Smart Grid Operation Using Hybrid Renewable Sources

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Abstract- This paper deals with a new approach to design a smart grid, which generates electricity using hybrid renewable sources that will provide uninterrupted power supply to the load. In the current work, solar and hydel power sources are applied to a rechargeable battery for harvesting energy through the charging circuits. The voltage of this battery is incessantly monitored through voltage track and microcontroller. If the battery voltage is less than pre specified value, relay circuit automatically switch-off the supply of that battery where the load is connected through an inverter and connects to another battery through relay driver circuit, which makes uninterrupted power supply to the load.

Keywords- smart grid, micro grid, renewable energy, energy storage system, hybrid power, solar energy**.**

I. INTRODUCTION

Energy is an indispensable factor for the economic growth and development of a country. Energy consumption is rapidly increasing worldwide. To fulfill this energy demand, alternative energy sources and efficient utilization are being explored. There are many forms of renewable energy sources available, which are solar, wind, biomass, hydroelectric, tidal etc., and their efficient utilization is comprehensively reviewed [1]. Also the trend in research and development for the technological advancement of energy utilization and smart grid system for future energy security is presented... Results show that renewable energy resources are becoming more prevalent as more electricity generation becomes necessary and could provide half of the total energy demands by 2050. To satisfy the future energy demand, the smart grid system can be used as an efficient system for energy security. Smart grid opens the door to new application with far-reaching inter disciplinary impacts, providing the capacity to safely integrate more renewable sources, it also delivers significant environmental benefits by conservation and renewable generation integration. In this paper solar and hydel are used as renewable sources [3] to maintain the continuity in generation of electricity, and a microcontroller is used to control the grid in all circumstances. The present work is to prove the viability of hybrid solar-hydro smart grid operation that could provide power during peak periods, thereby improving overall utilization and economics of the smart grid.
The rest of the paper is assigned as follows- Section 2, describes the block diagram of smart grid operation using hybrid renewable sources and its operation, Section 3, describes results and discussions of smart grid operation using hybrid renewable sources.

II. BLOCK DIAGRAM

Fig.1 shows the block diagram of the present work. Solar and hydel power generation sources are applied to the rechargeable battery of 12V for energy harvesting through the charging circuits. The voltage of this battery is continuously monitored through voltage circuit and microcontroller. As the voltage circuit is given as input to the microcontroller, depending on the required voltage, if it is less than the required voltage then it is automatically cut-off the supply of that battery by sending a signal to the driver circuit through microcontroller. The load connected through an inverter gets disconnected form that battery and connects to another battery through relay driver circuit which also makes uninterrupted power supply to the load, which has been successfully implemented and tested, the observations and analysis are shown in table 1 and figure2. At the same time to achieve maximum power from the solar panel, a tracking system is included, it consists of LDR'S (Light Dependent Resistor) as they are connected to the microcontroller, they senses the light and give signal to the microcontroller which in turn gives

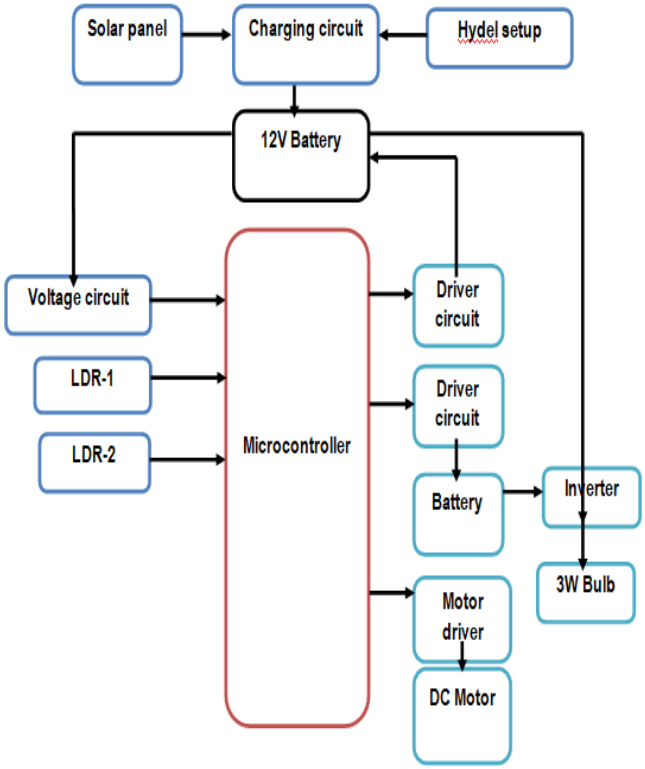

Fig.1: Block Diagram

signal to a motor driver circuit, which is used to drive the DC motor connected to the solar panel to change its direction according to the sunlight path.

(a).TECHNICAL SPECIFICATIONS

1. Solar panel – 12V DC, 0.5A (5W)
2. Battery – 12V, 1A
3. Microcontroller – Atmega 328P
4. Relay – SPDT (5V DC)
5. Inverter – 12V DC Input, 160-220V AC Output
6. Motor driver – L293D IC
7. DC Motor (Geared) – 10RPM

III. RESULT AND DISCUSSIONS

S.no	BATTERY 1		BATTERY 2	
	Time(mins)	Voltage(volts)	Time(mins)	Voltage(volts)
1	00:00	13.42	00:23	13.15
2	00:04	12.96	00:27	11.96
3	00:08	11.77	00:35	11.56
4	00:13	11.1	00:40	10.6
5	00:17	7.23	00:44	7.2
6	00:20	6.99	00:47	6.33
7	00:23	5.09	00:50	5.1

Table.1: Energy harvesting by using renewable sources and time

The table shows the voltage readings corresponding to time of two batteries, and its response is shown in the figure 2. From the table it is observed that as the time increases the voltage decreases, at a particular time the voltage goes below the pre determined value. Then the relay circuit operates and connects the load to another battery.

During the operation of second battery period batter one gets charged and if the voltage in the second battery goes below the predetermined value then the load is connected to battery one through relay circuit. As this process continues and provide uninterrupted power supply to the load.

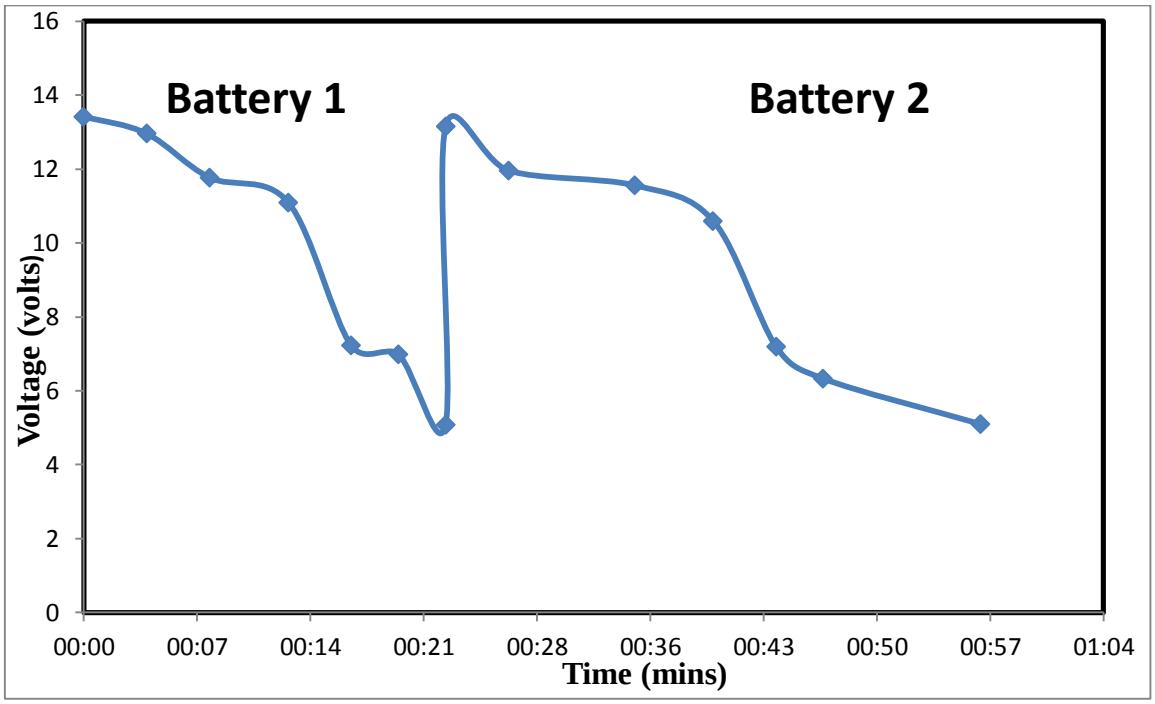

Fig.2: Voltage Vs Time

IV. CHANLLENGES

1. Availability of power [5]
2. Location of RE plants
3. Higher upfront cost
4. It requires storage capabilities

(a). BENEFITS

1. It has zero fossil fuel emission [6]
2. It reduces the greenhouse effect
3. It reduces carbon footprint
4. It will help to save natural resources by reducing extraction of fuels.

(b). APPLICATIONS

It is used to supply power for domestic loads as well as for industrial purpose etc., which can be practically implemented in real time. The figure 3 shows the prototype of connected load. This system can be used to supply power for DC loads by taking voltage directly from rechargeable batteries.

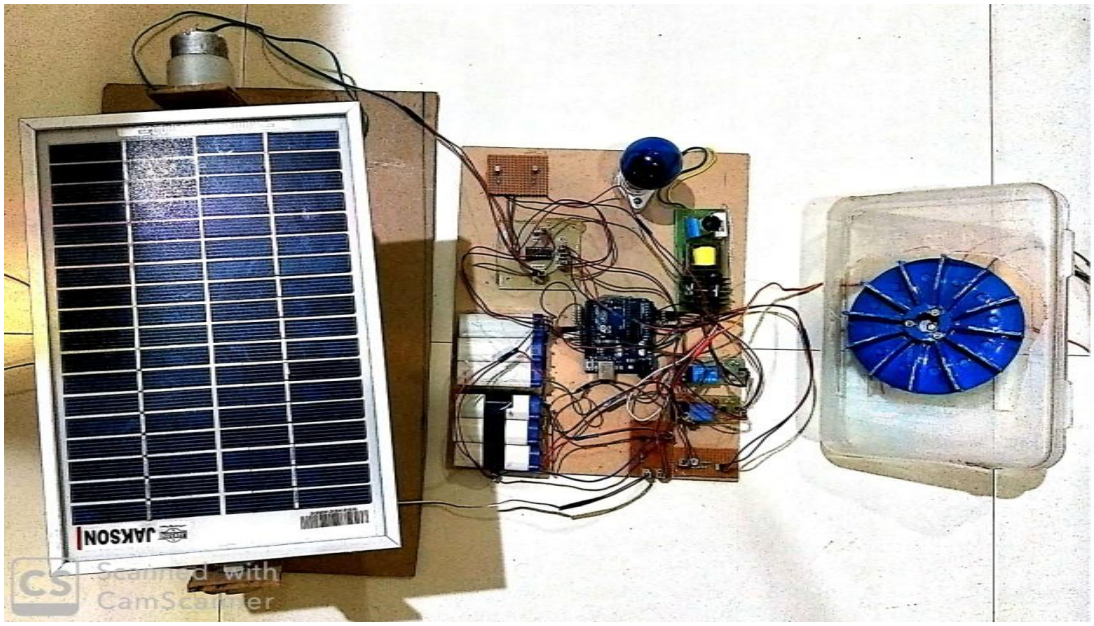

Fig.3: Prototype of connected load

V. CONCLUSION

"Smart grid operation using hybrid renewable sources" has been successfully designed and tested. It has been developed by integrating features of all the hardware components used. Presence of every module has been reasoned out and placed carefully thus contributing to the best working of the unit. Secondary, using highly advanced IC's and with the help of growing technology the design is successfully implemented.

VI. FUTURE WORK

The work can be extended to explore and synthesis. Micro grid system of the proposed and can implement the areas of need by considering the real time application in detail.

VII. ACKNOWLEDEGEMENT

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VIII. REFERENCES

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