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SOLAR PV CONVERTER FOR HOME ENERGY MANAGEMENT SYSTEM

Prof Muneeb Ahmad[1], Pooja Shahu[2], Shivani Arkhel[3], Vishal Bhoskar[4]

Department of Electrical Engineering
Priyadarshini College of Engineering, Nagpur, India

ABSTRACT:

The increasing demand for clean electrical energy coupled with recent advances in power electronic devices has driven researchers to seek better ways to harness electrical energy from renewable sources. One of such renewable energy sources is solar energy and the efforts that have been put into the development of a Smart Solar Energy Management System (SSEMS).SSEMS has been designed to effectively harness the sun‘s energy, utilise the energy to drive electrical loads and store any excess energy for use when demanded. The paper provides a preliminary documentation of the design, simulation, construction and testing stages of the energy conversion and supply subunits of the SSEMS.

Keywords: Solar Pannel ,Charge controller ,Battery ,Inverter kit

Objectives:

The Home Energy Management System or HEMS commonly adjusts the pattern of energy consumption, optimizes the charging scheduling of storage systems, and harvests the maximum power from renewable resources. It enables the buildings for off-grid operation as well. A Home Energy Management System, or HEMS, is a digital system that monitors and controls energy generation, storage and consumption within a household. HEMS usually optimizes for a goal such as cost reduction, self-sufficiency maximization or emissions minimization.

Introduction:

The main feature of smart homes is the capability to program controllers for the optimal scheduling of plugging time of the appliances. In some cases, the consumers can benefit from the installation of smart controllers as well as smart meters to manage their usage. A home energy management system (HEMS) can schedule the optimum operation of home appliances and electrical kitchenware to minimize the daily bills of end-users. In addition, installing photovoltaic (PV) panels can provide some benefits for the consumers and they can benefit from local power generation at their private area. Since the PV power generation merely depends upon the solar irradiance, installing electrical energy storage (EES) devices can improve the flexibility of power generation. Moreover, by installing the EES devices, end-users can benefit from different energy tariffs during the day by optimally scheduling charge/discharge of the EES to reduce the daily bills. On the other hand, there are some appliances with considerable energy consumption, like the washing machine (WM), the spin dryer (SD), the electric vehicle (EV), and the air conditioner (AC), that can be scheduled in a way to reduce the energy bill. Some of the appliances have merit order, like WM and SD, while some others have not any priority. The operating points of some appliances depend upon the previous time interval, such as EES and AC. rage. Besides the fact that solar panels are expensive, and a very large number of them are required to harness significant amount of energy, the mechanism used in storing collected energy in many of the present systems employ force charging systems whereby all the batteries within a battery bank are charged simultaneously irrespective of individual battery state of charge (SOC) and usage. This has brought about the need to develop devices that are smart, portable and able to more efficiently harness solar energy while at the same time reducing the number and thus cost of required solar panels. One of such devices is the Smart Solar Energy Management System (SSEMS) here presented.

Block Diagram

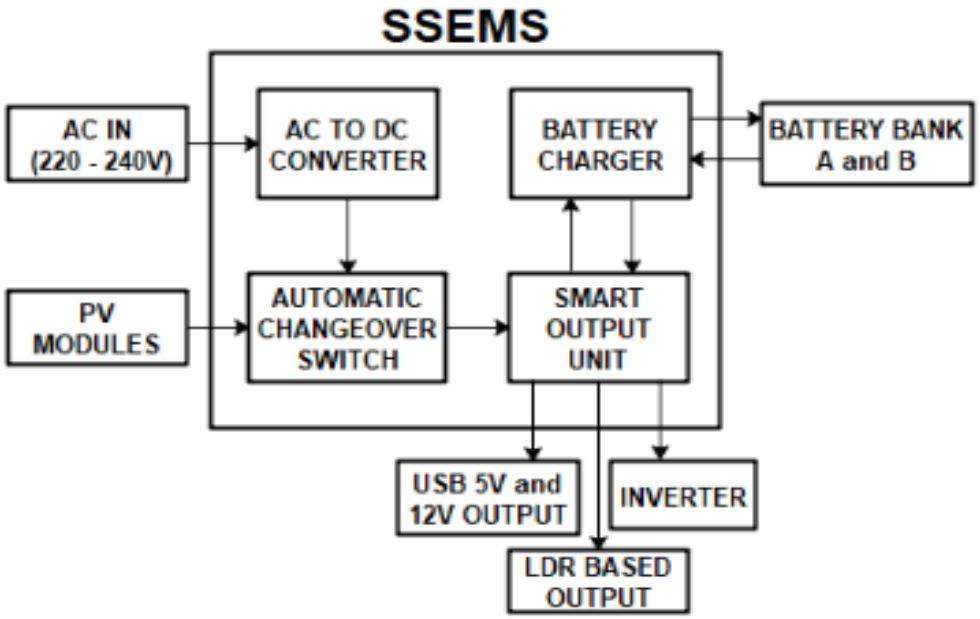

Figure 1: Block Diagram

Methodology

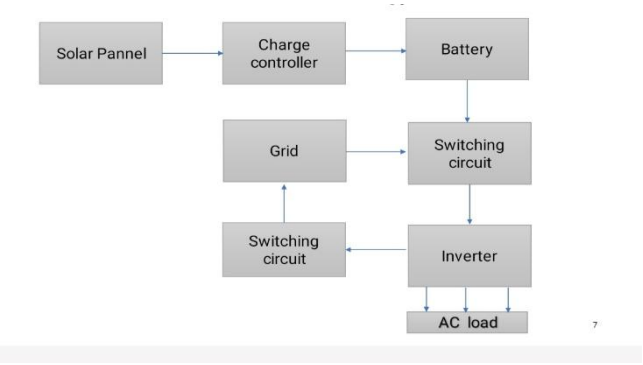

Fig 2 Block Diagram

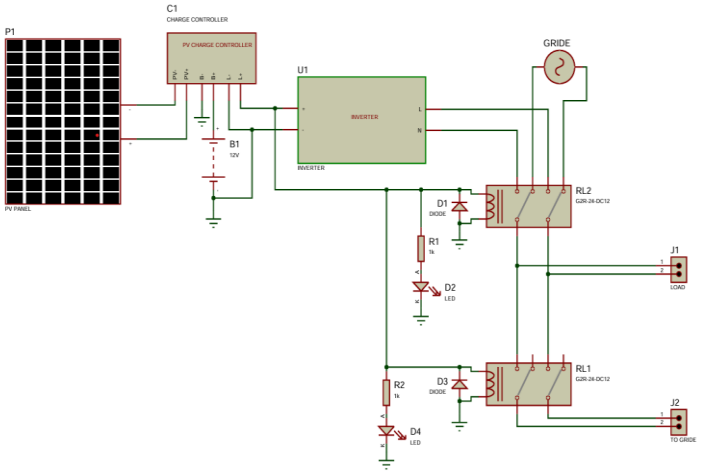

Fig 3 Circuit Diagram

For example, HEMS controls the distribution of your own solar energy. Generators (photovoltaic systems) and consumers (heat pumps, electric vehicles, solar energy storage, household appliances, etc.) coordinate through smart technology to minimize power costs and increase independence from energy suppliers. Knowing what *solar system* is best for you and your home comes down to a multitude of factors, examples being; your energy consumption, when and how you consume energy, your energy provider and their rates, and even where you live. Due to these many factors, it can be hard to fully understand what solar system is best for you. To fully understand your energy consumption and how best to control it, an option to consider could be home energy management systems.

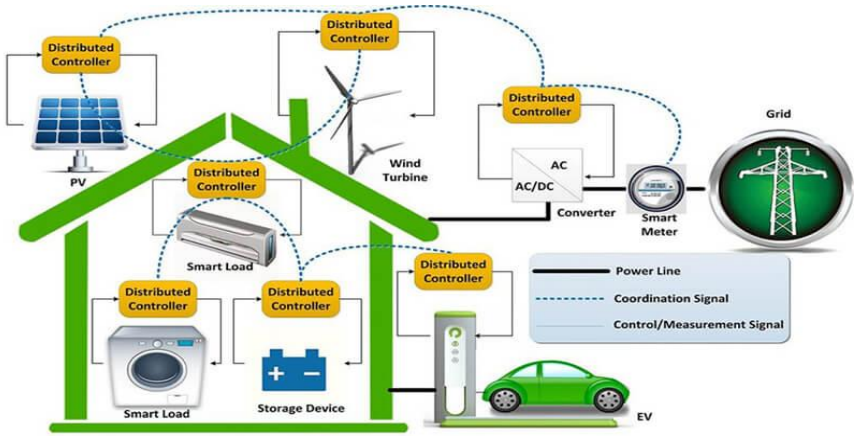

Fig 4 HEMS

Hardware Implementation:

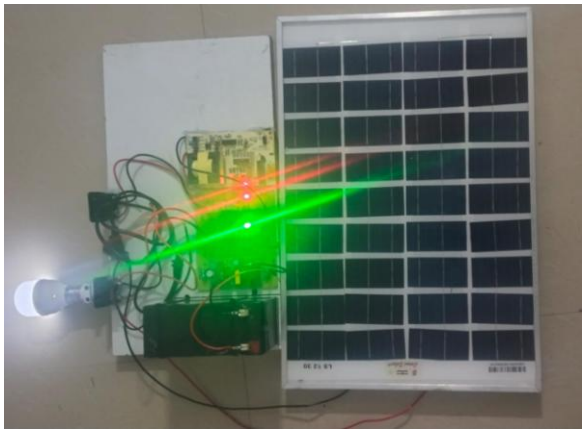

Fig 5 Real image of the poject

Advantages of HEMS:

● Home energy management system （HEMS） cost are still quite expensive, especially the installation costs and advanced smart home systems
● Home energy management system (HEMS） require continuous management and monitoring to gain the most benefit which is time-consuming and also requires dedication
● Concerns for the security of the home as monitoring and control of the device is done through an online portal and therefore the potential for the system to be infiltrated
● Solar integration

Results:

solar PV converter for home energy management system would likely include metrics such as energy efficiency, system reliability, cost-effectiveness, and integration with other components like batteries or smart appliances. It could also involve data on energy generation, consumption patterns, and any optimization achieved through the system. Detailed documentation of the installation process, performance testing, and any challenges faced during implementation

Conclusion

A smart solar energy management system that supplies energy to different loads at timed intervals also charging and discharging battery banks of different SOH has been presented. A modularized approach to design, simulate, construct and test the energy conversion, storage and supply subunits of the SSEMS was adopted. It has been shown that electrical energy harnessed from limited PV sources can be used to efficiently drive user loads in a preferential order while also charging attached battery banks. Therefore, with the smartness and portability of the presented SSEMS ascertained, it can be used for several purposes that are relevant to the academic and industrial communities.

FUTURE SCOPE:

This technology will also reduce both, the cost of energy consumption, production and the need of the grid storage. With its full implementation, smart grids will make renewable power feasible and equip the grid to meet increasing energy demands. It provides the user real-time control over their electricity bills. It can help reduce greenhouse gas emissions by up to 211 million metric tons and is much more reliable than a traditional grid. Research will focus primarily on machine learning, plug and play technology, self-healing and total automation of the grid. These leverage developments in sensing, communication and computational technologies to improve the reliability and efficiency of the system. In addition, newer technologies and future-proof solutions such as artificial intelligence to handle huge blocks of user data), internet of things, virtual/augmented reality, and automation are becoming integral parts. This contributes towards the 'Digital India' scheme initiated by the Government of India to transform into smart cities. Thus, every node in the power network of the future will be awake, responsive, adaptive, price-smart, eco-sensitive, real-time, flexible, humming and interconnected with everything else.

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