

Auto Selection of Any Available Phase in a Three Phase Supply System

Mr. P. P. Gawande¹, Bhagyashri Rajput², Gayatri Rothe³, Ganesh Kharat⁴, Prafulla Vanjari⁵

¹Lecturer, Electrical Engineering, Padm. Dr. V. B. Kolte College of Engineering, Malkapur, MH, India

^{2,3,4,5} Student, Electrical Engineering, Padm. Dr. V. B. Kolte College of Engineering, Malkapur, MH, India

DOI: 10.5281/zenodo.19306834

ABSTRACT

Uninterrupted power supply is a critical requirement in industrial and domestic environments where single-phase loads depend on a three-phase electrical source. Power interruptions caused by phase failure, imbalance, or voltage fluctuations can lead to equipment malfunction, productivity loss, and increased maintenance costs. This paper presents an automated system for selecting any healthy phase from a three-phase supply to ensure continuous power delivery. The proposed system continuously monitors the availability and quality of each phase and automatically switches the load to the most suitable phase using a relay-based control mechanism. A microcontroller-based unit performs phase detection, decision-making, and seamless switching without human intervention. The system enhances reliability, minimizes downtime, and provides a cost-effective solution for maintaining uninterrupted power to critical loads.

Keywords: - Three-phase supply, phase failure, automatic phase selector, microcontroller, relay control, uninterrupted power supply,

1. INTRODUCTION

Electrical power systems in industrial and commercial installations commonly use three-phase supply due to its efficiency and ability to handle heavy loads. However, many devices such as control circuits, lighting systems, and domestic appliances operate on single-phase power. In practical scenarios, power quality issues such as phase loss, voltage imbalance, and fluctuations frequently occur due to faults, overloads, or grid disturbances. Manual phase selection is time-consuming and unreliable, especially in environments requiring continuous operation. Hence, there is a need for an intelligent system that can automatically detect the availability of phases and select the healthiest phase for load operation. This paper proposes an automatic phase selection system that ensures uninterrupted power supply using a microcontroller-based control unit...

2. LITERATURE REVIEW

Earlier methods of phase selection relied on manual changeover switches or electromechanical contactors, which required human intervention and increased response time. Some conventional systems used comparators to detect phase failure but lacked flexibility and real-time monitoring.

Recent research focuses on embedded systems for power monitoring and control. Microcontroller-based designs have been introduced to improve switching accuracy, reduce response time, and enhance system reliability. However, many existing solutions are complex or costly. The proposed system aims to provide a simple, efficient, and economical solution suitable for both industrial and domestic applications..

3. SYSTEM ARCHITECTURE

The proposed system is designed to monitor three-phase inputs and automatically select the best available phase. The major components include:

Three-phase power supply, Phase sensing circuits, Microcontroller unit (MCU), Relay driver and relay unit, LCD display, Power supply unit and Load.

3.1 Block Diagram Description

Each phase (R, Y, and B) is connected to a phase sensing circuit that detects the presence and voltage condition of the phase. The sensed signals are fed to the microcontroller. Based on predefined voltage thresholds, the microcontroller identifies the healthiest phase and activates the corresponding relay through a relay driver circuit. The selected phase is then connected to the load. The LCD displays the current phase status and selected phase.

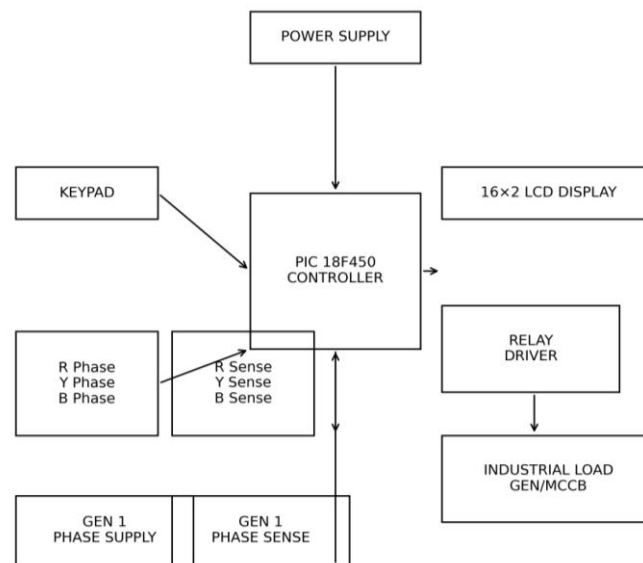


Fig -1: Block Diagram

4. PROPOSED METHODOLOGY

The system operates using the following steps:

4.1. Phase Detection:

The sensing circuit continuously monitors voltage availability of all three phases.

4.2. Signal Processing:

The microcontroller reads the sensed signals and compares them with reference voltage levels.

4.3. Decision Logic:

If the currently active phase fails or goes beyond acceptable limits, the controller searches for the next available healthy phase.

4.4. Automatic Switching:

The relay driver energizes the appropriate relay to connect the selected phase to the load.

4.5. Status Display:

The LCD displays phase availability and the currently selected phase.

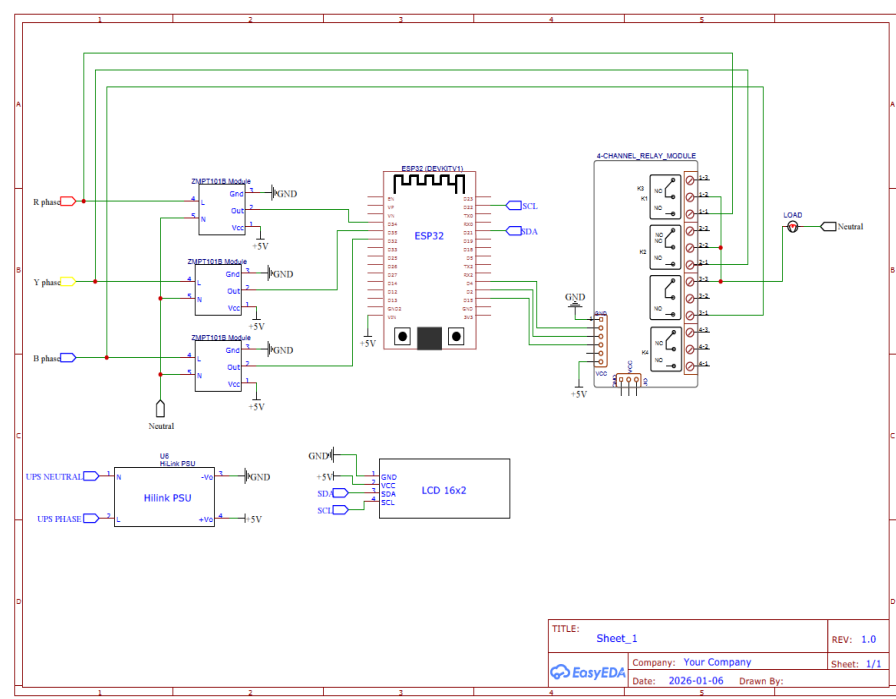


Fig -2: System Architecture

5. HARDWARE IMPLEMENTATION

- Microcontroller: Used as the central control unit for phase detection and switching logic.
- Phase Sensing Circuit: Converts AC voltage levels into logic-compatible signals.
- Relay Driver Circuit: Amplifies controller signals to operate high-power relays safely.
- Relay Unit: Performs physical switching of phases.
- LCD Display: Provides real-time system status.
- Power Supply: Supplies regulated DC voltage to electronic components.



Fig -2: Hardware Implementation

6. ADVANTAGES

Fully automatic operation, Fast response to phase failure, Reduced human dependency, Improved equipment protection, Low cost and easy implementation, Suitable for industrial and domestic loads

7. RESULT

The system was tested under various fault conditions such as single-phase failure, dual-phase failure, and voltage fluctuation. The controller successfully detected faulty phases and switched the load to the healthy phase within a short response time. The automatic switching reduced downtime and eliminated the need for manual

intervention. The results confirm that the system effectively maintains continuous power supply and improves operational reliability.

8. CONCLUSION

This paper presents an efficient and reliable automatic phase selection system for three-phase power supplies. By continuously monitoring phase conditions and intelligently switching to the healthiest phase, the system ensures uninterrupted power to critical loads. The proposed design is cost-effective, easy to implement, and highly suitable for real-world applications where power reliability is essential.

9. REFERENCES

- [1] IEEE Power & Energy Society, IEEE Recommended Practice for Monitoring Electric Power Quality, IEEE Std 1159-2019.
- [2] IEEE Standards Association, IEEE Standard for Voltage Ratings for Electric Power Systems, IEEE Std 141-1993 (Red Book).
- [3] M. H. Rashid, Power Electronics: Circuits, Devices, and Applications, 4th Edition, Pearson / Elsevier, 2014.
- [4] C. L. Wadhwa, Electrical Power Systems, 7th Edition, New Age International Publishers, 2017.
- [5] B. L. Theraja and A. K. Theraja, A Textbook of Electrical Technology – Vol. II (AC and DC Machines), S. Chand Publishing.
- [6] R. C. Dorf and J. A. Svoboda, Introduction to Electric Circuits, 9th Edition, Wiley, 2014.
- [7] N. Mohan, T. M. Undeland, and W. P. Robbins, Power Electronics: Converters, Applications, and Design, Wiley, 2003.
- [8] Raj Kamal, Embedded Systems: Architecture, Programming and Design, 2nd Edition, McGraw-Hill Education.