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Uninterrupted Power Supply for the Domestic Load Using Automatic Switching

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ABSTRACT: The contrariety in the growth of population has increased the demand for electricity irrespective of its generation. The frequent power fail is causing problems in industrial, domestic, and commercial sectors are to be prevented. Several countries across the globe, have adopted smart cities and smart metering programto muddle through the pressure of ever-increasing population and restricted infrastructure with diversified results. The ultimate objective of this paper is to provide continuous power supply to the loads by choosing the supply from the hybrid system namely, PV panel, wind, battery, and mains. The sources are prioritized, and the last priority is given to the mains. In this way the huge amount of electricity consumption from the mains can be minimized by enabling maximum utilization of energy from the renewable energy sources. A microcontroller is used, whose output is fed to the relay driver IC, which switches appropriate relay to ensure an uninterrupted supply to the load. Simulation is carried out through Proteus 8 software tool.

KEYWORDS: Automatic Switching, Continuous power supply, Critical load, Load management, Normal load, Source prioritization.

I. INTRODUCTION

As per the statistics made recently, it is found that almost 25% of the world's population is deprived of electricity. The generated electricity is not sufficient to meet the ever-increasing demand. The demand for electricity is rising every day and frequent power cuts is causingproblems in various fields. To fulfil the load requirement, it is preferrable to go for the extensionof the currently operating grids. Opting extension of grids is not always affordable and practically tedious Thus, an alternate arrangement for power source must be arranged. According to the survey, renewable energy sources have shown brilliant performance as a form of contribution to conventional power generation systems in the latest R&D. It exhibits many supremacies over conventional power generation systems, such as less pollution, excellent efficiency, variety offuels, and onsite installation. In our work as we are focusing on serving continuous power to the load it is not preferred to only relay on the non-conventional resources. Thus, a novel idea is proposed through this paper to achieve the continuous/uninterrupted supply to the domestic loads by retrofitting the hybrid power system with existing domestic loads. Thus it is possible to provide uninterrupted power to the consumers. Here loads are divided into two categories i.e., normal load and critical load. Load which requires continuous power throughout comes under critical load. (e.g., Lamps, fans). Loads which does not require continuous load which do not require continuouspower comes under normal load (eg. Escalator, lift etc.)

In this paper in to switch between the three sources the voltage divider circuit has been proposed. Arduino microcontroller has been used whose output is given to the relay driver IC, which switches appropriate relay to maintain an uninterrupted supply to the load. The voltage divider circuit is connected to microcontroller as input signals. The output is observed using a LED and a motor. On failure of the solar supply the load gets power from the next prioritized source i.e., wind. If the wind does not possess enough voltage, the battery switches over. If the battery also fails, then the load is fed from the last available option, mains. The status of the currently utilized source is displayed on an LCD.

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II. LITERATURE SURVEY

The various hybrid diode topologies [1] along with the energy management strategy is discussed with respect to hybrid energy storage system. Abrupt demand for power caused during the emergencies and and the power adjustment made during the uncertainties by adapting robust operation [2]. Implementation and testing of different algorithm for effective energy management system and the comparison study is made on the CANREL microgrid testbed [3]. Integrating the different types of renewable energy sources will result hybrid power system. The current work focuses on the integration of photo voltaic (PV) cell system, wind turbine system, fuel cell and battery for the generating power. The power flow among the various energy sources of the hybrid power system is managed by combining various energy sources of the hybrid system [4] &[5]. Thecontrol strategy designed for bidirectional flow of power by enabling smart switching between solar and the main grid [6].. Discussion for maximizing the utilization of the non-conventional energy sources on Load dispatch control and load management control is made. In [9] PLC based real time simulation is developed, analyzed, and verified for studying the power quality of renewable energy based Hybrid Power System. Supervisory control and energy management of an inverter-based hybrid power system is discussed in [10]. To provide the better quality of power through inverter, a method is developed by active integration of the energy converting systems and renewable energy sources. The generation of power is based on renewable sources and the two- level power management through a grid-connected inverter [11]. The detailed explanation of the generation of power from various renewable energy sources is discussed.

Above is the literature survey made before proceeding with the present work. The goal of the research is to primly utilize the available renewable energy sources (RES) and to ensure the uninterrupted supply of power to the domestic consumers.

III. PROPOSED SYSTEM DESCRIPTION

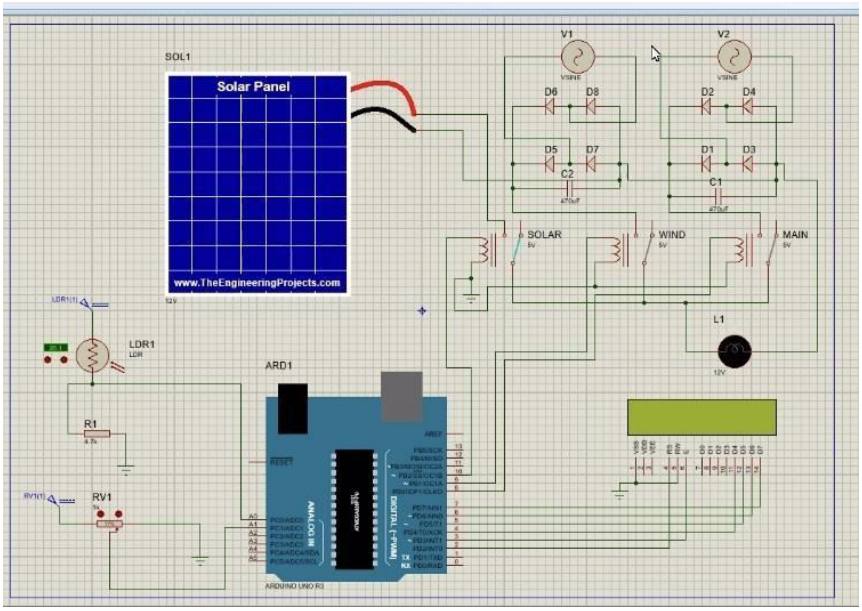

Fig 1: Simulation diagram of the proposed system

The paper is designed to automatically supply continuous power to the critical load through anyone of the sources of the supply that are PV, wind, and battery shown in figure 1. Normal load is supplied through mains. Here critical and normal loads are supplied through two separate sub circuit. The sources are prioritized i.e., priority is given to PV/Solar, next wind, then the battery and the last is mains. Through microcontroller programming depending on the availability of supply voltage, sources are switched automatically. A relay driver circuit is used to sense the output generated by microcontroller and switch the source connected to it to enabling the uninterrupted power supply. LED and motor is used as critical and normal load respectively for demonstration purpose. Critical load draws power always from the renewable energy sources.

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Here the sources are prioritized. Highest priority is assigned to Solar, followed by wind and then mains. When the mains fail the battery comes into operation.
Once the solar supply is sufficient to satisfy the load condition the power is drawn only from solar, and the process continues. During this process power generated from wind is stored. Similarly, when the energy from the solar gets insufficient to meet the requirement, as the sources are already prioritized, relay checks for the next source in priority which can meet the load demand. During this process, the energy generated from the source which is not utilized by theload is used to charge the battery. An LCD incorporated in the circuit displays the source which is currently being utilized and the available supply voltage. Under no load condition available solar supply is send back to the grid there by the consumption of electricity from the mains is minimizedas well as the electricity exchange can be made.

Table 1.: Priority Table for the Automatic Switching

Sl. no	SWITCHES					Main To grid LED	RELAYS				
	PV	Mains	Battery	Battery 30%	Load		PV	Main	Battery	Normal Load	Critical load
1	0	0	1	0	1	OFF	OFF	OFF	ON	OFF	ON
2	0	1	0	0	1	OFF	OFF	ON	OFF	ON	ON
3	1	0	0	0	1	OFF	ON	OFF	OFF	OFF	ON
4	1	1	0	0	1	OFF	ON	OFF	OFF	OFF	ON
5	0	1	1	0	1	OFF	OFF	OFF	ON	OFF	ON
6	0	1	1	1	1	OFF	OFF	ON	OFF	ON	ON
7	0	0	0	0	0	OFF	OFF	OFF	OFF	OFF	OFF
8	1	1	1	0	1	OFF	ON	OFF	OFF	OFF	ON
9	1	0	1	0	1	ON	OFF	OFF	OFF	OFF	OFF
10	1	0	1	0	1	OFF	ON	OFF	OFF	OFF	ON

The above table represents the switching operation of the sources and the loads. The power is not supplied to the load only under no load condition. The power is given to the mains from the grid after satisfying the load and there is maximum generation from the renewable source. The critical load draws supply from the mains only when the generation from the renewable is low and when the battery does not have the sufficient charge to provide to the load.

1. Algorithm for Automatic switching

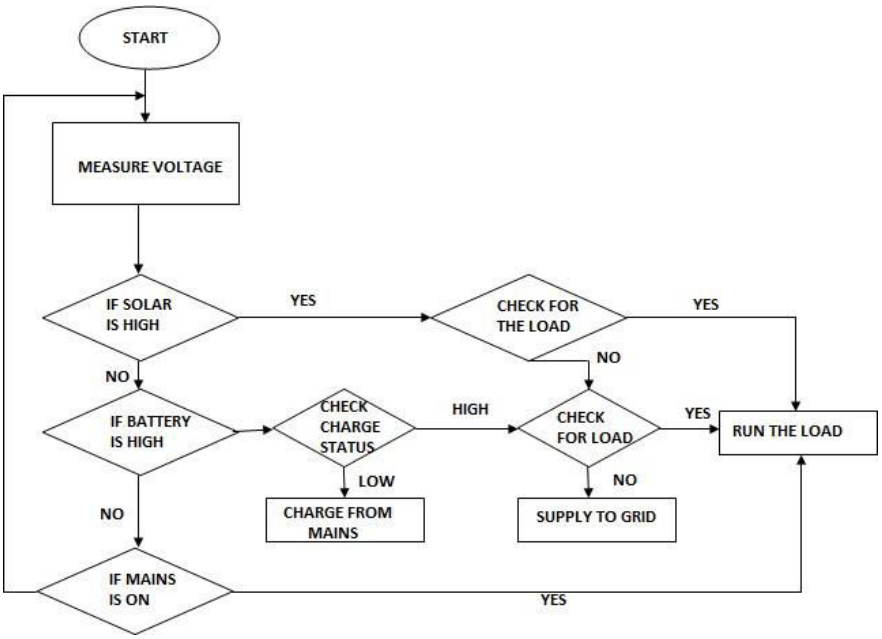

Fig 2: Flowchart of the proposed system.

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The flowchart in Figure 2. represents the working of the proposed system. Here the sources are prioritized. Initially the voltage required to run the load is measured from all the sources. If the solar alone can satisfy the load requirement, then the supply is only from the solar. If the solar fails to supply, then the next priority is given to the battery. The charge status of the battery is first checked. If the voltage is sufficient then the supply to the load is provided from the battery. In case the charge of the battery is low then the supply to the load is given from the mains. By following this technique, the uninterrupted power can be ensured to the load.

IV. CONCLUSION

The prime scope of this paper is to provide and ensure continuous power supply to the intermittent loads through any of the sources from the hybrid power system by prioritizing the sources. This method enables high switching speed to milliseconds between sources compared to the existing conventional one which takes minimum 1 second. To maximize the power utilization from the Hybrid Power System and to ensure the continuous power supply for the domestic loads. It withstands the present energy crisis by ensuring minimum consumption of electricity from the conventional sources. Ensures the smart supply of electricity and contributes to the overall power generation and thus meets the present demand.

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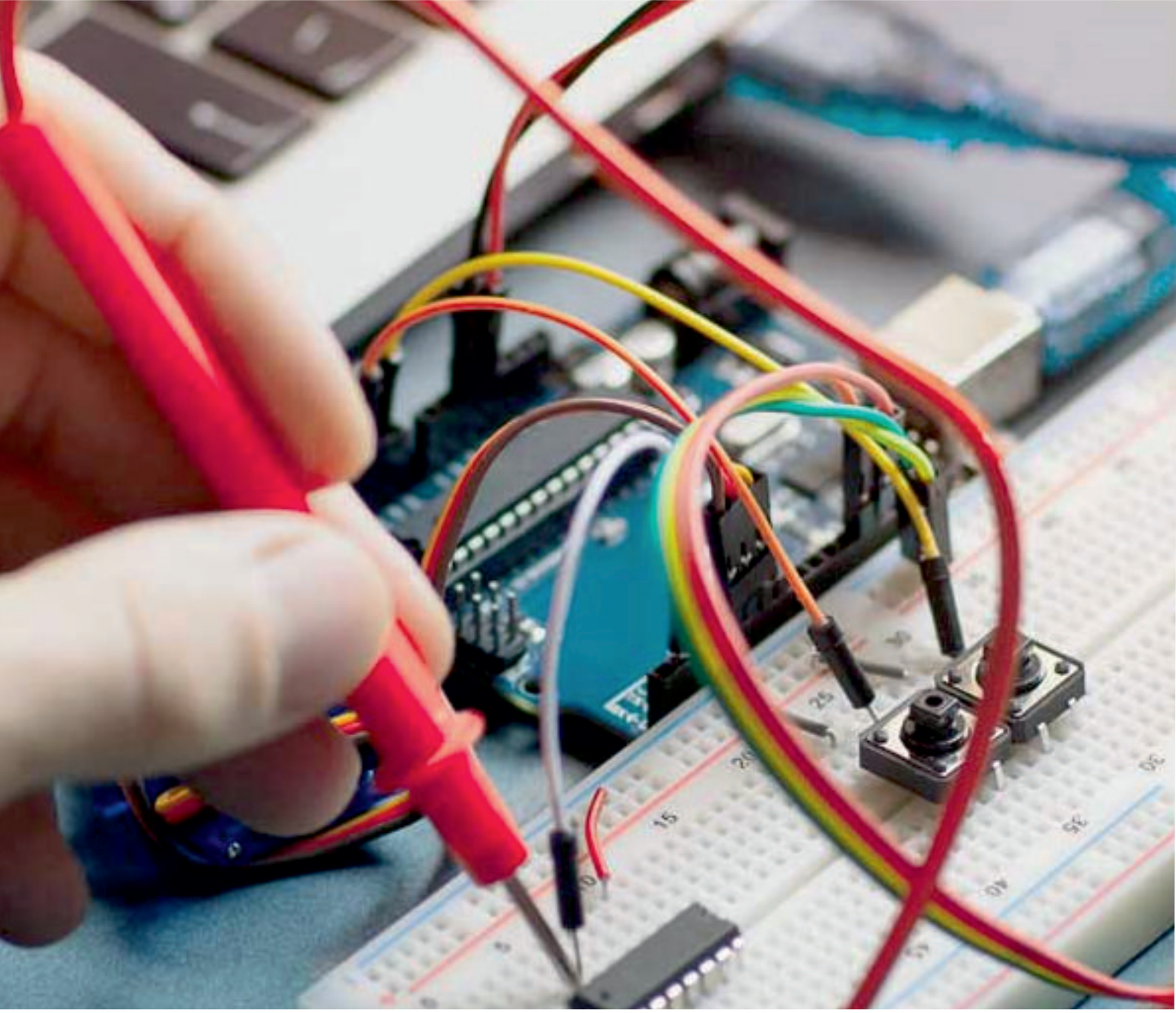

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