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RESEARCH ARTICLE

SOLAR PV SYSTEM USING MICROCONTROLLER.

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Abstract

The purpose of this project was to design a portable and low cost power system that combines both wind electric and solar electric technologies. This system will be designed in efforts to develop a power solution for remote locations such as rural and research areas as well as improve the general well-being of individuals in developing countries affected by natural disasters. For this reason, it is imperative to design a hybrid system that will deliver a minimum of 80-250 watts of continuous power which is enough to power a wide range of appliances and medical equipment.
Looking from the consumer perspective the cost of a hybrid system is still the biggest problem which can cost anywhere between 25,000 to 30,000 Rupee. Considering that a portable hybrid system is designed to deliver a limited amount of power, less than 1.5 kW-hr, this is a high price for such system. In order for this system to become more attractive to the public, we need to design and develop a product which will benefit their pockets.

Introduction:-

Buildings today consume more energy (41%) than either of society's other broad sectors of energy consumption industry (30%) and transportation (29%) [1]. India is fast growing country in the world. In recent years the electricity demand in India is increasing rapidly because of fast growing industry. 1.4 billion Still have no access to electricity (87% of whom live in the rural areas) and 1 billion that only has access to unreliable electricity networks.

Nowadays many issues appear due to the fact of using fossil fuel as a primary resource in generatingelectricity. The solution to such issues can be eliminated or reduced by means of using a renewableenergy such as a solar power system. The first issue that is related to use of fossil fuels is the globalwarming, where the increase of using fossil fuels such as oil and natural gas in generating electricity resulted several health and environmental problems. Natural gas gives off 50% of the carbon dioxide, the principal greenhouse gas, released by coal and 25% less carbon dioxide than oil, for the same amount of energy produced. Coal contains about 80% more carbon per unit of energy than gas does, and oil contains about 40% more [2]. Global warming has many effects such as earth increase in temperature, sea level. Second issue is the air pollution. A lot of pollutants are produced by fossil fuel combustion that is used to produce electricity such that Sulphur oxides, and hydrocarbons. In addition, total suspended particulates contribute to air pollution can combine in the atmosphere to form tropospheric ozone, the major constituent of smog. Third issue, is the cost of the fossil fuel, the electricity that produced by the fossil fuel process is more expensive than the electricity produced by the renewable energy such that solar power.

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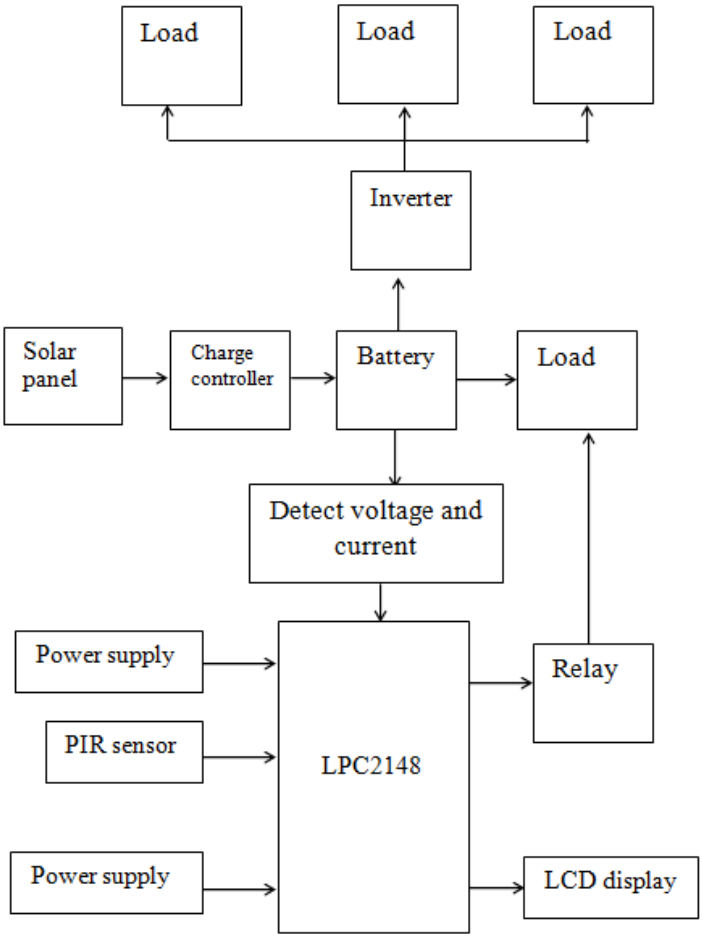
We need smart and practical approaches because energy, as a driver of development, plays a central role in both fighting poverty and addressing climate change. The government of India's make in India campaign will introduce more industry in India then there will be acute demand for more and more reliable power supplies. The energy sources in India is mainly Coal (56.65%), hydro (19.13%), Gas(9.2%), Nuclear(2.32%), Oil(0.58%) and other renewable sources(12.9%). From all above the renewable energy sources are free and can be easily utilize to have more energy.

The existing system has several disadvantages like solar energy and wind energy that are being in the system as an energy source can supply the load only for a particular period of time. A major drawback of the existing system is the charging of energy from the solar and wind is not always available.

The solar Photovoltaic (PV) cell is an electronic device that essentially converts the solar energy of sunlight into electric energy or electricity. Photovoltaic system consists of many cells, panels and array. The large scale PV plants are used for electricity generation that is fed into the grid and load. Such system, typically consist of one or more PV panels a DC/AC power Converter/Inverter. Additionally such system could also include maximum power point (MPP) and storage devices. The electricity generated is either stored, used directly for self-consumption or is fed into large electricity grids. Interconnections of panel or array, predict the output voltage or current or power and it is a variable that depends upon the sunlight. The converters may be used to regulate voltage and current at the load to control the power flow. There are many advantages of using solar Photovoltaic as a source for generating power, such as clean energy, no pollution and maximum power at peak hours. The modelling of solar PV system is to obtain maximum power for load requirements. Therefore energy storage system is very important for balancing the system or energy management of the system [3].

Block Diagram:-



Specification:-

Hardware:-

- Solar panel
- Rechargeable Battery(12 ,7A/h)
- Microcontroller
- PIR Sensor
- Max 232
- Light Sensor
- Charge controller
- Lcd display 16x2
- Inverter

Software:-

- Protel 99 SE 2.8
- Proteus 7.8
- Keil uVision 4.3

Type of PV system:-

There are generally two types of PV systems [5] off-grid and grid-tied depending on their connection to the utility grid.

***Off-grid DC/AC PV system*: (DC without inverter, AC with inverter):-**

 Off-Grid DC system (without inverter) - The DC output is immediately directed to DC loads. Excess power is stored in the battery banks controlled by the charge controller. Common applications of this system are found in RVs, boats, cabins, farm appliances, or rural telecommunication services. A backup generator may be included as shown in Fig. 1.

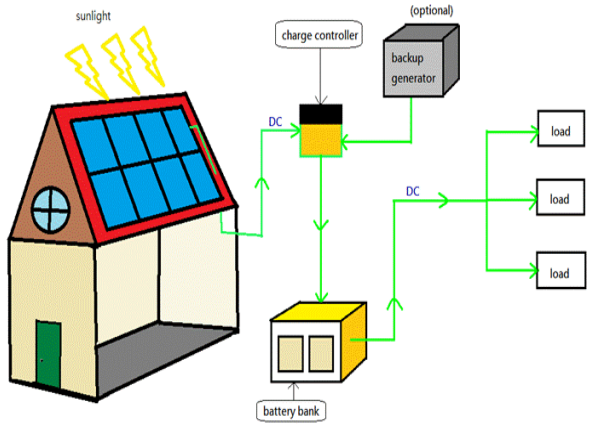


Fig 1:- Off-grid DC system (without inverter)

 Off-grid AC system (with inverter) - An inverter is added to this system. The generated energy is directed to the inverter that converts DC to AC electricity for conventional electric appliances. Excess energy is stored in batteries and an optional backup generator can be addedincluded as shown in Fig. 2.

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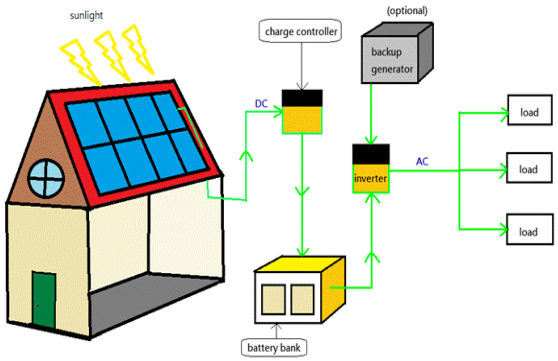

Fig 2:- Off-grid AC system (with inverter)

 Hybrid system- In this system, another renewable energy generator is added to generate more power. For example, the wind turbine can be added to generate electricity from wind. This system is useful in places where the weather is sunny and windless during summer but cloudy and windy during winter. This system is typically off-grid and the excess energy is stored in batteriesincluded as shown in Fig. 3. If neither the PV panel nor the wind turbine generates enough electricity, backup power such as a diesel generator can be added to generate the more energy.

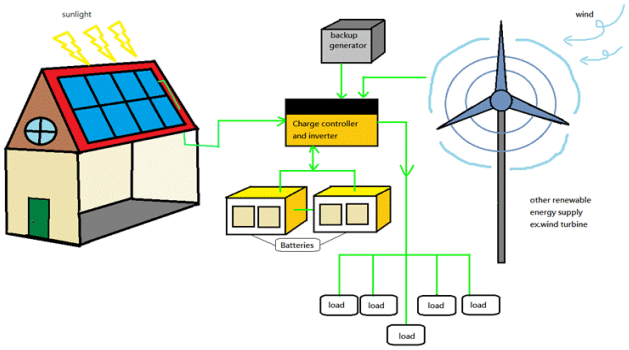

Fig 3:- Hybrid system

Grid-tied system: with battery backup or no battery backup:-

 Grid-tied system (without battery backup) - In this system, the generated DC is converted to AC and used on-site. The solar power production is monitored by the solar production meter. If there is an excess energy, the energy can be fed into the electricity grid. If the PV system does not generate enough power because of higher demand, needed energy can be drawn from the gridincluded as shown in Fig. 4. This process of drawing or feeding electricity to the grid is monitored by the export/import meter.

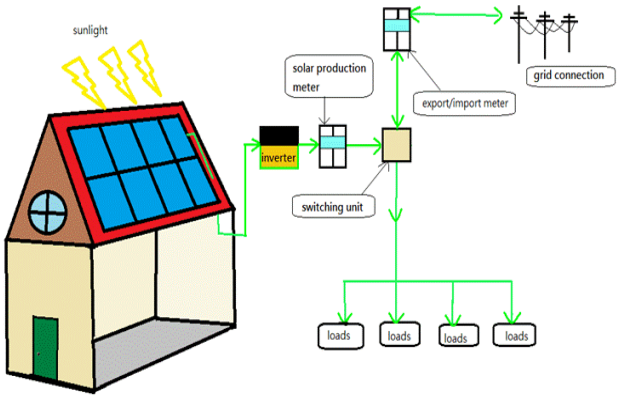

Fig.4:-Grid-tied system (without battery backup)

Grid-tiedsystem (with battery backup) - In this system, the converted AC is used on-site or stored in batteries. The charge controller monitors the battery capacity and excess energy is stored in the batteries for backup. If the batteries reach their full capacity, the excess energy can be fed into the electricity grid. On the other hand, if the PV system does not generate enough power, needed energy can be drawn from the gridincluded as shown in Fig. 5.This process is done automatically through a net metering program.

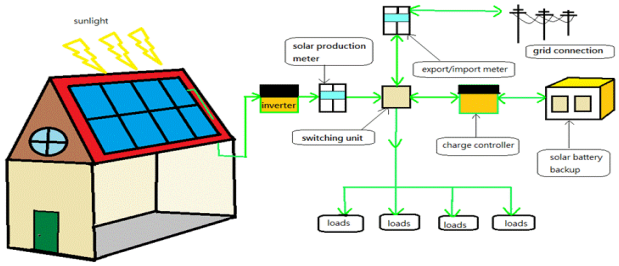

Fig.5:- Grid-tied system (with battery backup)

Advantages and Disadvantages:-

Advantages:-

1. Electricity produced by solar cells is clean and silent. Because they do not use fuel other than sunshine, PV systems do not release any harmful air or water pollution into the environment, deplete natural resources, or endanger animal or human health.
2. Photovoltaic systems are quiet and visually unobtrusive.
3. Small-scale solar plants can take advantage of unused space on rooftops of existing buildings.
4. PV cells were originally developed for use in space, where repair is extremely expensive, if not impossible. PV still powers nearly every satellite circling the earth because it operates reliably for long periods of time with virtually no maintenance.
5. Solar energy is a locally available renewable resource. It does not need to be imported from other regions of the country or across the world. This reduces environmental impacts associated with transportation and also reduces our dependence on imported oil. And, unlike fuels that are mined and harvested, when we use solar energy to produce electricity we do not deplete or alter the resource.
6. A PV system can be constructed to any size based on energy requirements. Furthermore, the owner of a PV system can enlarge or move it if his or her energy needs change. For instance, homeowners can add modules every few years as their energy usage and financial resources grow. Ranchers can use mobile trailer-mounted pumping systems to water cattle as the cattle are rotated to different fields.

Disadvantages:-

1. Some toxic chemicals, like cadmium and arsenic, are used in the PV production process .These environmental impacts are minor and can be easily controlled through recycling and proper disposal.
2. Solar energy is somewhat more expensive to produce than conventional sources of energy due in part to the cost of manufacturing PV devices and in part to the conversion efficiencies of the equipment. As the conversion efficiencies continue to increase and the manufacturing costs continue to come down, PV will become increasingly cost competitive with conventional fuels.
3. Solar power is a variable energy source, with energy production dependent on the sun. Solar facilities may produce no power at all some of the time, which could lead to an energy shortage if too much of a region's power come from solar power.

Application:-

1. Agriculture-Water-pumping installations (very important in developing Countries): systems of automatic irrigation.
2. Industry, Telecommunications & Public Services-Cathode protection of gas, oil pipelines and other types of piping; provision of power in general, in particular for limited electric charges (in the order of a few kW) always in areas far from the grid or where power is unreliable (discontinuous electrical supply).
3. Radio/television relay stations: telephone devices; stations for data surveying and transmission (meteorological, seismic, for levels of watercourses, indicating the presence of fires), often very useful for civil protection services.
4. Lighting of streets, gardens and public transportation stops, street signaling.
5. Health- Especially for refrigeration, very useful particularly in developing countries for the conservation of vaccines and blood.
6. Residential-Power provision (especially lighting) for houses and mountain refuges. Very significant applications of this type in developing countries: photovoltaic systems do not require special maintenance and are easy to install.
7. Free Time- For charging boat and camper batteries.

Conclusion:-

The objective of his project was to design a portable power system that combines both, a wind turbine and a solar panel in one single unit. The main idea of combining the two types of systems together was to try to archive a constant power production, which would be available most of the time.

Future Scope:-

As a team with many innovative ideas we believe that the implementation of the following ideas will make the designed Solar and Wind Hybrid Power System a better product:-

1. Design and manufacture a cover for the permanent magnet wind turbine generator- In order to better protect the product and reduce customer complaints in the future, it is always a good idea to take protect the systems key component. By developing a cover for the generator, quality will increase tremendously as it will be protected from rain, snow, and dirt. Throughout time, these types of particles can have a tremendous burden on the system.

2. Design and adapt a lightweight base that is permanently fixed to the tower of the power system.- Many portable power systems in the market have been developing their products with built in bases. They are lightweight and are easy to assemble. By implementing a built in base to the design, customers will not have to worry about how they will be setting up.

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