SMART SOLAR AUTOMATION MONITORED AND CONTROLLED USING IOT

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ABSTRACT

Data logger and monitoring systems are very crucial for the efficient, robust and smooth operation of PV solar energy system. Data logger and monitoring system enables the proper operation and contributes to identifying system malfunctioning before any major breakdown. In this thesis, a low-cost, user-friendly, reliable data logger and monitoring system has been developed mainly for a pico solar home system in a rural area of a developing country. This ESP 8266 microcontroller based data logger stores all monitoring parameter in a micro SD card and displays that on a Blynk App. Data can be downloaded directly from the webpage to analyze and verify the system operation. The developed data logger hardware prototype uses only four sensors for humidity, temperature, voltage, and current sensing. An already developed Android app is use for cell phone to display all parameters in real time basis for an efficient monitoring which can also able to give important information to maintenance personnel for any issues in battery charging. To accomplish the task, we have developed the hardware implementation of remote data acquisition architecture of photovoltaic systems based on the Internet of Things. The overall cost of this prototype is economical.

Keyword -
Solar PV, Internet of Things, Mobile Application, Online Monitoring , Motor, Arduino Nano and Esp 8266, etc…

1. INTRODUCTION

In this modern world, Electricity is also added to the most basic needs in everyone's life. The graph of energy consumption is getting increased day by day where as the energy resources are diminishing parallel. In order to balance the scarcity for electricity, various sources are used to generate electricity. For the generation of electricity, there are two ways: one is by conventional method and other one is nonconventional method. Some of the energy carriers like fossil fuels and nuclear fuels are also used, but they are not renewable resources (i.e., they are not 'refilled' by nature) and it is said to be non-conventional. In its broadest sense, sustainable power source can be achieved by using the solar power as source. The wide availability of solar energy has throughout the world. Even The sun has produced energy for billions of years. The sun's rays may cat as an important source for the generation of electricity by converting it into a electric power. Such application is called as solar thermal energy, which is conventional. Even though various sustainable sources are available such as wind, rain, tides and geothermal, natural based bio fuels and conventional biomass, solar power have huge benefits.

Nowadays in India, frequent power cut is very common. For that it is primary to use the renewable energy and monitoring it secondarily. The rapid growth in renewable energy applications have been empowered by a critical drop in cost over the earlier decades and specialized change in their productivity, unwavering quality and lifetime. And by means that of monitoring the energy prediction, households and communities, the productivity gets increased.

In case of India's development and economic growth, electricity plays a vital role. In energy consumption, India is the fourth biggest country after China, USA and Russia. The electrification rate in India is 64.5%, while 35.5% of

the population still lives without access to electricity. Internet of things means that merely the network of Physical objects. This provides the connection of each and every object in the world by means of wireless sensor network. Some devices, buildings, vehicles and other objects embedded with software, network connectivity and sensors can enables these objects to collect and exchange data.
This IoT (Internet of Things) is achieved by wireless sensor networks, sensor networks, 2G/3G/4G, GSM, GPRS, RFID, WI-FI, GPS, microcontroller, microprocessor, etc. Empowering advancements for the Internet of Things are considered and gathered into 3 classifications. They are,
• Advance that empower "things" to accept contextual information or Data.
• To process the relevant data, and
• Innovation to enhance security and protection.

1.1 Existing System

- It can only Monitoring Manually
- It is Bigger in size
- It does not give any intimation

1.2 Objective

An android based design of an electronic system for the measurement and control of the physical parameters like water temperature, solar collector's fluid temperature, solar radiation level, etc. to monitor and consequently optimize thermal-solar plant functioning is presented. The designed control unit can monitor and program the device functionality by means of a touch-screen graphical display that to check or correct operation and quickly reveal any fault, to manage and view locally the plant functioning by serial connection to PC with terminal role, and also remotely viewing and monitoring actions, by Android-based mobile devices, through RS485/Ethernet adapter and modem/router device connected to internet network.

1.3 Contribution

Accepting the information and processing the relevant data can provide an understanding which is needed to build the "intelligence" into "things". This is the highlighted feature that differentiates IoT from standard internet. The need for using IoT concept in this solar tracing system is to overcome the major disadvantages of electricity generation from the solar energy. The range of sun's radiation that reaches the ground surface is not in a fixed value. Because the range may varies according to location, time and climatic conditions. For that the solar panel can be completely exposed to the sun's radiation always. And hence the solar panel can be monitored by using Internet of Things. Among all techniques which have been studied for the solar panel tracking system by using IoT.

2. LITERATURE SURVEY

In this paper, monitoring and remote control of domestic equipment based on IoT from an Android application using esp 8266 card is possible. The main objective of this paper is to automate all the devices i.e. home appliances through internet using Raspberry Pi, as well as we can have the security for the system by using sensors like PIR, LPG, temperature sensors. Which is a credit sized single board computer operating on Linux operating system. The algorithm is developed in Python language, which is default programming language of Esp 8266. To minimize the amount of carbon emissions that we contribute towards the cumulative carbon emissions of this earth, Use of Renewable Energy Sources in Household application has always been the most effective method. By developing different codes the communication between the remote user, the web server, the Esp 8266 and the home components is possible. Using the Internet Of Things Technology for supervising solar photovoltaic power generation can greatly enhance the performance, monitoring and maintenance of the plant. With advancement of technologies the cost of renewable energy equipments is going down globally encouraging large scale solar photovoltaic installations. This massive scale of solar photovoltaic 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. The discussion in this paper is based on implementation of new cost effective methodology based on IoT to remotely monitor a solar photovoltaic plant for performance evaluation. This will facilitate preventive maintenance, fault detection, historical analysis of the plant in addition to real time monitoring. Data logger and monitoring systems are very crucial for the efficient,

robust and smooth operation of PV solar energy system. Data logger and monitoring system enables the proper operation and contributes to identifying system malfunctioning before any major breakdown. In this thesis, a low-cost, user-friendly, reliable data logger and monitoring system has been developed mainly for a pico solar home system in a rural area of a developing country. This ESP 8266 microcontroller based data logger stores all monitoring parameter in a micro SD card and displays that on a Blynk App. Data can be downloaded directly from the webpage to analyze and verify the system operation. The developed data logger hardware prototype uses only four sensors for humidity, temperature, voltage, and current sensing. An already developed Android app is use for cell phone to display all parameters in real time basis for an efficient monitoring which can also able to give important information to maintenance personnel for any issues in battery charging. To accomplish the task, we have developed the hardware implementation of remote data acquisition architecture of photovoltaic systems based on the Internet of Things. The overall cost of this prototype is economical. Renewable energy sources are proven to be reliable and accepted as the best alternative for fulfilling our increasing energy needs. Solar photovoltaic energy is the emerging and enticing clean technologies with zero carbon emission in today's world. To harness the solar power generation, it is indeed necessary to pay serious attention to its maintenance as well as application. 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 main advantage of the system is to determine optimal performance for better maintenance of solar PV (photovoltaic). The prime target of PV monitoring system is to offer a cost-effective solution, which incessantly displays remote energy yields and its performance either on the computer or through smart phones. The proposed system is tested with a solar module of 125-watts to monitor string voltage, string current, temperature, and irradiance. This PV monitoring system is developed by a smart Wi-Fi enabled CC3200 microcontroller with latest embedded ARM processor that communicates and uploads the data in cloud platform with the Blynk application. Also the Wireless monitoring system maximizes the operational reliability of a PV system with minimum system cost. Using the Internet of Things Technology for supervising solar power generation can greatly enhance the performance, monitoring and maintenance of the plant. With advancement of technologies the cost of renewable energy equipment is going down globally encouraging large scale solar plant installations. This massive scale of 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. The Project is based on implementation of new cost effective methodology based on IoT to remotely monitoring a solar plant for performance evaluation. This will facilitate preventive maintenance, fault detection of the plant in addition to real time monitoring.

3. PROPOSED SYSTEM

The work flow of the PV monitoring system is given in the form of step below:

Step 1: Arduino display the power usage using sensed values through current sensor and voltage divider.
Step 2: ESP 8266 fetch the arduino nano output data through serial port and display on Blynk App.
Step 3: ESP 8266 sends the monitoring data on to the cloud.
Step 4: Cloud display the data in the form of graph, which is visible to the entire user.

The solar energy stored in battery by solar panel is DC current. Arduino sense all the parameters like temperature, humidity, UV radiations, load current and voltage value through the senser connected to Analog pins. Output is send to the EPS 8266. EPS 8266 is considered as the server. The monitor displays the web page and cloud data.

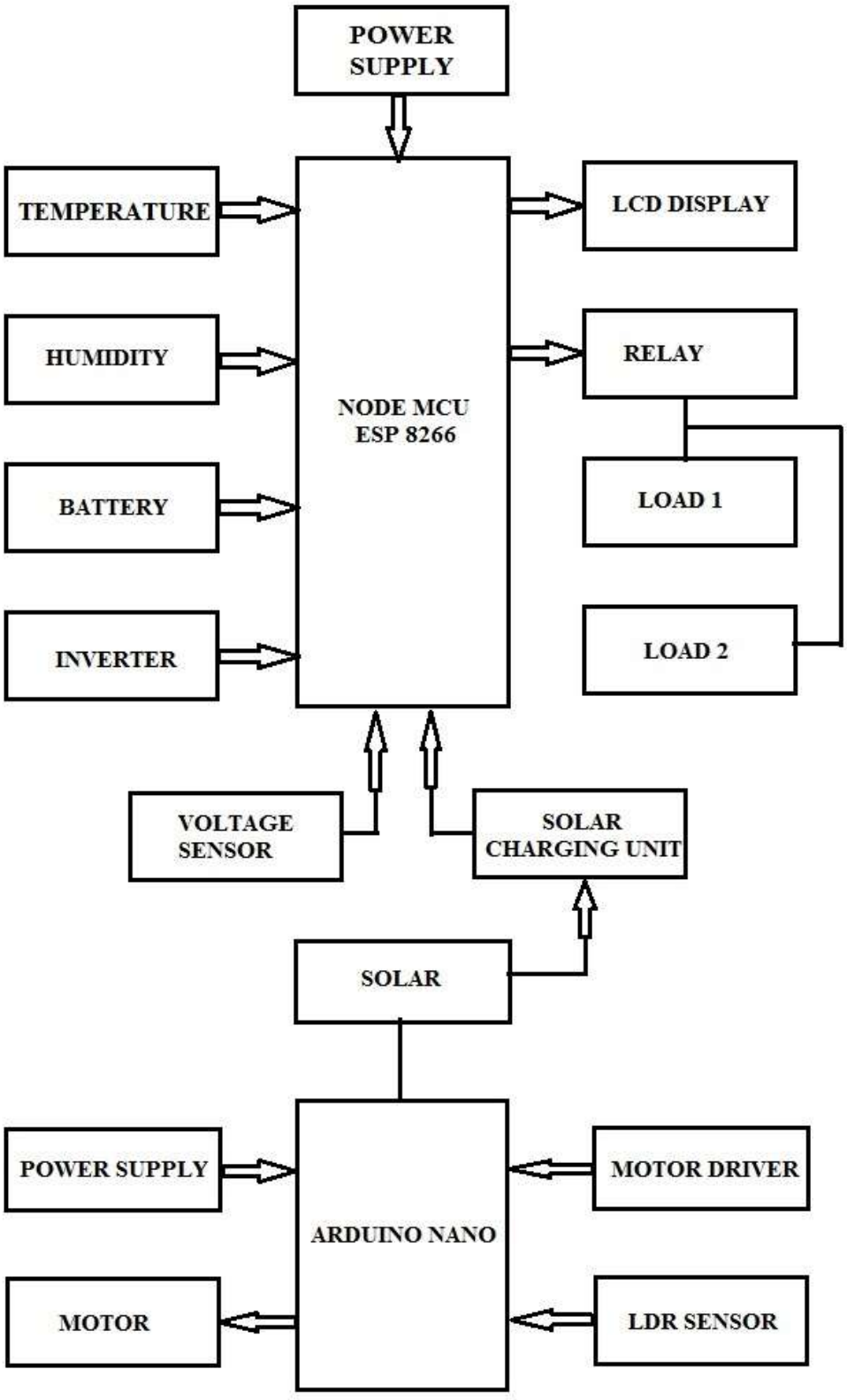

Fig.No. 1 Block Diagram For Proposed System

3.1 Advantages of Proposed System

- It is automatic Monitoring
- It sends the information to our mobile
- It is develop by Mini Inverter
- It is alert when the battery is low or any cut off

4. RESULT & DISCUSSION

Since the system requires external power supply of 5 volts and 3.3 volts for its operation which can be taken rid of by utilising 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.

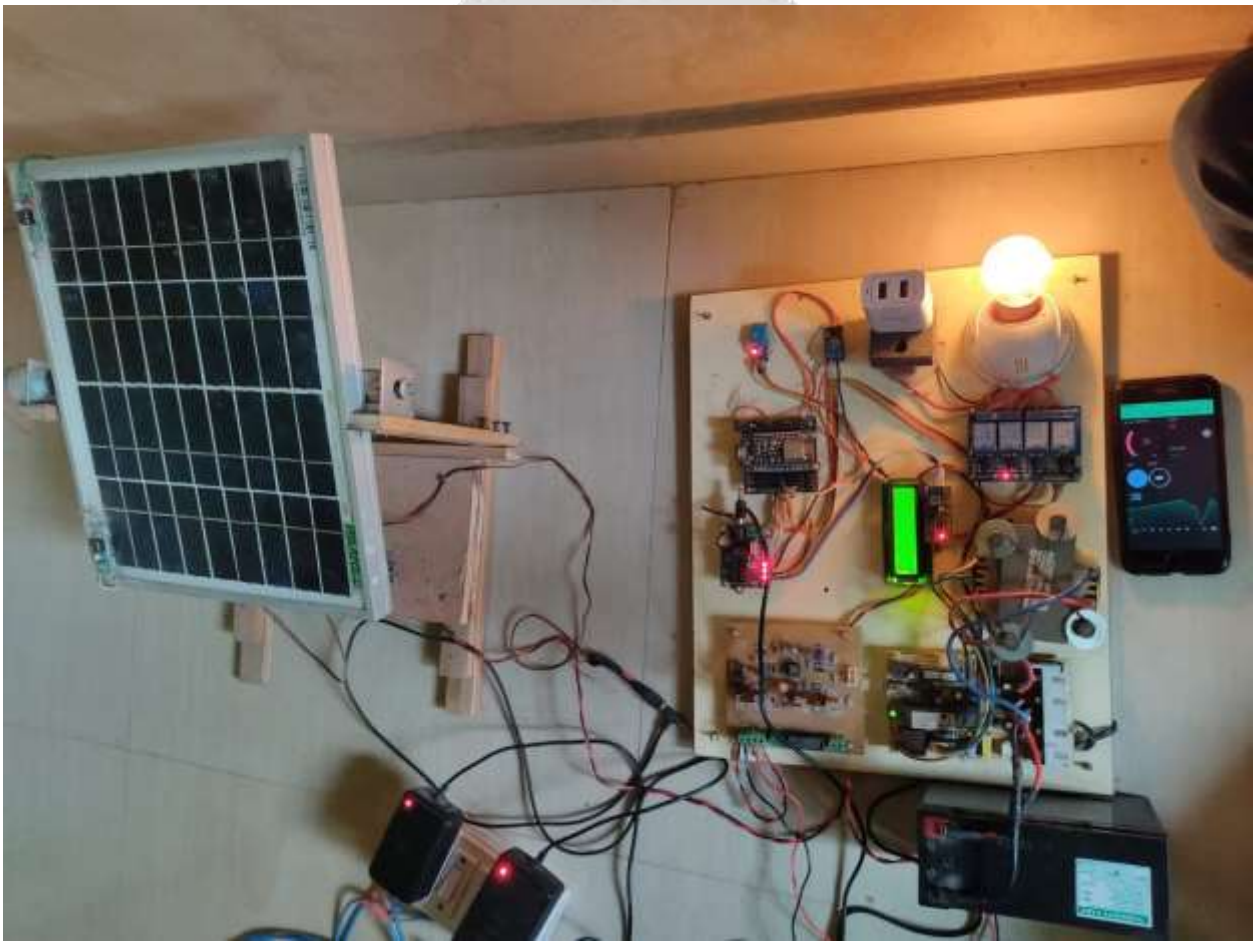

Fig.No. 2: Snapshot of Hardware Prototype

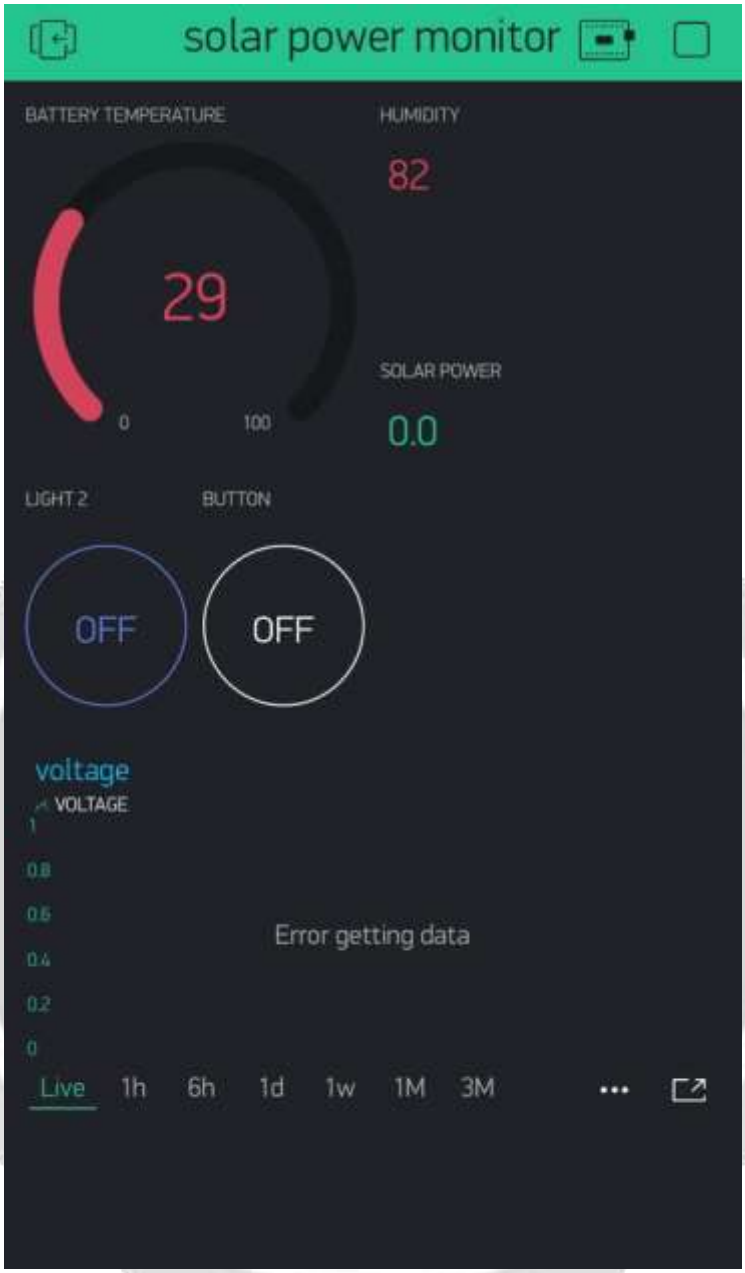

Fig.No. 3: Snapshot of Hardware Prototype

5. CONCLUSIONS

The integration of renewable energies into the electricity distribution network has become a necessity and consequently the search for new and effective solutions for remote monitoring and control is required. In this project, an IOT-based solar panel remote monitoring system has been proposed to collect data on important parameters of solar panels. The continuous record of performance data and failure data enables by IoT, so that it can be used for analytics for predicting and forecasting the future power generation possibilities, income production etc. The frequent maintenance of the photovoltaic systems also gets prevented by it. IoT will play a major role in accessing the control over the photovoltaic system installed at remote locations or far away from the control center. IOT-based monitoring will improve the energy efficiency of the system, reduce intervention and supervision time, and facilitate network management.

6. REFERENCES

[1] Hugo T.C. Pedro, Edwin Lim, Carlos F.M. Coimbra(2018), "A database infrastructure to implement real-time solar and wind power generation intra-hour forecasts", International Journal of Renewable energy Elsevier, Vol.123,pp.513-525.

[2] Amit Kumar Rohit, Amit Tomar, Anurag Kumar, Saroj Rangnekar(2017), "Virtual lab-based real-time data acquisition, measurement and monitoring platform for solar photovoltaic module", International Journal of Resource-Efficient Technologies,pp.1-6.

[3] N.A. Othman, N.S. Damanhuri, I.R. Ibrahim, R. Radzali, M.N. Mohd (2010), "Automated Monitoring System for Small Scale Dual-Tariff Solar PV plant in UiTM Pulau Pinang", Proceedings of the World Congress on Engineering(WCE) U.K, Vol.2, pp.1-3.

[4] Kangkana Hazarikaa, Pradyumna Kumar Choudhurya(2017), "Automatic monitoring of solar photovoltaic (SPV) module", Science direct proceedings Vol. 4,pp.12606–12609.

[5] Soham Adhya, Dipak Saha, Abhijit Das, Joydip Jana, Hiranmay Saha (2016), "An IoT Based Smart Solar Photovoltaic Remote Monitoring and Control unit", IEEE International Conference on Control, Instrumentation, Energy & Communication (CIEC), pp.432-436.

[6] Renata I. S. Pereira, Ivonne M. Dupont, Paulo C. M. Carvalho, Sandro C. S. Juca (2017), " IoT Embedded Linux System based on Raspberry Pi applied to Real-Time Cloud Monitoring of a decentralized Photovoltaic plant", International Journal of measurement Elsevier,Vol.2,pp.1-18.

[7] Aissa Chouder, Santiago Silvestre, Bilal Taghezouit, Engin Karatepe(2013), "Monitoring, modeling and simulation of PV systems using LabVIEW", International Journal of Solar energy Elsevier, Vol.1,pp.337-349.

[8] Bipin Krishna, Kaustav Sinha (2013), "Tracking of Sun for Solar Panels and Real-Time Monitoring Using LabVIEW", Journal of Automation and Control Engineering Vol. 1, pp.1-4.