurs. Automatic Phase Changer circuit can provide nominal voltage to the emergency loads with the

help of healthy line. In the next portion, the principle of circuit operation is going to be described.

In three-phase applications, if low voltage is occurred in any one or two phases then to maintain normal voltage for the equipment this circuit can play an effective role. However, a proper-rating fuse needs to be used in the input lines (R, Y and B) of each phase. The circuit provides correct voltage in the same power supply lines through relays from the other phase where correct voltage is available. We can use solar energy as a back-up power in the condition where all three phases are unavailable to provide required supply to the load. This way we are providing continuous uninterrupted supply to the consumer load.

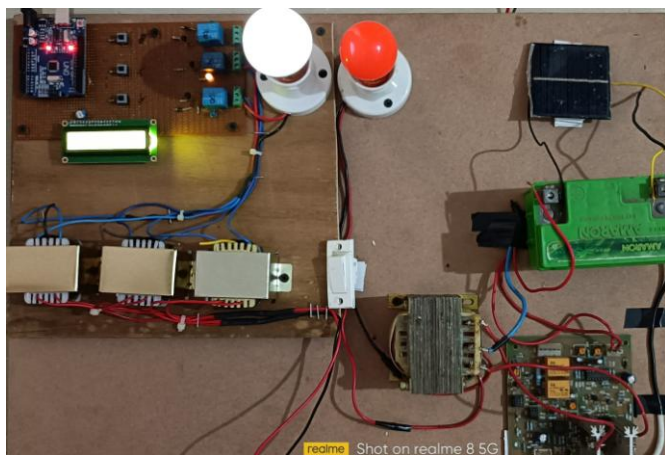


Fig 1: Model design of proposed system

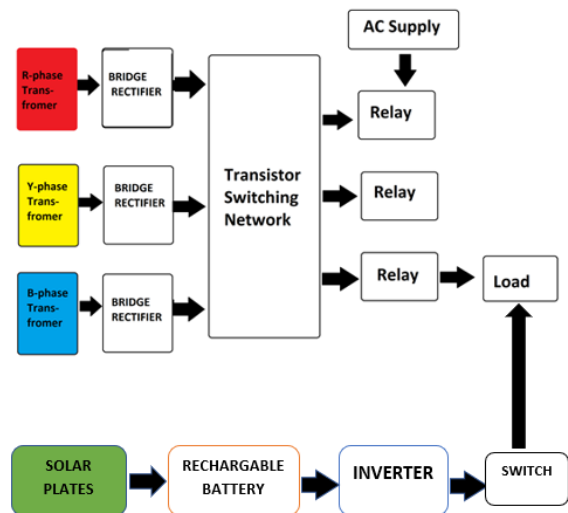


Fig. 2: Block Diagram of Proposed Approach

In this three-phase supply system, the auto selection is achieved by using a set of relays interconnected in such a way that if one of the relays feeding to the load remains energized always. Under the phase failure condition, the corresponding step-down transformer is turned on using a transistor assembly. Here, we are having three phases namely the R phase, Y phase, and B phase. To control the switching of the phase, there are three switches. LED which is placed on left is used to indicate which phase is on or off, the led and relays placed on the right indicates, which supply is providing power to the load.

We also connect solar plates system as a back-up power supply to the load in case of all three phases are not available to provide required electric power supply to load. Where we used rechargeable battery to store energy generated by solar plates and then it connected to inverter circuit which convert stored DC energy to AC electric energy which required to load.

The above block diagram represents the basic layout of the entire system, of which this paper is all about. The main objective of the system is to

provide uninterrupted power to critical loads in the event of missing phase. Along with that to sense the faults and automatically disconnect the supply to avoid large scale loss and inform the individual by sending a message in case of permanent fault.

The entire process is carried out using transformers which depict the three-phase supply system. The 220V is first step-down using transformer to 12V which is then rectified and using voltage regulator sent to the micro-controller such that the relay gets functioned. The auto selection is carried out using a set of relays which are connected to the load. The auto selection is made possible in a way that if one of the relays feeding to the load remains energized always.

III. RESULT

EXPERIMENTAL RESULT

R Phase	Y Phase	B Phase	Selected Phase
Active	Active	Active	Any of three (Say R)
Active	Absent	Active	B
Active	Active	Absent	R
Absent	Active	Active	Y
Absent	Absent	Absent	None

Step 1: load on phase R (Primary)

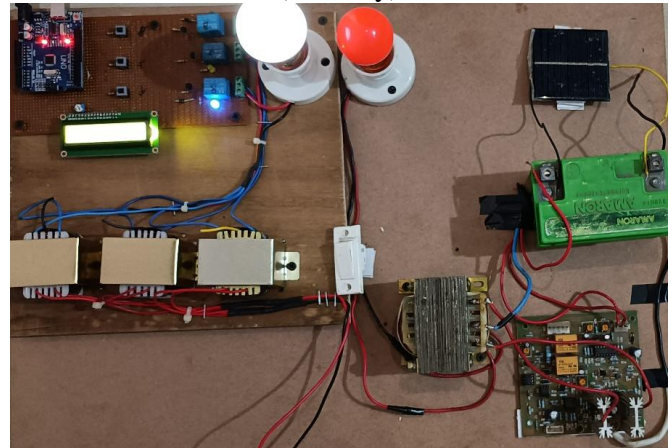


Fig. 3: All phase on and load on(R)

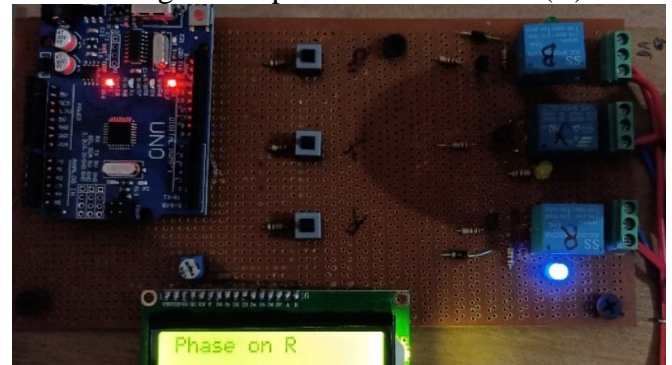


Fig. 4: Display Phase on R

Step 2: Load on phase y when fault on R phase

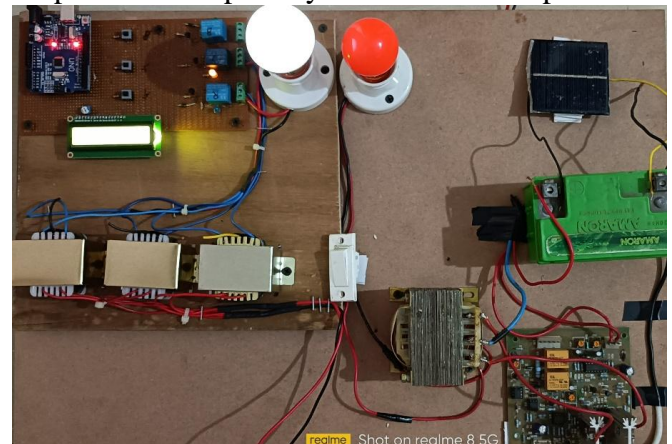


Fig. 5: One phase is off (R phase) and load shift on(Y)

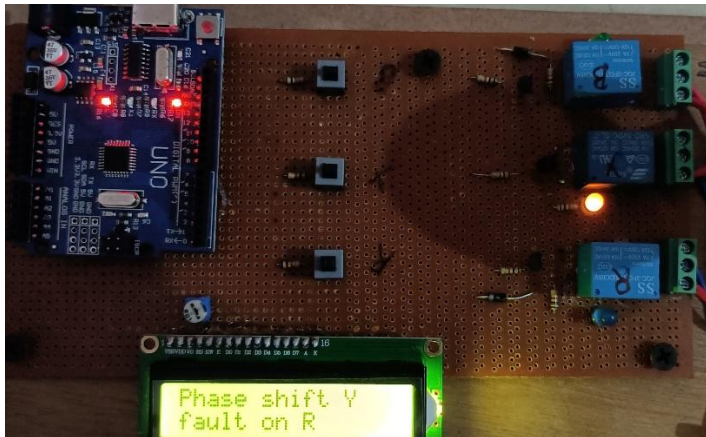


Fig. 6: Display Phase Shift Y, fault on R

Step 3: Load on phase B when fault on R and Y phase

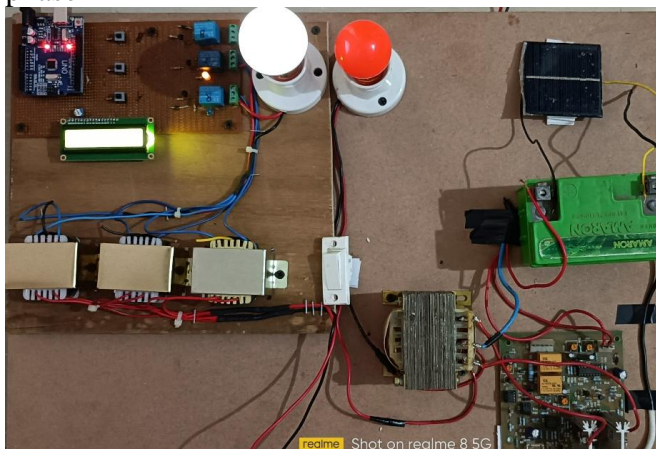


Fig. 7: Two phases off and load shifted on(B) phase

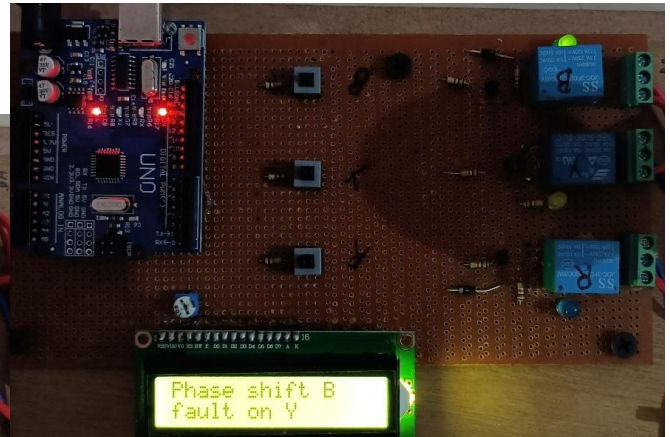


Fig. 8: Display Phase Shift B, fault on Y
Step 4: Load is working on solar (DC Energy) when fault on R, Y, B phase

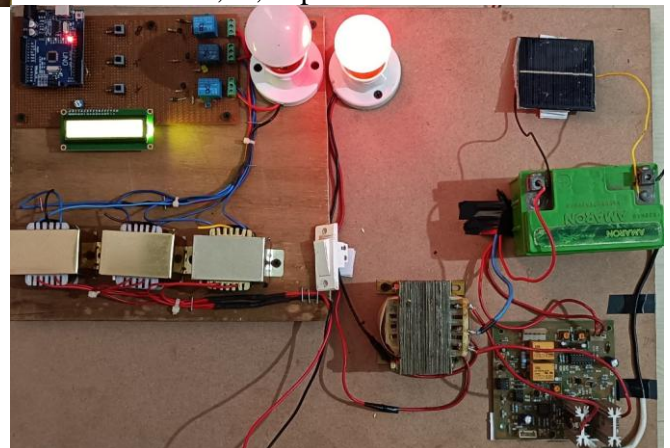


Fig. 9: All three phases off and load on via solar

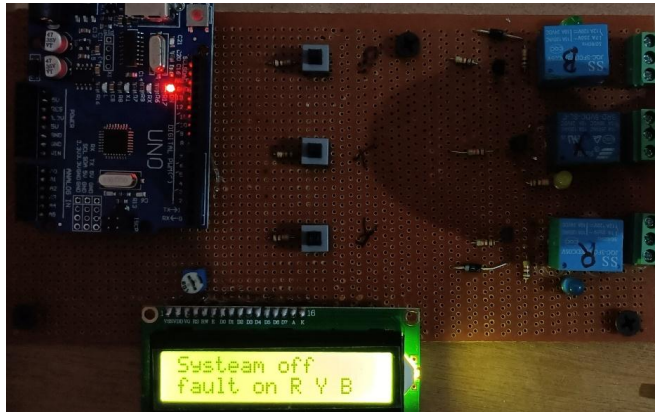


Fig. 10: System OFF, fault on R Y B

IV. ADVANTAGES

- Gives protection to the any commercial or domestic single-phase system.
- Less time-consuming protection system.
- Self-operating and static system.
- Low cost and reliable circuit
- The time required of switching between the phases have been drastically reduced.
- More automatic operation with the elimination of selector switch
- Reduced circuit size and easier implementation
- The problem of sparking between the selector switch and the phase connection does not arise.
- Highly sensitive
- Works according to the phase availability
- Low cost and reliable circuit
- Complete elimination of manpower
- System had power back up in the form of solar energy.

V. DISADVANTAGES

- The only disadvantage of this project model is the consumer is unaware about the fault occurs (Single phasing fault) on the line of his area on three phase supplies.
- Because of unawareness of consumer, there is delay in to correct or repair the fault by electrical technician.

VI. CONCLUSIONS

Using this project, a correct voltage level at result is provided to the required phase. In - short the uninterrupted power supply can be provided. The circuit also provides an automatic phase change in the system (i.e., R, Y, and B). Hence using this circuit human effort is reduced and the motive of phase change is achieved automatically with the help of advanced controller that is Arduino which leads to various industrial and commercial usages. It is an intelligent system which has the ability to monitor, control and switch the system between phases. It is also less expensive and easily available. It reduces the stress and saves time. It also provides better protection as compared to the manual practice because of the use of overload is the changeover system.

Automatic phase changer finds wide application in modern world. During earlier times, if there is a power failure in any of the three phases, we must manually switch to phase which is available. By implementing automatic phase changer, the phase is automatically shifted where the current voltage is available.

VII. APPLICATIONS

Power failure or low voltage. Automatic Phase Changer automatically cuts supply during low voltage; thus, it protects the equipment from the harmful effects of unhealthy low voltage.

It can be used in

1. Residential building.
2. Commercial small offices.
3. Factories operating with 1 phase machineries.
4. Hospitals/Banks/Institutions

Automatic phase changer finds huge application in the modern world. This device is more cost effective, reliable and of maintenance free.

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BIOGRAPHIES



Prof. Vikramsingh R. Parihar: He is an Assistant Professor in Electrical Department, PRMCEAM, Badnera-Amravati having 10 years of experience. He has received the B.E degree in

Instrumentation from Sant Gadge Baba Amravati University, India, in 2011 and the M.E degree in Electrical and Electronics Engineering, Sant Gadge Baba Amravati University, India, in 2014. He is editorial board member of more than 30 prestigious and recognized journals and life member of ISTE, HKSME, ICSES, IJCE, the IRED Engineering New Zealand and IAENG. His domain of research includes Electrical Engineering, Instrumentation, Electrical Power Systems, Electrical and Electronics Engineering, Digital Image Processing, Neuro Fuzzy Systems and has contributed to research in a commendable way by publishing more than 50 research papers in National/International Journals including 4 papers in IEEE Conferences. He has written 8 book chapters and also authored 3 books.



Prof. Rohan Vijay Thakur received the B.E. in Electrical Engineering and M. Tech. in Electrical Power System from Government College of Engineering, Amravati, Maharashtra, India in 2009 and 2012 respectively. He is currently working as an Assistant Professor in Electrical Engineering Department of Prof Ram Meghe College of Engineering & Management, Badnera-Amravati, Maharashtra, India. His area of research interest includes Power Quality, Power System Stability, Design and modelling of custom power devices, etc.



Prof. Aparna R. Khairkar has completed Bachelors Of Engineering in Electronics & Telecommunication and Masters in Management

Studies with finance specialization. She has completed Masters in Engineering in Electrical and Electronics from SGBAU university. She has also completed Masters in Business Administration.



Prof. K. S. Kalkonde received ME Digital Electronics from SGBAU Amravati Since 2011. He is working with Prof Ram Meghe College of Engineering and Management Badnera

Amravati in Department of Electrical Engineering. He has 11 years of teaching experience. His area of interest includes Signals and System, Digital Image Processing.



Prof. Roshani S. Nage is Assistant Professor in Electrical Engineering Department, PRMCEAM, Badnera-Amravati having 7 years of experience. She has received the B.E degree in Electronics and

Telecommunication Engineering from Sant Gadge Baba Amravati University, India, in 2012 and the M.E degree in Electrical and Electronics Engineering, from Sant Gadge Baba Amravati University, India, in 2014. Her domain of research includes Digital Integrated Circuits, Control Systems, Digital Signal Processing, Digital Image Processing. She has published 5 research papers in National/International Journals and conferences.