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Solar Plant Efficiency Monitoring System With Cold Storage Unit

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ABSTRACT

This paper presents a new system, PV-on time, which has been developed to supervise the operating mode of a stand alone PV Power Plant in order to ensure the reliability and continuity of its supply. This system presents an architecture of acquisition devices, including wireless sensors distributed around the plant, which measure the required information. It's time to use the renewable sources of the nature. The purpose of this project has been to investigate the possibility of heating and cooling air by connecting Peltier Elements to a PV panel.

Keywords: Solar Photovoltaic, Microcontroller, GPS System, Sensor Network , thermoelectric cooler, cold storage.

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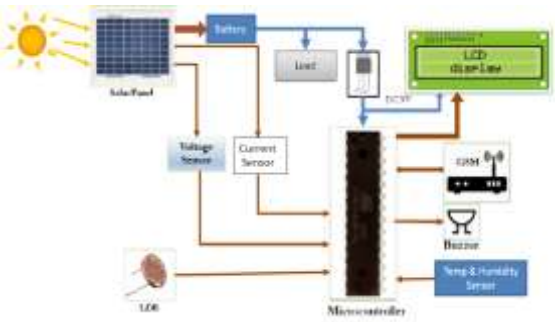
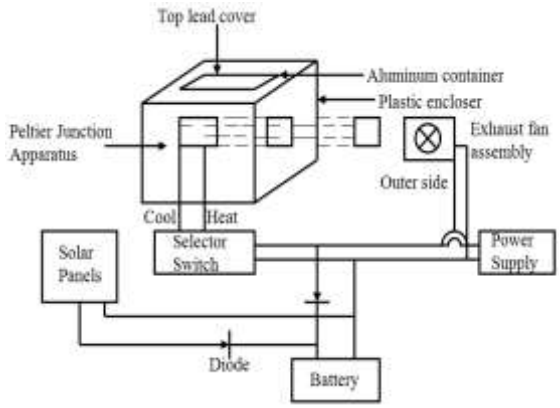
I. INTRODUCTION

In large scale PV power station, a monitoring and control system is necessary to monitor and control the system operation. The PV power station is often consists of photovoltaic array strings, storage batteries bank, power conditioning unit and electrical loads appliances. In the operation of such station especially with large size (kilowatt or megawatt scales), the system performance should be carefully monitored and a proper decision must be taken in time. The monitoring system for PV power station is very important to analyze, examine and decision making issues. For example, if one cell or branch of cells in one module is shadowed, broken, or have a problem, a hot-spot phenomena will be occurred and the PV cell or module may be damaged. It also reduces the overall system efficiency. Therefore a warning alarm should draw the operator attention to take a decision in order to remove or repair that fault. The role of monitoring system is to discover such drawbacks and inform the operator by the type and location of the failure to take decision or act a fault tolerant system if the monitored hardware is supported. In this work, integrating several types of instruments make the system very popular and may be used in system monitoring, control, or data logger issues. These instruments such as current and voltage sensors, state of charge (SOC) sensor for the battery bank, pyranometer, and temperature sensor combined in single system capable of acquiring measurements from all data sources placed on-line. In the proposed system, the advantages of NI software in combined with the robust, reliable and more cost effective microcontroller to present a more cheap system for PV power stations applications. The system also maintains an extensive database of minute-by-minute data for subsequent retrieval and analysis, and regularly updates hourly, daily, and monthly summary performance graphs. The main objective of our project is to charge 12 volts DC battery with the help of solar panel and then the power of battery is used for cooling and heating goods placed in insulated chamber with the help of thermo electric circuit (peltier circuit).We are use peltier circuit as a thermoelectric circuit. A peltier element provides a cold or worm surface depending on the polarity of the electric power. This enables a system with rechargeable batteries as the only energy source.

II. BLOCK DIAGRAM





III. METHODOLOGY

A. Solar Cooling Options

The conventional refrigeration and space conditioning devices are based on vapour compression machines and need electrical energy and/or fossil fuels for their operation. With the advent energy crisis and the realization the depleting nature of the fossil fuels, the search for the use of alternative energy sources becomes an essentiality. Solar energy has a very high potential amongst renewable sources of energy since it is abundantly available and is an inexhaustible global source of energy having no pollution hazards associated with it, Solar cooling is one of the most important aspects of solar the following factors:

- The demand for cooling is generally the greatest at times of maximum availability of solar radiation
- The cooling is far more needed in hotter regions than in colder climes.

A prototype of a solar photovoltaic driven thermoelectric cooler have array of solar cells, DC/DC converter, storage battery and thermoelectric cooler module. The block diagrammatic representation of solar PV thermoelectric cooling system is shown in Fig. 1. During daytime the solar cells receive radiant solar energy from the sun and convert it into electrical energy, which is supplied to the thermoelectric cooler module installed inside the storage box. If the amount of electric power produced by the solar PV is sufficient to meet the cooling demand of the storage box, then the surplus electric power can be stored in the battery. If the solar power is deficit to meet the cooling load, the battery will supply power to the thermoelectric cooler. If the solar cells cannot produce sufficient electric power e.g., on cloudy or rainy days the storage battery will act as a backup power source.

The DC/DC controller plays a role in maintaining constant voltage to the thermoelectric cooler from the solar PV panel. During night, the storage battery is used to power the thermoelectric cooler.

The cold side of the module is placed inside the cooler and the hot side is set outside. A fin-type heat exchanger is attached with the hot side of the thermoelectric cooler. In designing a portable thermoelectric cooler driven by solar cells, weight and cost of the total system are of great importance. It is expected that the system would be as light as possible and would not be expensive. For the thermoelectric refrigerator described above, a thermoelectric cooling module and electric power supply are extremely necessary. Since the storage battery is the heaviest component and the solar cells are most expensive. In this paper, the experiment work is focused mainly on testing the performance of the solar driven thermoelectric cooler during daytime without the need of a storage battery, and therefore, battery is not involved in the discussion of material characteristics of a thermoelectric module.

IV. HARDWARE SYSTEM.

Figure solar PV panel.

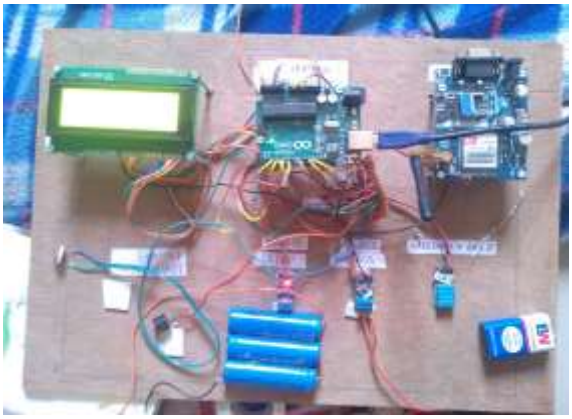


Figure circuit of microcontroller and GSM model.

Figure. thermoelectric cold storage box

V. EXPERIMENTAL RESULT

Figure experimental result

VI. CONCLUSION

The efficiency of solar cell influence on the output value of the solar panel, where is the higher the efficiency the higher the solar radiation is produce. By this monitoring system, the solar panel can be used at long term usage and the maintenance can be done at instant when the notification (SMS) and buzzer system is installed on the system to the user. The theoretical analysis shows that the cooling power increases with solar radiation and the energy efficiency decreases with solar radiation.

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