SOLAR POWER MONITORING SYSTEM BASED ON IOT

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Abstract

The system detects and alerts the user or the administrator when is fall below the predefined conditions, and display on the Web browser. Using the Internet of Things Technology for supervising solar power generation can greatly enhance the performance, monitoring and maintenance of the plant. Solar power plants need to be monitored for optimum power output. The solar system deployment requires sophisticated systems for automation of the plant monitoring remotely using web-based interfaces as majority of them are installed in inaccessible locations and thus unable to be monitored from a dedicated location. A solar panel is used that keeps monitoring the sunlight, here different parameters like voltage, current and intensity of light are displayed on the LCD and web browser by using IOT technology. Our system will constantly monitor solar panel parameter and transmit to IOT system over the internet. This make remotely monitoring of solar plant very easy and ensure best power output.

Keyword-IOT, Solar Power, Internet of Things

Introduction

The IoT based solar energy monitoring system is proposed to collect and analyzes the solar energy parameters to predict the performance for ensuring stable power generation. The Internet of Things has a vision in which the internet extends into the real world, which incorporates everyday objects. The IoT allows objects to be sensed or controlled remotely over existing network infrastructure, creating opportunities for pure integration of the physical world into computer-based systems, and resulting in improved efficiency, accuracy and economic benefit in addition to reduced human intervention. This technology has many applications like Solar cities, Smart villages, Micro grids and Solar Street lights and so on. As Renewable energy grew at a rate faster than any other time in history during this period. The proposed system refers to the online display of the power usage of solar energy as a renewable energy.

This monitoring is done through the combination of Microcontroller Atmega 328 & Wi-Fi module ESP8266. Smart Monitoring displays daily usage of renewable energy. This helps the user to analysis of energy usage. Analysis impacts on the renewable energy usage and electricity issues.

Literature Review

The performance of PV systems is highly affected by internal and external factors such as the structural features, aging, radiation, shading, temperature, wind, pollution and cleanliness. Any type of climatic change causes changes in the solar radiations and in the ambient temperature, hence causing changes in the solar PV output performance. In the present study, a detailed investigation on air dust particles effect on photovoltaic (PV) model performance has been carried out. The scanning electron microscope analysis of the collected dust samples was being carried out, and the obtained images were being analyzed in order to observe the character and topography of the dust sample particles. The data for dust samples of different weights with change in power loss in a PV module at three solar irradiations levels of 650, 750 and 850 W/m^2 have been collected. In present study, the effect of environmental dust particles on power loss in PV module has been evaluated by measuring the electrical performance index such as voltage, current and power. The minimum power value of 3.88 W has been observed during the accumulation of rice husk on PV module. The degree of efficiency deterioration depends on the specific mass and size of dust particles deposition on PV module surface. As the mass of dust deposition increases, power output and the efficiency of the module decrease, and as the size becomes smaller, power output decreases as smaller particles block more radiation on PV module surface. The different pollutant depositions may include red soil, ash, sand, calcium carbonate, silica, etc. The presence of air pollution may significantly deteriorate the energy yield of PV panels; even after a short period of the panels' outdoor exposure (e.g., 2 months) without cleaning, it may cause a decrement of 6.5% in energy production approximately (Sarver et al. 2013). Most of the researchers carried out the studies on effect of dust accumulation on the surface of PV modules. It is proved that power decreased up to 50% due to dust

accumulation for a 6-month study. Also the authors investigated the performance of a solar collector drops progressively as dust is accumulated on its surface. The authors selected rooftop PV panels to evaluate the PV performance for a certain time period, and the influence of different dust deposition densities on the energy yield and the economic performance of the small power station is estimated. Many researchers had made many studies in this major problem and proved that 50% of the PV solar panels performance reduces by the dust accumulation on the cleaned panels.

Fig.1 Solar module covered by heavy layer due to dust accumulation before cleaning

The studies made on the effects that causes to the solar panel due dirt the by well-known organization in the world google of 1.6 MW solar plant in there California headquarters. 4.7% average loss is recorded in the pioneer‟s investigations by impact of dust in the solar systems that is made by the authors Hottel e.l. . The authors Salim et al made an investigation on dust accumulation and stated that there is a 32% reduction of solar power in a span of eight months in a solar village near Riyadh. An experiment is conducted by the authors Dirk Goosen et. Al in on the deposition of the dust particles which had affected the performance of the PV cells and investigated the airborne concentration and wind velocity effect caused by accumulation of dust. Author Garg of Roorkee made an experiment and discovered that panel would reduce 8% average transmittance by the accumulation of dirt on 45-degree tilted glass plate after a 10-day period. Due to accumulation of dust on the panels it is observed that useful energy is reduced by 30%. The common methods used to clean the dust are by spraying water on the panels with cleaning agent. Vibrating the panels with motors as the cell phone vibrates so that the dust goes off from the panels. The dust jumps off from the panels by creating a positive charge. By using a brush manual, we must clean the PV panels. Solar panel monitoring is important. It is vital that solar panels are monitored regularly in one way or another. You need to make sure they are operating correctly, and the system is generating as much as predicted. If you have solar panels installed, you should at the very least check the generation meter once a week and take a note of the reading. And should go to the place of the panels arranged and note the readings every time. It is a manual checking procedure, always should go to the place of solar panel system arrangement to note down the readings. So, it is not possible to take readings all the time, whenever required should go to the place of system arrangement. And optimum power cannot be obtained due to no proper alignment of solar power.

Methodology

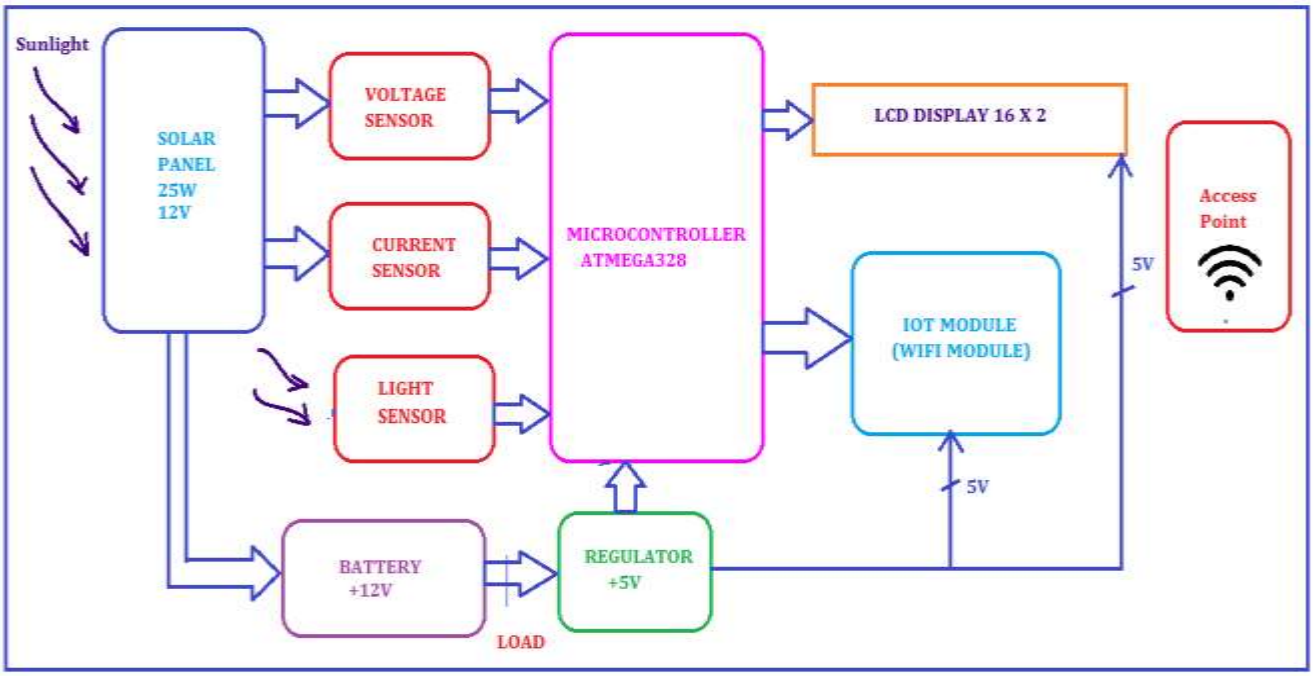


Fig. 2 Block diagram of solar power monitoring system using IOT

A solar cell, or photovoltaic cell (PV), is a device that converts light into electric current using the photovoltaic effect. The array of a photovoltaic power system, or PV system, produces direct current (DC) power which fluctuates with the sunlight's intensity.

Solar Power Generation From Pv Cell

A PV cell (can be called as a solar cell) is a semiconductor device that converts the sunlight energy into electricity without going through any energy conversion steps. This conversion takes place by photovoltaic effect and hence they are called Photovoltaic (PV) cells. It generates voltage and current at its terminals when sunlight incident on it.The way and the amount of power generated by a solar cell depend on the sunlight falling on it. This also includes some factors such as intensity of light, angle at which the light falls on it and area of the cell. The more is the power generated, if higher is the light intensity. If the area of the cell is more, the power generated is also more. And the optimum power is generated by it when light falling is perpendicular to the front side of the cell. The solar cells are made with silicon semiconductor material and is treated with phosphorous and boron to make a thin silicon wafer. The wafer layers are then aligned together to make the solar cells, once they are doped. Irrespective of the technology and material used, every solar cell has two terminals (positive and negative terminals) so as to take the electric current from it. Typically, a solar cell consists of front contact at the top, PN junction in the middle and back contact at the bottom. Basically, the sunlight consists of bundles of photons, where each photon has a finite amount of energy. To generate the electricity from a solar cell, these photons must be absorbed by it. The energy of the photon and also the band-gap energy of semiconductor material decide the absorption of a photon. Here is the term Electron-volt (eV) which is the unit of energy that expresses the photon energy and the band-gap energy of a semiconductor material.

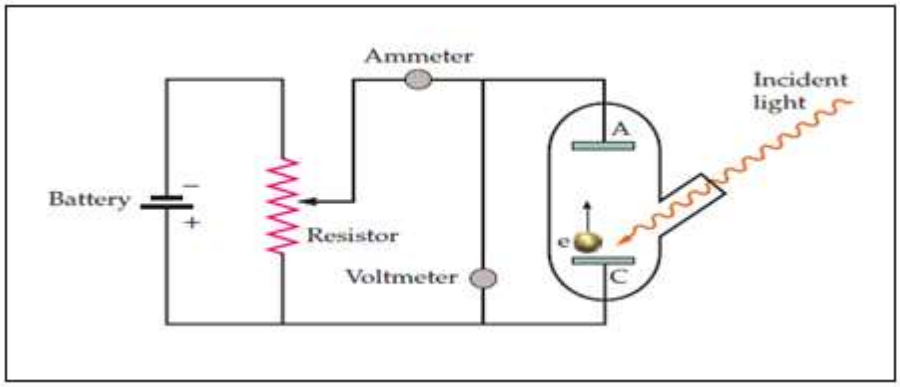


Fig. 3 Photo electric effect

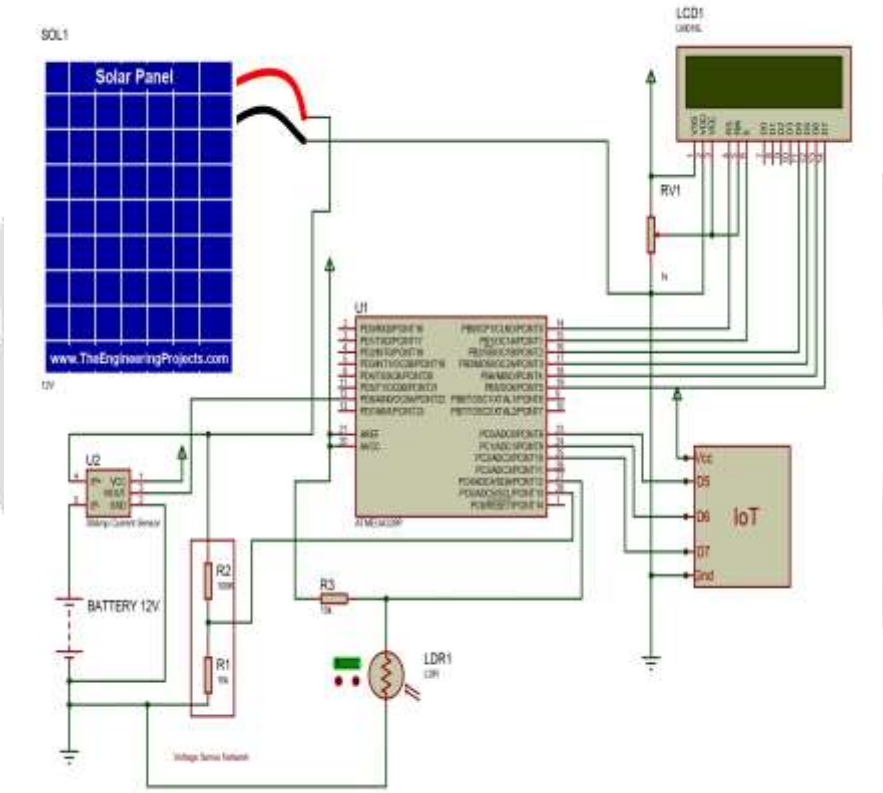


Fig. 4 Circuit Diagram of Solar Power Monitoring System using IOT

Result

The Voltage of Solar panel will show on LCD Panel in Volt(V).

2. The Current generated from solar panel will show on LCD panel in milliampere(mA-A).

3. The intensity of sunlight will show on LCD in percentage.

4. The voltage and light intensity will show on web browser.

When System will ON it will display message “Solar Pannel Using IOT” on LCD Display

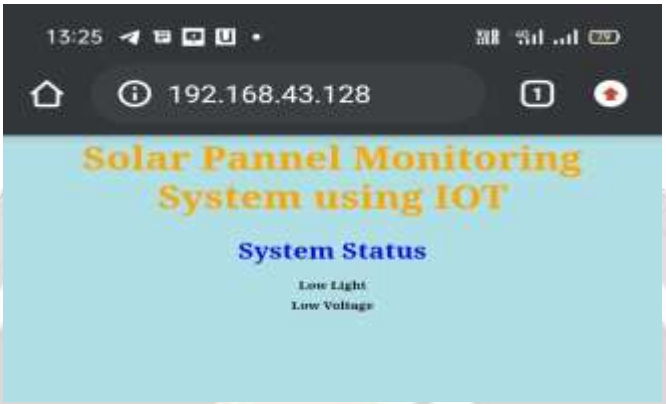
Then LCD will show on time voltage(V), current(mA-A) and Light intensity(in %).

Above 12 to 13 voltage LCD will show reading simultaneously it will show message that

" System is Healthy"

If any disturbance to solar panel it will display message_ "Plz check Pannel needs cleaning"

When system will have some disturbance then it will show message on web browser that System Status : Low Light and Low voltage



When system will have some disturbance then it will show message on web browser that System Status: System Healthy, Voltage :- OK & Current :- OK

Conclusion & Future Scope of Study

- A monitoring system is designed for there is any malfunctioning of the solar panels will be displayed on and we can also get information about whether the solar or battery connected for the loads.
- It now displays these parameters as to the user using an effective GUI and alerts user when the output falls below specific limits.
- As this system keeps continues track of solar power plant ,the daily weekly and monthly analysis becomes easy and efficient also with the help of this analysis it is possible to detect any fault occurred within power plant as the generated power may show some inconsistency in data of Solar power plant.
- IoT based remote monitoring will ensure comfortable plant monitoring, display of yield, Power, earnings, status messages via email to PC and mobile phone.
- It is an ideal solution to increase efficiency of plant monitoring presentation of PV generation, consumption and self consumption, recommended consumption, automatic and intelligent control of loads visualization of Live Data.

- Solar panel is used that keeps monitoring the sunlight. Here different parameters like voltage, current and light are displayed on the LCD by using IOT technology. Now we are getting only information we can see it in cloud but in future we can control whole system through IoT which Distant is a way.
- In future other physical parameter related to weather can also combine with system and can make this system advance and much informative.
- This project can be further enhanced, by using the results of this current project, i.e. the monitored values obtained are helpful in predicting the future values of the parameters considered. Prediction of the amount of solar energy will be stored in the battery. The data stored in cloud can also be analyzed using the Matlab.

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