International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 08 Issue: 07 | July 2021 www.irjet.net p-ISSN: 2395-0072

SOLAR PANEL ANALYSIS USING IOT AND IMAGE PROCESSING

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Abstract – "*Solar energy is gaining strong momentum as the future clean and renewable source among other sources of energy. Solar power generation has attracted much attention but there are not enough specialists for condition monitoring of the solar panel. As solar panels are exposed to outside conditions there are chances of reduction in efficiency due to dust, partial shading, cracks, delamination etc. this Project provides the analysis at normal and some faulty condition using equipment like PV analyzer, Solar Power Meter and thermal camera to compare the results. The obtained data is periodically uploaded to the cloud using NodeMcu, the uploaded data can be further used for monitoring the installed plant*"

***Key Words*: Voltage Sensor, Current Sensor, IOT-Internet of things, Solar Panel.**

1. INTRODUCTION

This Project is Developed to monitor the voltage and current produced (use voltage and current sensors) in the solar panel and a servo moter is fixed on the top of the Solar panel for cleaning purpose, it has humidity and temperature sensors also, and everything is connected vie Node MCU and it is connected to the internet through blynk server and the then the data can be displayed in the blynk Application(In mobile phone). And a web camera is mounted in front of solar panel for finding any cracks on the solar panel(using OpenCV).

1.1 Description

The cloud severs made thing very simple for connecting devices. This is easy to clean the solar panel for any distance but we proper internet connection. By using the servo Motor and some current sensors and voltage sensors. By use of these sensors we can monitor the current generated by the

Solar panel, and also any crakes on the solar panel through web camera. The overall system is cost efficient, and it can run long period of time.

1.2 Problem Identification

So, in this grow world the power consumption is to high and we need to maintain it properly otherwise we may face scarcity of electricity. This model is designed to detect the dust on the solar panel and any crack on the solar panel through web camera.

1.3 Related Work

The Papers referred are [1] An Exclusive review on IOT based solar photovoltaic remote monitoring and controlling unit. [2]solar power based remote monitoring and control of Industrial parameters using IOT. [3] solar power monitoring system using IOT. [4] A smart IOT system for Monitoring solar pv power conditioning unit. [5] Review on solar power Remote monitoring and controlling using iot. [6] IOT based Solar energy monitoring system. [7] Design and implementation of a renewable energy monitoring system.

2. METHADOLOGY

This system is proposed to maintain the constant generation electric power from the solar panel and if voltage or current drops then we can monitor through phone application. We can clean the panel though mobile phone application. Alart message will be provided. V-I characters can be obtaines And the everything is upload to cloud.

2.1 Modelling and Analysis

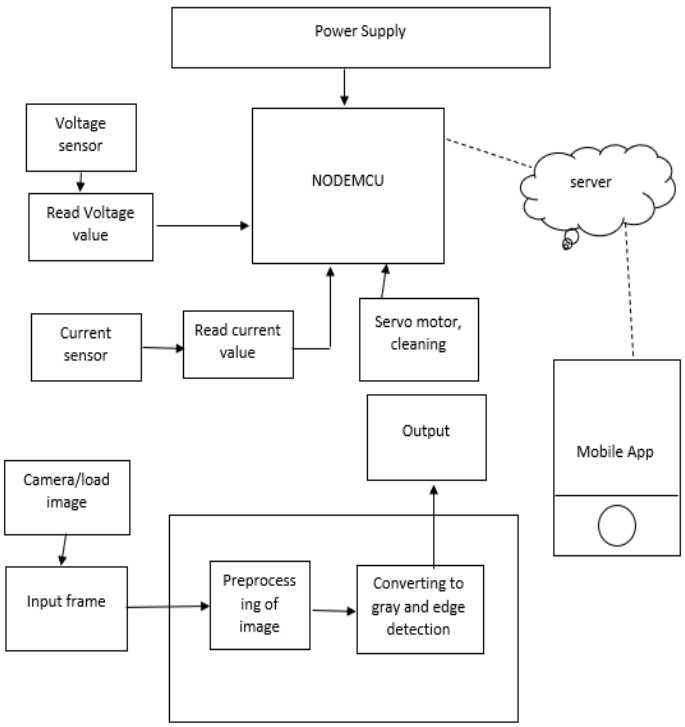

Figure1:System Architecture

So in this voltage senser will detect the voltage produced by the solar panel and also the current sensor. The humidity and temperature sensors will update the information every 3 seconds and every 1 second the voltage and current is updated to the blynk Server. And if any voltage is dropped the we can monitor over web camera mounted over the solar panel(camera should be placed towards solar panel). By using the servo motor (Blynk application) we can clean the solar panel. And the voltage will be restored.

We require voltage sensor, current sensor, temperature and humidity sensor and servo motor, Solar panel,NodeMCU, web camera, and some software like Python, OpenCV and wiping blade.

Voltage Sensor:

The +ve end is called vcc and -ve end is called GND,and S is for analog connection,This voltage sensor is used to measure the voltage generated by the solar panel.

Figure 2: Voltage Sensor

Current Sensor:

This current sensor is used to measure the current generated by the solar panel.

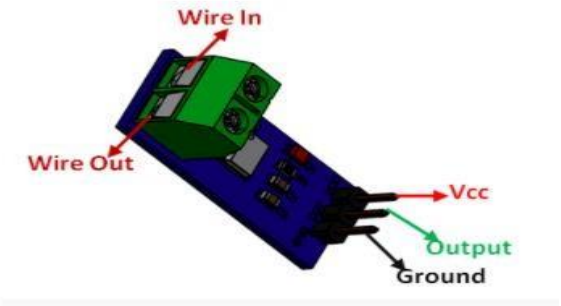

Figure 3: Current Sensor ACS712

NodeMCU:

All the sensors and servo motor is connected to this nodemcu. It requires wi-fi connection.

Figure 4: ESP8266 NodeMCU WiFi Devkit

Python:

It is used for coding, where we use canny edge Detection algorithms. (To find the crack on the solar panel)

Solar panel: For producing electric power.

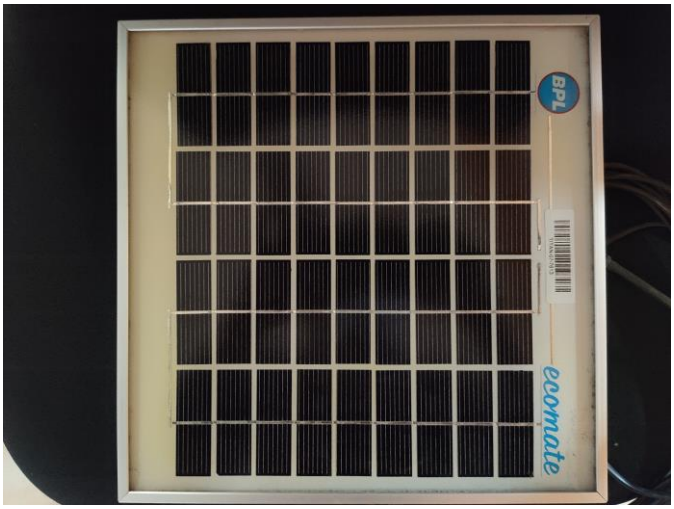

Figure 5: solar panel

Servo motor:

It is connected to the NodeMCU.
And this motor is fixed on top of the solar panel
For cleaning the solar panel.

Figure 6: Servo motor

2.2 Advantages

It is easy to clean the solar panel from the far distance and we can easily monitor the Voltage and current produced by the solar panels And it is cost efficient and we can detect the cracks on the solar panel and also we can obtain all the data (solar panel)to the mobile phone.

2.3 Disadvantages

This system requires external power to connect and to start the entire system. It always require the internet connection. The wifi range is short compared to SIM cards.

3. CONCLUSIONS

The described experimental setup demonstrates that partial shade and dust accumulation reduce PV panel efficiency, as evidenced by the fluctuation in PV Analyser data. Because the solar irradiance on the panel changes as a result of partial shade and dusty conditions, the V-I characteristic changes as well. The data from the PV Analyser is forwarded to the Super chart and server for storage. And it is more cost efficient And it is east to clean.The taken image condition, image processing and the respective contours of detecting edges and cracks are obtained.

Future Scope

Since the system requires external power supply of 5 volts and 3.3 volts for its operation which can be taken rid of by utilizing the power generated by solar panel only. Also with the help of motor and controlling it is possible to track the sun for better power generation. Apart from that by using various Machine Learning algorithms and model it is possible to make system smart enough to take decision about data and performance.

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