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IoT Based Solar Power Monitoring and Control Unit

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ABSTRACT

The Internet of Things has a vision in which the internet extends into the real world which is accepting everyday objects. The IoT gives permission to the objects to be sensed and/or handled distantly over existing network infrastructure, generating chances for pure combination of the physical world into computer-based systems, and resulting in enhanced efficiency, accuracy and monetary advantage in addition to reduced human interference. 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 more rapid rate than any other time in history during this period. The anticipated system refers to the online display of the power usage of solar energy as a renewable energy. This examination is done through Raspberry pi using flask structure. Smart Monitoring displays daily usage of renewable energy. This helps the user to investigation of energy usage. Investigation impacts on the renewable energy usage and electricity issues.

INDEX TERMS: IoT, internet of things, solar, tracker, energy, renewable energy, flask, cloud.

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I. INTRODUCTION

The Internet of Things (IoT) is a system of associated computing devices, mechanical and digital machines, objects, people or animals that are provided with sole identifiers and also likely to transmit data over a network without requiring person-to-person or person-to-PC interaction. Smart devices, Smart-phones, Smart cars, Smart homes, Smart cities. A smart world. In the IoT visualization, "Smart" stuffs play a vital role in the IoT , since embedded communication and information technology would have the ability to transform. With the growing presence of Wi-Fi and 4G-LTE wireless Internet access, the progress toward universal information and communication networks is already evident. According to the International Energy Agency (IEA), Renewable will be the fastest-growing source of electricity, in which wind and solar PV are technically mature and inexpensive. But still there is raise in world's demand for energy. Accepting Renewable Energy technologies is one advance way of reducing the environmental impact. Solar energy is extensively available all through the world and can have contribution to minimize the reliance on energy imports.

II. INTERNET OF THINGS: SOLAR ARRAY TRACKER

Due to economies of extent and improvement in silicon technologies, influential computing platforms are escorting a new era in computing and connectivity. These platforms are occasionally categorized under the umbrella of Internet of Things (IoT). One such platform is used to propose and assemble an Internet of Things solar tracker. The solar tracker forecasts the sun position for utmost power output, controls servos that move the cell, monitors the output of the solar cell, collects and processes raw data to infer information that can be transferred futher to a remote station for further analysis. Similar solar trackers can be mounted at solar farms to facilitate in power harvesting and management over a large geographical area. Solar trackers drive the processed information to a central location where supplementary study provides energy utility companies with fine-grained power yielding and management capabilities; thus improving overall efficiency of power production and utilization. The Internet of Things (IoT) is occasionally portrayed as the union of several technologies like embedded systems, the Internet, web technologies, sensor technologies, and actuation devices. Although there are

many meanings for the concept of IoT, there is a consent that this new example excel the above-mentioned technologies and that it even assists other technologies and regulates to achieve bigger importance like Big Data and cyber security. We influences some of the technologies to propose and assemble an IoT solar tracker. It is anticipated that IoT will play a vital role in the development of green energy monitoring, yielding, and supply. IoT systems are described as systems that have calculating, sensing, activating, and Internet connectivity abilities [1].

III. LITERATURE SURVEY:

Kyle Williams et al., [1] has proposed an IoT centric solar tracker system was developed, modeled and tested. The IoT solar tracker is capable of tracking the sun for maximum power production; it is also capable of processing the raw data of current and voltage output to calculate power, record time of day, and other statistics. It processes the raw data to infer information and then pass on that information to a distant central location for further processing and management. Future work to develop the tracker is to apply Maximum Power Point Tracking (MPPT). Using the solar cell characterization data it is probable to evaluate with the output of the solar cell in order to positon the solar cell appropriately. Sensors could be added for evaluating temperature and cloud cover to help understand the solar cell's output. Several solar trackers can be distributed across a large geographical area where they are all linked to a central node that gathers the information for managing and producing the solar power.

Suprita Patil et al., [2] has presented that implementing Renewable Energy technologies is one suggested way of reducing the environmental impact. Because of recurring power cut it is significant to use renewable energy and monitoring it. Monitoring guides the user in investigation of renewable energy usage. This system is cost efficient. The system efficiency is about 95%.This permits the efficient use of renewable energy. Thus it is reducing the electricity concern. This project can be further improved, by using the results of this current project, i.e. the monitoring values obtained are helpful in forecasting the future values of the factors considered. The information stored in cloud can also be examined using the MatLab. The CSV file from the cloud is taken for examination in R. The web application can be developed for communication with the end user; the user can also forecast values of the future events. In the same manner we can go for android application also. During the forecast two or more models can be used for identical dataset, to find the accuracy of each model.

Andreas S. Spanias et al., [3] with the work has described herein, that this paper is allied with the important converse of the author at the IISA 2017 which disputes that communication feature of an array of solar panels can be viewed in the context of Internet of Things. We portrayed several new technologies, electronics, and algorithms for solar array monitoring and control. The electronics and algorithms developed by mutual activities concerning industry, university and government organizations exhibit that an Internet-of-Things framework can be definitely used for utility-scale solar farms. We have discussed numerous approaches involving statistical signal processing, machine learning and computer vision that can be used in combination with this IoT solar energy framework to promote efficiencies.

Hashem Bukhamsin et al., [4] has presented an ultimate design which was developed by an NAU Mechanical and Electrical Engineering group based on performance and cost. By using a low power micro controller and a low power low torque actuator, the system meets the most wanted capabilities of generating as much output power as possible while still being cost efficient to consumers. This system is compliant to meet the requirements of small scale power generation as well as the desires of a large scale solar farm.

IV. METHODOLOGY:-

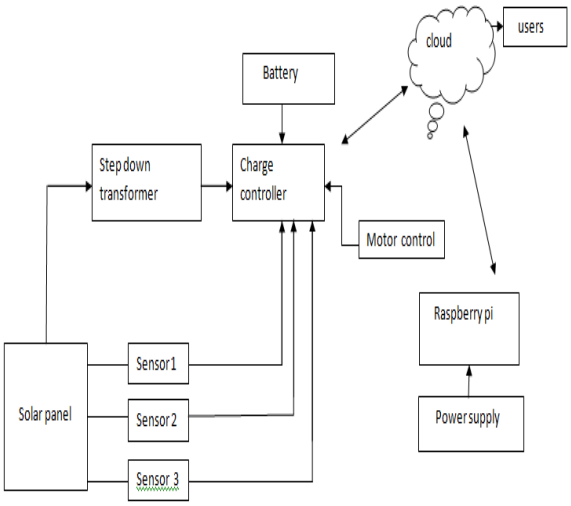

Fig.1.Block Diagram of the Proposed System

The figure shows the block diagram of the proposed system IoT Based Solar Power Monitoring And Control Unit. The main objective of this proposed work is to monitoring the power of the system using the current and voltage value is sensed by the Arduino. The screen of the solar energy system shows the power and energy usage. This method helps to execute in smart network for efficient usage. In the system solar panel is used to store the energy. Step down transformer is used to step down the voltage level of solar panel. And this low voltage will be further transferred to the charge controller. ATmega328 is a low-power CMOS 8-bit microcontroller based on the AVR enhanced RISC architecture. Raspberry Pi (RPi) is working as a server. The data from the controller is displayed on the web page through Raspberry Pi. The monitored data will be uploaded to the cloud through Raspberry Pi.

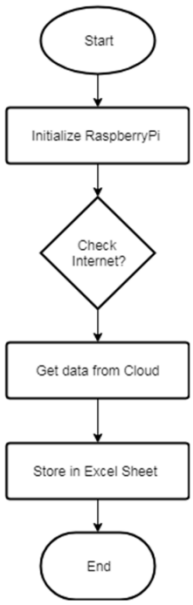

Fig.2.Flow Chart of the Proposed System

Work Flow

Fig 2 represents the process of proposed system. The work flow of the monitoring system is presented in the form of step below:

Figure 4: Work flow of the system

Step 1: Initialize the Raspberry Pi
Step 2: Check the internet connection.
Step 3: Get the data from the cloud.
Step 4: Store the data in excel sheet fetched from the cloud.

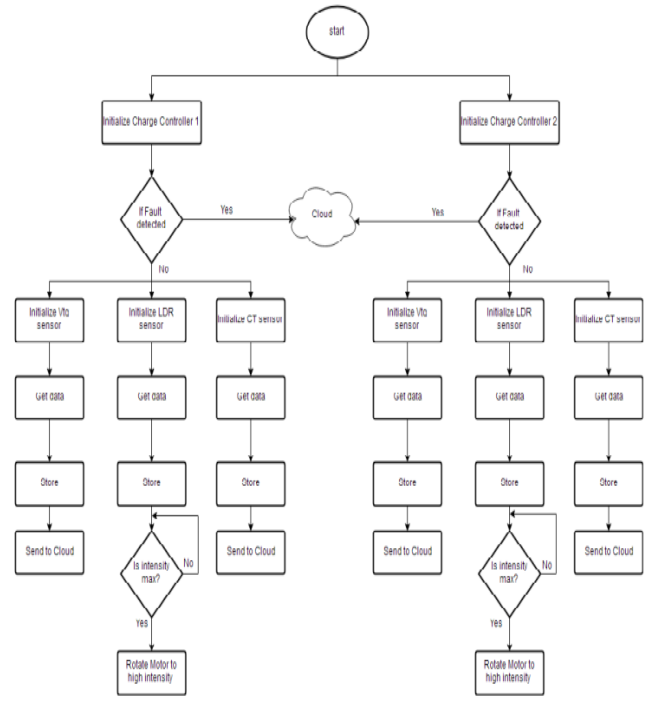

Fig.3Flow Chart of the Proposed System

Above shows the flow chart of the system. The initialization of Charge Controllers and monitoring the power of the system using the current and voltage value sensed by the Arduino. The monitored data will be uploaded to the cloud through Raspberry Pi.

CHARGE CONTROLLER 1 INITIALIZATION:

After initialization of the charge controller 1, it checks either the fault is detected in the system or not. If the fault is detected in the system then it will send data to cloud with the help of microcontroller. ATmega328 is a microcontroller which is used to read the sensor values and control the system. Raspberry Pi (RPi) is working as a server. The data from the controller is displayed on the web page through Raspberry Pi. The monitored data will be uploaded to the cloud through Raspberry Pi.

If no fault is detected then voltage sensor, LDR sensor and CT sensor will be initialized. These sensors will sense the data such as current, voltage,intensity. This data will be stored and send to the cloud and will be displayed on the web page through Raspberry Pi which is working as a server. In case of LDR sensor, the data will be sensed by the sensor and will be stored and the intensity of the data will be checked either it is maximum or not. If the intensity of the stored data is maximum then the motor will be rotated at the high intensity and again it will go back to check the intensity either it is maximum or not and if the intensity of the stored data is maximum then again the motor will be rotated at the high intensity. This process will take place number of times to check the intensity of the stored data. The main objective behind this is to monitor the power of the system using the current and voltage value is sensed by the Arduino. The screen of the solar energy system shows the power and energy usage. This method helps to execute in smart network for efficient usage.

CHARGE CONTROLLER 2 INITIALIZATION:

After initialization of the charge controller 2, it checks either the fault is detected in the system or not. If the fault is detected in the system then it will send data to cloud with the help of microcontroller. ATmega328 is a microcontroller which is used to read the sensor values and control the system. Raspberry Pi (RPi) is working as a server. The data from the controller is displayed on the web page through Raspberry Pi. The monitored data will be uploaded to the cloud through Raspberry Pi.

If no fault is detected then voltage sensor, LDR sensor and CT sensor will be initialized. These sensors will sense the data such as voltage,current,intensity,temperature. This data will be stored and send to the cloud and will be displayed on the web page through Raspberry Pi which is working as a server. In case of LDR sensor, the data will be sensed by the sensor and will be stored and the intensity of the data will be checked either it is maximum or not. If the intensity of the stored data is maximum then the motor will be rotated at the high intensity and again it will go back to check the intensity either it is maximum or not and if the intensity of the stored data is maximum then again the motor will be rotated at the high intensity. This process will

take place number of times to check the intensity of the stored data. The main objective behind this is to monitor the power of the system using the current and voltage value is sensed by the Arduino. The screen of the solar energy system shows the power and energy usage. This method helps to execute in smart network for efficient usage.

V. PROPOSED SYSTEM:

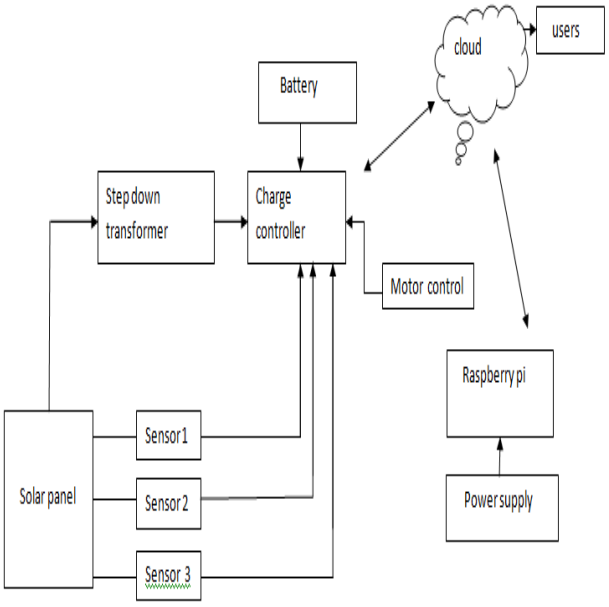

Fig.4.Block Diagram Proposed System

The figure shows the block diagram of the proposed system IoT Based Solar Power Monitoring and Control Unit. The major aim of this proposed work is to monitoring the power of the system using the current and voltage value sensed by the Arduino. The screen of the solar energy system shows the power and energy usage. This method helps to execute in smart network for efficient usage. In the system solar panel is used to store the energy. Step down transformer is used to step down the voltage level of solar panel. And this low voltage will be further transferred to the charge controller. ATmega328 is a microcontroller which is used to read the sensor values and control the system. Raspberry Pi (RPi) is working as a server. The data from the controller is displayed on the web page through Raspberry Pi. The monitored data will be uploaded to the cloud through Raspberry Pi.

VI. CONCLUSION

Implementing Renewable Energy technologies is one suggested way of reducing the environmental impact. Because of recurring power cut it is important to use renewable energy and monitoring it. Monitoring guides the user in investigation of renewable energy usage. This proposed system is cost effective. The system effectiveness is about 95%.This enables the well-organized use of renewable energy. Thus it is reducing the electricity issues. This project can be further improved; by monitoring the values obtained which are helpful in predicting the future values of the parameters considered. The data stored in cloud can also be analyzed using the MatLab. The network application can be developed to interface with the end user; the user can also forecast values of the future events. In the same way we can go for android application also. During the calculation two or more models can be used for same dataset, to find the accuracy of each model.

VII. ACKNOWLEDGMENTS

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