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UPS Battery Monitoring System Using Battery and Supply Changeover

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Abstract

Today, every business scale has grown more, and power use has grown more than it did in the past, boosting the need for a UPS system on the consumer side. A UPS battery system is utilized to ensure a constant power supply so that the consumer won't be affected by unexpected power outages in the system.

In this system, the UPS battery is charged utilizing both solar and grid power. Solar electricity is used to first charge the UPS battery. The supply is automatically changed and the battery is charged using grid power if the amount of solar energy available is less than the needed voltage. In this system, two battery packs are being used. While the battery with the larger charge is attached to the load, the battery with the lower charge is connected to the supply and charged. Automatic battery switchover occurs based on the charge remaining in the battery packs.

Using this, we can ensure that the customer has a constant supply of power. We can provide power without interruption because this system uses solar energy and two battery packs. This system's architecture is such that it can simultaneously power both AC and DC loads.

Keywords: Uninterrupted power supply (UPS), Microcontroller, Transformer, Relay, Batteries

I. INTRODUCTION

Industries all over the world have used power backup systems to ensure that their machines and equipment function properly without being affected by power outages. In order to ensure that the system as a whole operates effectively, the power backup system is crucial. The power backup system frequently fails to function properly when it is needed, causing industries to lose time and money. Any abnormal activity that occurs in the system can be found by a system that can monitor this power backup system. The system is also capable of protecting against faults that can hurt all of the processes. UPS systems have boosted the caliber of power sources by delivering dependable, clean electricity. This system uses a microcontroller to remotely monitor and manage the company's UPS system battery. In the banking, finance, defense, and healthcare sectors, battery monitoring is crucial. The major components of this system are a battery monitoring and control system, a voltage sensor, and an LCD to display the voltage. The suggested solution is highly beneficial for battery-powered electronic equipment systems. The user can monitor and manage the UPS system around-the-clock by using this system.

A microcontroller-based monitoring system with an ADC module that transforms analog voltage into a digital value makes up this system. The microcontroller transforms the unprocessed voltage into a value that can be read by humans. The voltage is continuously monitored by the microcontroller, and if it falls below the predetermined value, it simply attaches the new battery and disconnects the old battery using a relay-based control circuit.

In this system, the battery is charged using a step-down transformer and solar energy. The supply to the transformer for battery charging will be changed if the solar voltage is low. The inverter, which converts DC to AC power and uses that AC power to turn on the light, receives this battery power as input.

I. LITERATURE REVIEW

The advantages and drawbacks of current, comparable systems are examined in this section. There are some methods that only keep an eye on the UPS battery system without making any adjustments. There hasn't been an effective system in place that can deliver power consistently for a few days.

The UPS battery monitoring and battery changeover system measures the battery's voltage, and then automatically switches the battery over by relaying information to the microcontroller. Power may be supplied continuously and without interruption thanks to this system configuration.

II. PROPOSED SYSTEM

In order to accomplish a certain task, an embedded system mixes hardware and software. Two common parts used in embedded projects are microprocessors and microcontrollers.

Microprocessors are commonly referred to as general-purpose processors since they merely accept input, process it, and output. A microcontroller, on the other hand, not

only accepts data as inputs but also manipulates it, connects it to other devices, controls it, and ultimately produces the output.
The PIC microcontroller-based "UPS battery monitoring system using automatic battery changeover" system is distinctive in that it can monitor, regulate, and also automatically charge UPS batteries.

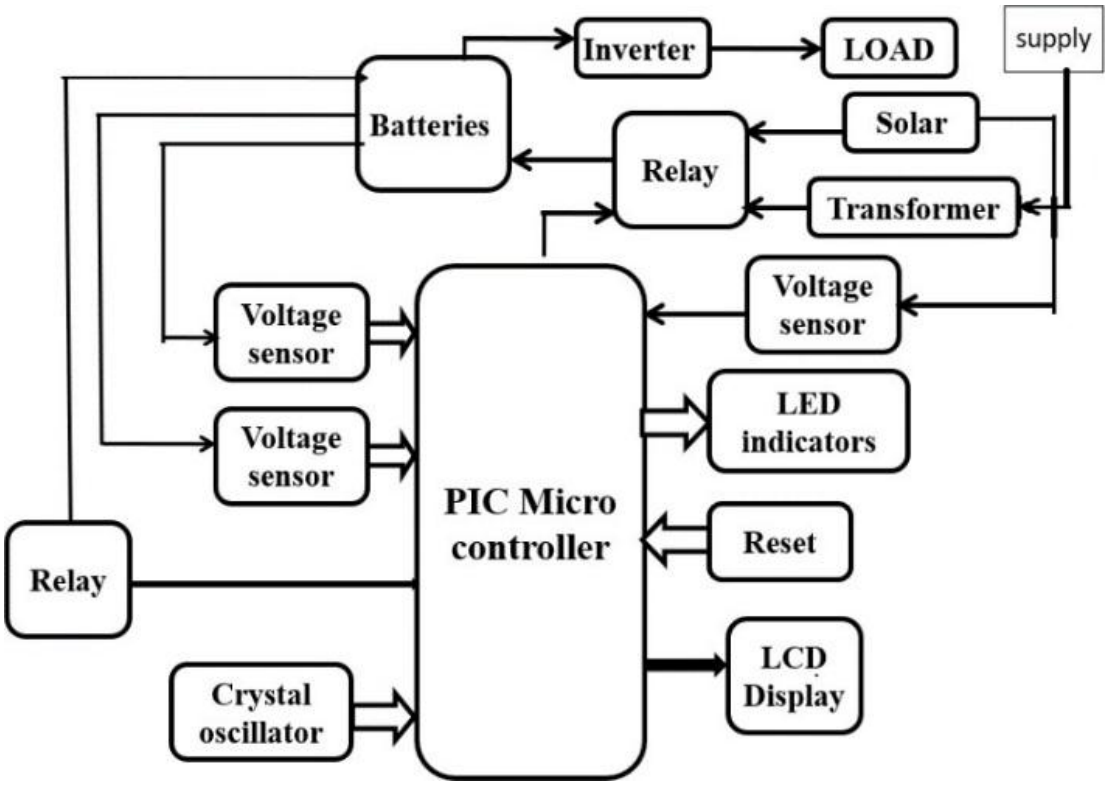

Figure 1: Block diagram

Design method:
A simple UPS monitoring system has a PIC16f72 Microcontroller that has all the necessary components interfaced with it. The utilities connected in the circuit will receive 12 volts, 2 amps of power from this UPS.
This system comprises of a potential divider circuit consisting of 1k and 10k resistors that function as a voltage sensor to detect the voltage across solar panel, transformer , and batteries.
The electromagnetic relays connected to microcontrollers function as a switching system between various power sources, such as solar, grid or transformer, and battery packs.
A solar panel of 12 volts and 50 watts, two dry acid batteries with a storage capacity of 12 volts and 2 amps, and a bridge rectifier circuit composed of 1 k ohm resistors are connected in this system.

I. RESULTS

The "UPS battery monitoring system using automatic battery changeover" introduces a better battery model in a more sophisticated way than the current procedure. A PIC Microcontroller serves as the system's main controller. The PIC microcontroller, voltage sensors, relays with drivers, LCDs with drivers, solar panels, transformers, and inverters are incorporated components of the controller. The Complete arrangement of components in the system is shown in fig 2.

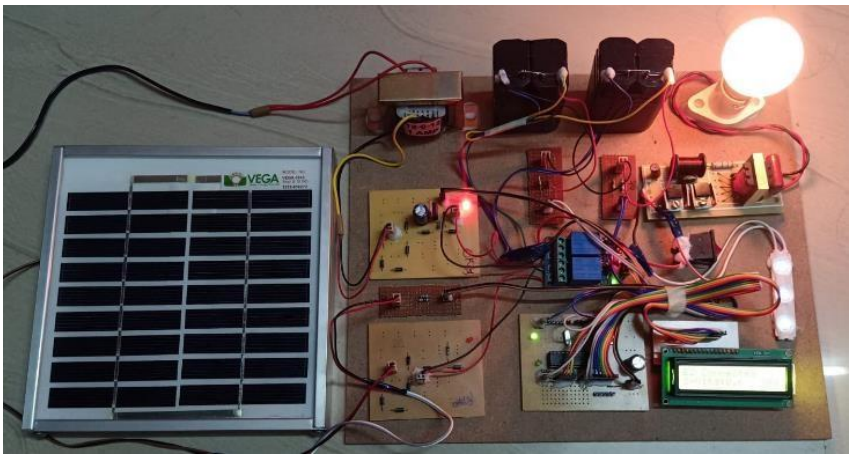

Figure 2: Experimental setup

The voltage values of each battery pack are displayed on the LCD module together with the continuous display of the solar panel voltage when any one of the battery packs needs to be recharged. The supply will be switched via relay by the microcontroller depending on the battery voltages. This system uses an inverter circuit to turn on the AC loads by converting DC voltage to AC voltage.

The LCD, which is depicted in the below figure, displays the system's status. The figures below show that the solar voltage is 0.2 volts, which is less than 8 volts. As a result, power from the Grid is used to charge the batteries.

Figure 3: Battery 1 status

Figure 3 depicts that Battery 1 is connected to the load, while Battery 2 is receiving power from the grid.

Figure 4: Battery 2 status

Figure 4 depicts that Battery 2 is connected to the load, while Battery 1 is receiving power from the grid.

Figure 5: Voltage across Batteries and Solar Panel.

According to Figure 5, the voltage across both batteries is the same, and the voltage across the solar panel is 0 volts.

II. CONCLUSION

All of the hardware components employed in its creation have integrating features. The placement and arrangement of each module has been carefully thought out in order to maximize the unit's functionality. As can be observed, the relays installed in the system allow for UPS monitoring and battery changing. The system has been completed successfully using cutting-edge ICs thanks to advancing technology. Design and testing for the project were successful as an outcome.

III. ADVANTAGES, LIMITATIONS, AND FUTURE SCOPE

A. Advantages

- Continuous power supply to the utility.
- Automatic battery charging.
- Inverter-based conversion of DC voltage to AC voltage.
- LCD monitoring of battery voltage.
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B. Limitations

- The distance covered by electric cars is constrained.
- Costlier to buy electric cars.

C. Future scope

- This system can be made longer by using a GSM module that sends alerts when the battery is running low.
- If a buzzer is included, it provides an alert

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