

Priority Based Power Distribution System Using GSM Alerts

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ABSTRACT

Continuous electrical power supply is essential for critical loads in domestic, commercial, and industrial applications. Interruption of a primary power source can adversely affect important equipment when power is distributed without considering load priority. This paper presents a priority-based power distribution system using GSM alerts for continuously monitoring available power sources and automatically managing connected loads during source failure. The proposed system is developed around a PIC16F876A microcontroller that monitors two power sources and controls the loads through electromagnetic relays. When a power source becomes unavailable, the controller automatically disconnects the low-priority load while maintaining supply to the high-priority load through an alternative source. An LCD and LED indicators provide local operating status, while a buzzer indicates switching conditions. A SIM800L GSM modem is incorporated to provide SMS notification regarding source failure. The developed prototype demonstrates automatic source monitoring, priority-based load management, source switching, and remote fault notification. The system provides a simple and economical approach for improving power availability to critical loads.

Keywords— Priority-based power distribution, PIC16F876A, GSM, SIM800L, microcontroller, relay, load management, power source monitoring.

INTRODUCTION

Reliable electrical power distribution is important in applications where interruption of supply to critical loads cannot be tolerated. Conventional distribution arrangements may supply different loads without considering their relative importance. Consequently, when a source fails or the available supply becomes insufficient, both critical and non-critical loads may be affected. A priority-based distribution strategy can overcome this limitation by maintaining the supply to important loads while disconnecting loads having lower priority.

The proposed system continuously monitors the available power sources and automatically controls the connected loads according to predefined priorities. When one power source is unavailable, the low-priority load associated with the available power is disconnected and the high-priority load is supplied from an alternative source. A microcontroller serves as the central control unit and interfaces with the power-source sensing circuits, relays, LCD, LEDs, buzzer, and GSM modem.

The system employs the PIC16F876A microcontroller for monitoring and control. The source conditions are sensed through optocoupler-based circuits, while relays perform electrical switching. The LCD displays the operating condition and LEDs provide visual indications. A buzzer is used for local alert generation. In addition, the SIM800L GSM module provides remote notification through SMS whenever a source-related abnormal condition is detected. Embedded C programming is used to implement the required monitoring and switching logic.

LITERATURE SURVEY

Wei *et al.* [1] proposed an intelligent household control system based on Internet and GSM technology. Their system was designed to detect faults automatically and transmit alerts through GSM so that corrective measures could be initiated. Although GSM-based fault notification provided remote information regarding system conditions, the requirement of maintaining continuous power to high-priority loads remained an important consideration.

Rajeswari and Prasannavalli [2] presented an uninterrupted power distribution system employing Arduino-based PLC control. The system utilized an auxiliary feeder when a fault occurred in the main feeder and provided information regarding the fault condition. Raviselan [3] investigated an intelligent power distribution system using GSM to address discontinuous power supply to critical loads. The work emphasized continuous monitoring of the power supply and the importance of differentiating between critical and non-critical loads. These studies indicate the need for a distribution system that integrates automatic source monitoring, priority-based load control, source switching, and remote GSM notification.

PROBLEM STATEMENT

Power interruptions caused by faults in transmission and distribution networks can result in the loss of supply to critical as well as non-critical loads. Identifying and clearing faults may require considerable time, during which essential loads remain without power. Therefore, a power distribution system is required that continuously monitors available sources, automatically disconnects low-priority loads during source failure, and transfers critical loads to an alternative source. The system should also provide local indications and remote alerts to enable timely identification of abnormal operating conditions.

OBJECTIVES

The main objectives of the proposed system are:

1. To continuously monitor the available power sources and automatically manage the loads according to predefined priority during a source failure.
2. To maintain supply to high-priority loads through automatic source switching while providing local indications and GSM-based remote alerts regarding the power-source condition.

PROPOSED SYSTEM

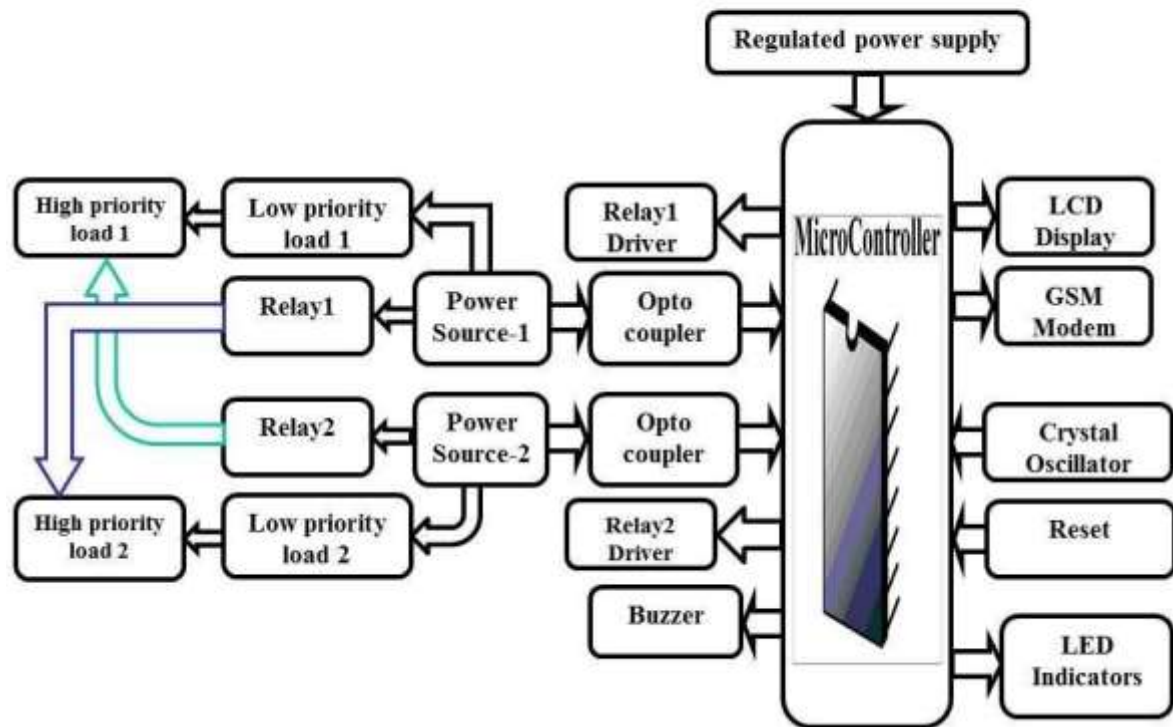
The proposed priority-based power distribution system is centered on a PIC16F876A microcontroller. Two electrical power sources are continuously monitored through source-sensing circuits connected to the controller. Loads are divided into high-priority and low-priority categories. Under normal operating conditions, the available sources supply their corresponding loads. When a source failure is detected, the controller executes the programmed priority-based control strategy.

The low-priority load is disconnected when necessary so that the high-priority load can continue to receive power. Relays connected through suitable driver circuits perform the required switching operations. An LCD displays the condition of the power sources, while LED indicators and a buzzer provide additional local status information. The SIM800L GSM modem communicates with the microcontroller and transmits SMS alerts to a registered mobile number when source failure is detected.

BLOCK DIAGRAM

Fig.1 shows the block diagram of the priority-based power distribution system using GSM alerts. The microcontroller continuously monitors the two power sources through optocouplers and controls the relays to supply high-priority

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loads during power-source failure. The LCD, LED indicators, buzzer, and GSM modem provide local status indication and remote alert notification.

Fig .1:Block Diagram Of Priority Based Power Distribution System With Gsm Alerts

CIRCUIT DIAGRAM

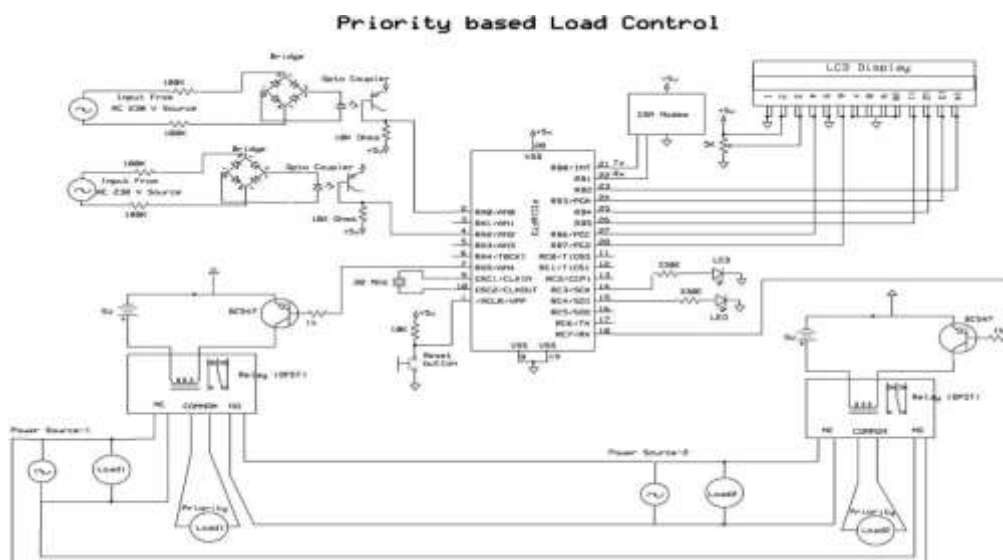


Fig 2 :Circuit Diagram Of Priority Based Power Distribution System With Gsm Alerts.

Fig. 2 shows the circuit diagram of the priority-based load control system, where two AC power sources are monitored through optocouplers and interfaced with the microcontroller. The controller operates the relay circuits to manage high- and low-priority loads, while the LCD, LEDs, and GSM modem provide system status indication and remote alerts.

METHODOLOGY

The proposed methodology begins with continuous sensing of the two power sources using optocoupler-based sensing circuits. The sensed source-status signals are supplied to the PIC16F876A microcontroller. The controller processes these inputs according to the priority-based algorithm programmed using Embedded C. When both sources are available, the system maintains the normal load arrangement and continuously updates the status through the LCD and LED indicators.

If one of the power sources fails, the microcontroller identifies the failure and executes the corresponding switching sequence. The low-priority load is switched OFF when required, while relay operation transfers the high-priority load to the available alternative source. The controller simultaneously updates the LCD and indication LEDs and activates the alert mechanism. The GSM modem is initialized and controlled by the microcontroller to transmit an SMS indicating that the corresponding power source is unavailable. When the source returns to its normal condition, the controller can restore the load to the designated source and continue monitoring.

RESULTS AND DISCUSSION

Fig. 3 shows the developed project prototype integrating the power supply, relays, loads, LCD, PIC microcontroller, and GSM modem. The prototype demonstrates the practical implementation of the power-switching and control sections for automatic priority-based power distribution and load management.

Experimental operation of the developed system demonstrates continuous monitoring of the power sources. When one source becomes unavailable, the controller identifies the condition and automatically disconnects the corresponding low-priority load where required. The high-priority load can subsequently be supplied from the alternative available source, thereby improving continuity of supply to critical loads.

The LCD provides immediate information about whether each power source is ON or OFF, while LED and buzzer indications assist in identifying the operating condition locally. GSM communication extends this notification capability by providing an SMS alert to a remote user. Thus, the developed system combines source monitoring, automatic switching, load prioritization, and communication in a single microcontroller-based platform.

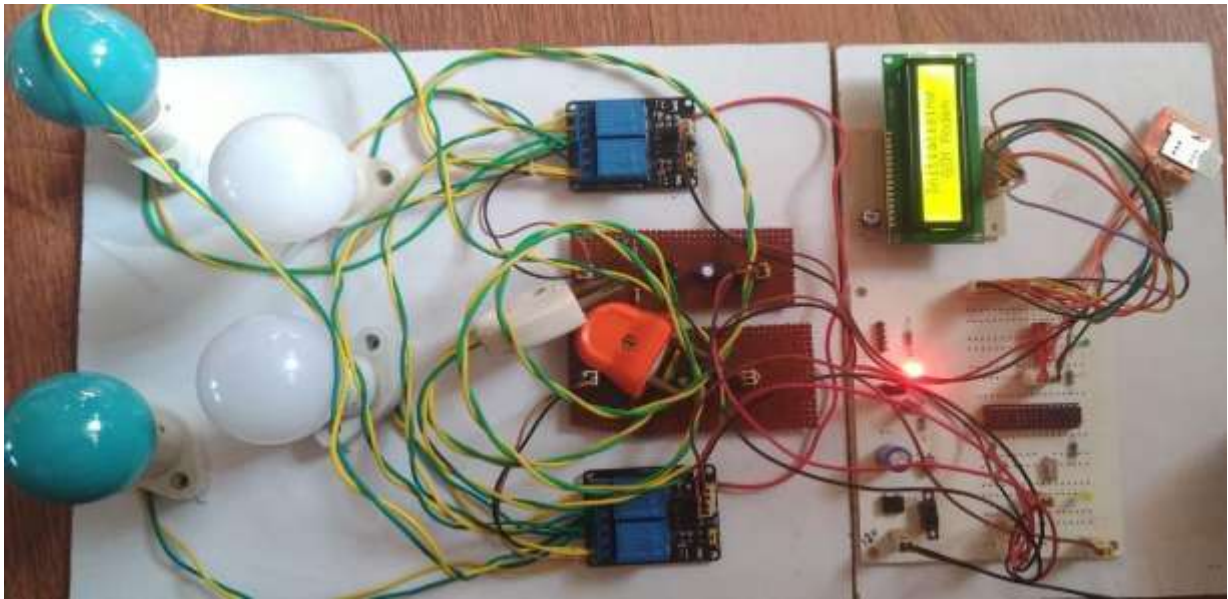


Fig. 3. Overall view of the developed project prototype.

CONCLUSION

A priority-based power distribution system using GSM alerts has been designed and implemented using a PIC microcontroller, relays, source-sensing circuits, LCD, buzzer, LED indicators, and SIM800L GSM modem. The system continuously monitors the available power sources and automatically manages connected loads according to predefined priority.

During a power-source failure, the system disconnects low-priority loads when necessary and maintains supply to high-priority loads through an available alternative source. Local indications are provided through the LCD, LEDs, and buzzer, while the GSM modem enables remote SMS notification. The developed prototype was successfully implemented and tested, demonstrating the feasibility of microcontroller-based priority load management for improving the continuity of electrical supply to critical loads.

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