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PHOTOVOLTAIC THERMOELECTRIC GENERATOR MONITORING SYSTEM USING DAQ AND ATMEGA328P

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ABSTRACT

In this project, we are going to measure the voltage produced by the PV &TEG module during the entire day from sunrise to sunset. The ATMEGA328P microcontroller chip which is Arduino used in this project is capable of measuring the voltage every second in real-time. By using the data acquisition technique to automatically collects and record data from sensors. Sunlight can be converted into electricity to generate renewable energy. In this PV-TEG system, the photovoltaic module in this system converts the solar heat energy into electrical energy up to some small wavelengths of the solar energy. The long wavelengths of solar energy are converted into heat energy to use this lost energy we use the TEG module. In this module, the heat energy is applied at one side and another side is attached to a cold side due to this temperature difference the TEG module generates usable renewable energy. For energy management, that is the voltage produced by the Photovoltaic cell and the thermoelectric generator is stored by using the IoT-based management.

Keywords *- Photovoltaic, Thermoelectric generator, Data Acquisition, Microcontroller, Arduino.*

1. INTRODUCTION

The hybrid photovoltaic-thermoelectric system (PV-TE) recently gained a lot of recognition because of its potential to use solar energy across the entire spectrum and to increase the energy efficiency of the combined system. Solar energy is considered to be one of the most renewable energy sources as it is easily available, clean, and cheap. Nowadays, solar energy production has been given more importance because of fast technological development and possible usage towards the worldwide energy demands.

The information about climate-energy sources and temperature availability are associated with the locations. Energy plays an integral role in the socio-economic development of any society. Power plays a great role wherever there is a livelihood. So for storage of information, we are using the Data acquisition system technique.

The data acquisition system (DAS) plays an important role in any monitoring system and is used to collect data from different sensors of a PV system. Then, this data is digitalized for storage and the DAS sends data to the control centre for processing and presentation. The data acquisition system should be automatic using an A/D system to convert the analog signal from the instruments to digital form. Here, we are using the principle of data acquisition that we are storing the data of the produced voltage by using the iot cloud (using thing speak).

A data acquisition system (DAQ) is a device used to automatically collect and record data from sensors and electronic equipment, which are later used for simulation and data analysis.

The data acquisition device is broadly used in all systems relating to technology in all electronic spheres. It has been used to gather data for a system related to meteorological and electrical parameters because of its ability to collect and store data over a more extended period. In particular, in Photovoltaic (PV), the DAQ was used in monitoring the electrical parameters. It is pretty valuable for a PV system as it can collect a range of data over a long period without an operator having to inspect them thoroughly.

2. EXISTING SYSTEM

In this, we are using both sunlight and heat energy to generate electricity. But unfortunately, there is no existing system for this that uses both sunlight and heat energy to generate electricity, and currently, all the existing systems are based on sunlight only to generate electricity.

3. PROPOSED SYSTEM

Fig. 1 shows a schematic diagram of the data acquisition system. The system comprises 3 central units; the Atmega328P microcontroller board unit, the sensing units (voltage), and the IoT unit (WiFi. The Arduino (atmega328P) board unit control is a significant unit responsible for controlling and monitoring the data acquisition system using an LCD screen and Thing speak IoT platform. The sensing unit is responsible for measuring the sensor's voltage values.

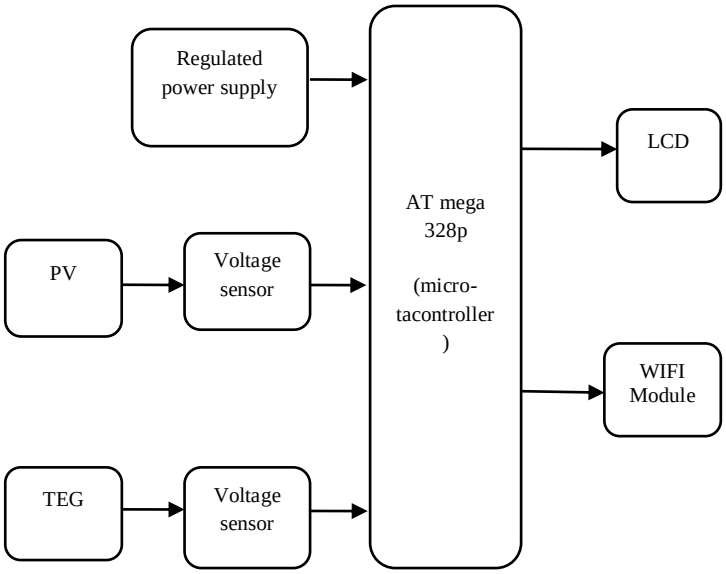


Fig : proposed system block diagram

Photovoltaic:

A photovoltaic system, also a PV system or solar power system, is an electric power system designed to supply usable solar power by means of photovoltaics. It consists of an arrangement of several components, including solar panels to absorb and convert sunlight into electricity, a solar inverter to convert the output from direct to alternating current, as well as mounting, cabling, and other electrical accessories to set up a working system. It may also use a solar tracking system to improve the system's overall performance and include an integrated battery.

PV systems convert light directly into electricity, they are not to be confused with other solar technologies, such as concentrated solar power or solar thermal, used for heating and cooling. A solar array only encompasses the ensemble of solar panels, the visible part of the PV system, and does not include all the other hardware, often summarized as balance of system (BOS).

Thermoelectric Generator/TEC:

A thermoelectric generator (TEG), also called a Seebeck generator, is a solid-state device that converts heat flux (temperature differences) directly into electrical energy through a phenomenon called the Seebeck effect (a form of thermoelectric effect). Thermoelectric generators function like heat engines, but are less bulky and have no moving parts. However, TEGs are typically more expensive and less efficient.

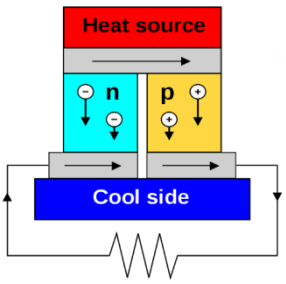


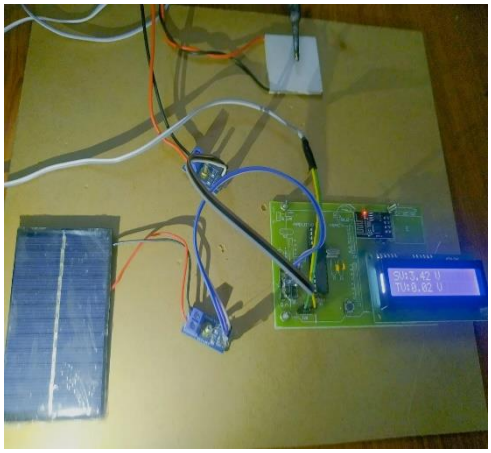
Fig : Teg Working

Voltage Sensor:

Voltage sensors are wireless tools that can be attached to any number of assets, machinery, or equipment. They provide 24/7 monitoring, constantly watching for voltage data that could indicate a problem. Low voltage may signal a potential issue, while other assets may be in danger when voltage is too high.

LCD:

A liquid-crystal display (LCD) is a flat-panel of display or other electronically modulated optical device that uses the light-modulating properties of liquid crystals combined with polarizers. Liquid crystals do not emit light directly, instead using a backlight or reflector to produce images in color or monochrome. LCDs are available to display arbitrary images (as in a general-purpose computer display) or fixed images with low information content, which can be displayed or hidden.



WIFI MODULE (ESP8266):

ESP8266 was designed by the Chinese company Espressif Systems for use in Internet of Things (IoT) systems. ESP8266 is a complete WiFi system on a chip that incorporates a 32-bit processor, some RAM, and depending on the vendor between 512KB and 4MB of flash memory.

4. ADVANTAGES

Using the IoT app we can monitor the PV & TEG continuously, and generated electric city is used for motors which we can use for agriculture. A clean and green energy source. The most prominent advantage of PV cells is the clean &green energy it provides. The thermoelectric plate is environmentally friendly. Have high scalability which means they can be applied to a heat source of any size. Lower the production cost. TEG can recycle wasted heat energy.

5. RESULT

The below figure shows the result of the PV,TEG which produces the electric city or voltage produced by the solar panel and thermo electric generator.

Fig : prototype of pv &teg

Fig : variation of voltage at different time of pv

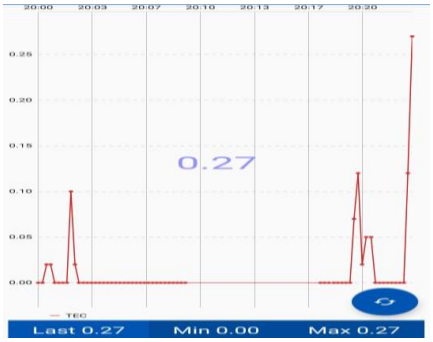


Fig : variation of voltage at different time of teg

The above two figures shows the value that we get maximum in when it records the high voltage through PV &TEG along with time.

6. CONCLUSION

This project proposes that with the use of solar concentrators and optical Filters, energy wasted from the conversion of solar energy to electricity can be conserved and higher efficiency is achieved. The Thermoelectric effect is the same as that of the “Green technology” which is used to generate electric power. The hardware is developed in such a way that the power is generated from two different sources that are from solar and thermoelectric modules these sources are continuously update the amount of electricity generated by the sunlight and heat energy to the Thing speak IoT cloud. This module can be implemented in any type of sectors. They can also be implemented in high renewable energy power plant areas to generate power gain. Since solar panels cannot be used in the absence of sunlight, we are using a thermoelectric module to convert heat energy into electricity, along with a solar panel. By this, we are generating power using hybrid sources.

7. FUTURE SCOPE

In future we can extend this project by using this system we can measure the data for longer time periods and we can work the entire system in real time which can also used to store tha voltage geneted by the systems automatically.

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