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PLC Based Auto Power Supply for Critical Load

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Abstract: An important requirement of electric power distribution systems is the need for automatic operation. In particular, the rapid and reliable transfer of the system from one power source to another during certain system events is important to achieving the reliability goals for such systems and the facility serves. In the existing system, use of four switches to demonstrate the corresponding failure of that power supply has been attempted. By pressing any one of the switches, absence of that particular source can be found out. The switches are connected as input signals to Programmable Logic Controller. In this system the PLC is used. The relay driver IC collects output of PLC, which adjusts relay to maintain continuous supply to the load. This work mainly focuses on the automation. Future add-ons to the product can make it as a complete independent working model .An attempt has been made to study the use of PLC to get uninterrupted power supply without the need of human intervention, saving non-conventional energy and reduce the overall cost as it saves the electricity bill tariffs and the maintenance cost is less as the solar cells lasts long .Use of non-conventional energy sources these days is a transformation in itself.

Keywords: PLC, Solar Energy, Auto Power Supply, Critical Load, Automation

I. INTRODUCTION

In India, the power outages, including extended power cuts, are much more common; hospitals & many other public utility places invest into expensive inverters and DG sets. Even these so called solutions present their own problems in terms of the smoke and waste that they create, which are both a health risk and contribute greatly to air pollution. The best way to guarantee constant clean power is having a reliable, long term, renewable power- generating unit that is installed, operated, and located ideally within the premises. Places where it is unlikely to have the space or resources required to construct a wind farm or hydroelectric power plant, they are left with one viable alternative a rooftop solar power plant. Solar promises assured and uninterrupted power to a sector that cannot afford power cuts! This is where hybrid solar systems, which come with batteries can be essentially the perfect fit. Power generated during the day time/ peak hours of the sun can be stored and then utilized as and when required[3]. Sizing of the solar system and the battery therefore would be key. With more than 300 sunny days in India, generation is virtually guaranteed. What s more is that a well-maintained solar system with right O&M techniques generally has an up time of 99%, which is incredibly reliable. Rooftop solar power plants make use of residual space & have a 25-year lifetime Unlike other forms of power generation, rooftop solar plant requires no independent space and can optimally utilize hospital rooftops.

II. WORKING METHODOLOGY

To implement any system in a hardware form it is very important to initially build the block diagram and then proceed to design the appropriate circuit diagram. In the initial stage of planning of this project, we decided to build a simple

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auto power supply switching circuit comprising of a 8 I/O PLC with four different types of supplies which include solar power, inverter, generator and the mains supply[5]. Fig 1 Shows the complete circuit diagram.

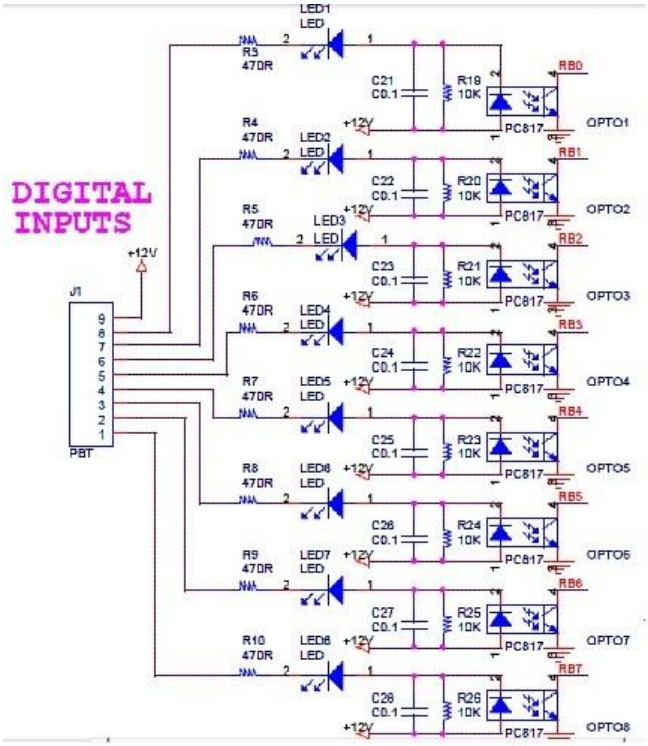

Fig 1 Complete Circuit Diagram

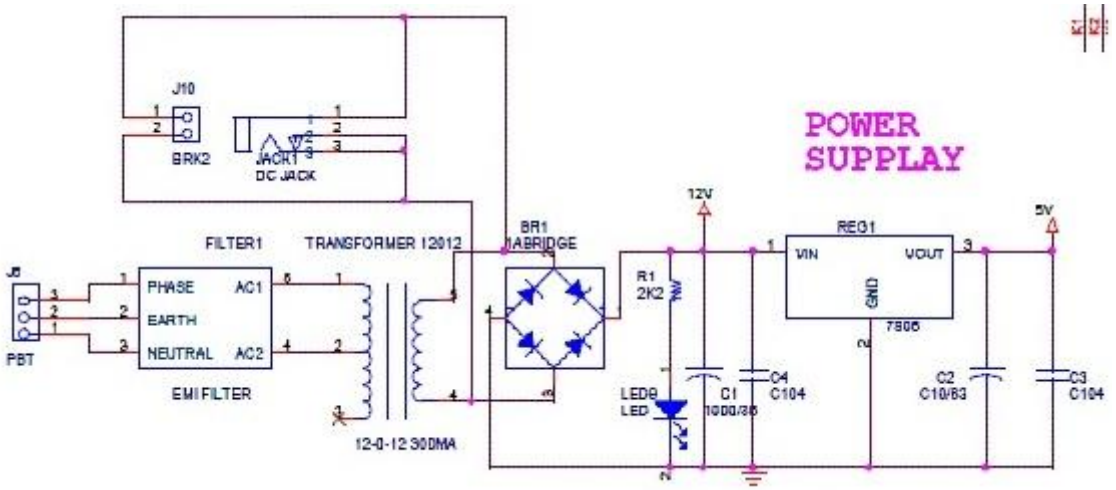

Fig 2 Complete Circuit Diagram

The circuit diagram **Fig 1 & 2,** is the internal structure of the PIC based PLC that we have used which consists of digital inputs, a relay section, a controller, RS232 for serial communication, a power supply, switches and a liquid crystal display for the output[4]. We further use four different types of power sources which includes a solar cell, an inverter, mains and a generator which are channelized to the load through switches and are given priorities to get an uninterrupted power supply.

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It provides a continuous power supply to the output load through any of the sources from which we are operating the device, i.e., solar, inverter and generator automatically in the absence of any of the source. In future, the use of automation will be smarter and faster. It would be extended to the large-scale environment such as industries, schools, colleges, offices and factories etc[1].

Changing the source of power supply automatically based on the priority set. Priority based changer should be there which gives the priority to non-conventional source first[2].

The priorities assigned are-

1. Solar energy
2. Inverter
3. Generator
4. Mains

By this we design a smart automated device which controls switching of power supply without the need of human intervention.

This method of automated switching of the power supply for saving conventional energy as well as money, which is utilized in a model of hospital where there are four types of load two critical and two non-critical loads which are connected to the remaining four digital inputs hence all the 8 I/O ports are utilized and are again prioritized in such a way that the critical load is never out of power and it gets supply from some source or the other in case of power outage if any. Here there will be continuous transmission of power to the critical load i.e. the ICU where there is constant monitoring of the patient□s heartbeat, temperature and in non-critical load if there is no need for power supply it can be switched off or the number of non-critical loads say lights in the corridor may be reduced for time being so that the critical load is not interfered in case of power saving during the power outage[6]. This work ends with the continuous supply to critical load if in case there is need to cut the power supply of non-critical load automatically[7], so the critical patient□s condition can be continuously monitored.

III. RESULT AND DISCUSSION

- The switching of the power supply between the four-power source is done with the help of ladder logic and it works effectively.
- There is continuous flow of power from the source to the load with the help of PLC and the source which is currently in use is displayed on the LCD display.
- The judgement of critical load is done by the use of priority encoder technique which prioritize the critical unit (ICU) more than non-critical load.
- This project can be utilized in any hospital majorly in the rural areas where there is frequent power outage, so that there is continuous monitoring of ICU patients and there is no disturbance in life support system equipment.
- It also helps in saving conventional energy, provides uninterrupted power supply automatically and helps save money as the electricity tariffs are very high these days.

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IV. SUMMARY AND CONCLUSION

This study works effectively with the use of PLC and we get the expected outcome i.e. uninterrupted power supply without the need of human intervention, saving non-conventional energy and reduce the overall cost as it saves the electricity bill tariffs and the maintenance cost is less as the solar cells lasts long. Most importantly, it plays a crucial role in hospitals as all the equipment used in hospital are based on electricity and this project helps provide continuous power supply which helps the monitoring of patients and hence deaths that occur in hospitals due to power outage can be prevented

V. FUTURE SCOPE

In future, the use of automation will be smarter and faster. It would be extended to the large-scale environments such as industries, schools, colleges, offices and factories & many other public utility places, etc.

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