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IoT based Solar Power Analysis and Tracking System

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Abstract - *In this paper we are going to build the IOT solar power station monitoring system. The main motto behind this project is to measure the power of each and every solar panel in real-time, and manage the future use of power according to the generated power. Also we can able to check the real-time battery status and battery life with real-time battery security and health detection system.*

***Key Words*: Atmega328, ESP8266, My SQLite, PHP My SQL Cloud**

1. INTRODUCTION

Recently the Ministry of New and Renewable energy has announced that they are going to set up the 500 MW solar plants across each state. So as to make this initiative successful we have did some research on solar power generation? In which we found that in the solar plant only the 60% of energy we can get at maximum throughput even if by applying latest solar tracking devices also. Maximum energy will get wasted due to improper handling and improper distribution from source point to destination.

To avoid such a instances we have designed the system which can give maximum output power with the proper handling of resources by using them with LDR based sun intensity tracking applications, also with the help of IoT we can able to get live voltage and power monitoring of main system. We are going to send all Power relates values like Voltage, Current and Power to server for every second and with the help of Server side smart algorithm we can be able to predict the expected energy outcome from the weather report or with the help of Map API to utilise the available resources properly and get maximum power from minimum resources.

Also our system consist of the Battery Status indicator which shows the live battery status weather it is connected to the source or not. It battery is not connected to the source then it sends the alert message to the main in charge of the system

2. System Description

This Solar power management system consists of various electronics, hardware and software components. As described in main system block diagram shown in. Fig-1.

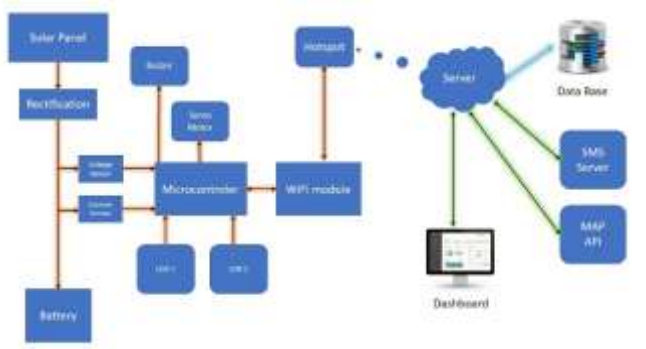

Fig -1: Block Diagram of System

3. Hardware & Software Design:

In design part of the system we have divided this part in two sections as hardware system design and software system design as Follows.

3.1 System Hardware Design:

A. Microcontroller:

This System is Equipped with Atmel's Atmega 328 Microcontroller this is High Performance 8 Bit Microcontroller with RISC Architecture. It has 14 general purpose I/O Pins and various resources. We have chosen this microcontroller just because of it has sufficient GPIO pins to connect our various Sensors and it has 2 UARTS. In our System Major Sensors are based on Serial Communication Interface of information exchange this microcontroller best suits for this application.

Fig -2: Atmel 328

B. ESP8266-12E WiFi Module:
This is the WiFi module with inbuilt 32-bit microcontroller it is made by Espressif System Inc. Shanghai Based Chinese Company in 2014. It has inbuilt TCP/IP Stack, so we will use it for communication purpose with our server. For that we will operate this chip in STA (Station) mode and will connect to our main internet enabled hotspot or gateway router, so it can access internet.[1]

Fig -3: ESP8266 12E

3.2 System Software Design:

A. Main Server:
Is our system works in dynamic nature our all database is stored virtually in real web server [3]. For that we have used free domain hosting site called as 000Webhosting. It provides free domain name and webhosting, so we created one domain name for our project and hosted our main server's PHP file over there. For that we have used PHPs 7.1 version with apache server [3].

Fig -4: Site Dashboard

B. Database:
For the purpose of data storage, we have used My SQLite database in our system. For that we created the one database in our main apache website server. And with the help of backend PHP language we have created the API to access the values from database to frontend webpage


```
{
  - solarpanel: [
    - {
        id: "1",
        voltage: "12",
        current: "1",
        power: null
      },
    - {
        id: "2",
        voltage: "12",
        current: "2.4",
        power: "28.8"
      },
    - {
        id: "3",
        voltage: "12",
        current: "2",
        power: "24"
      },
    - {
        id: "4",
        voltage: "12",
        current: "230",
        power: "2760"
      },
```


Fig -5: Database

We can see in Fig-5 the by requesting to the server will responds you back with the last values that have been generated from the Solar power station for visualization purpose

4. Result & Discussion:

The overall result shows that Values of current and Voltage has been uploaded to server with the help of API and with the Chart.js JavaScript API.

The Hardware model shows that the

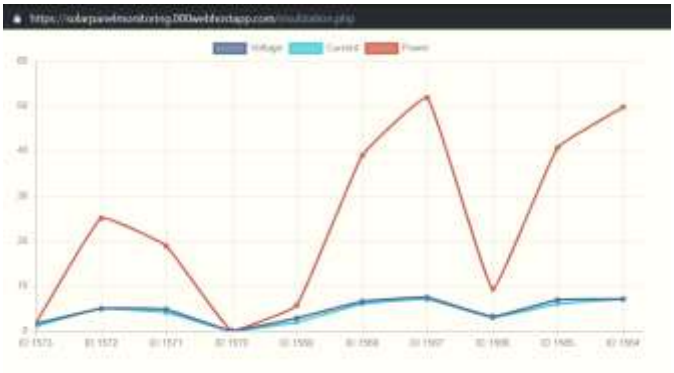

Fig -6: System shows Power Statistics.

The Hardware result shows that the Tracking maximum intensity tracking system for solar panel. With the live battery status as shown in Fig – 7.

Fig -7: Actual Hardware Model.

5. CONCLUSION

This Developed system can be implement in various solar plant stations to measure the exact power generated from those devices. Also this system can be implemented in the remote desert areas.

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