

A Review on Solar Energy Monitoring System using IoT

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Abstract— The Internet of thing now a day has extends to different vision of the internet to the real world embracing everyday objects. The IoT has made the objects to be sensed or controlled the network infrastructure remotely over the network, it has the opportunities of integration and creating the physical world into computer based systems, and it results into improved efficiency, accuracy and economic benefits to reduce the human work. It is used in many areas such as solar cities, micro grids, smart villages and solar street light and many more. The renewable energy is growing in such a faster rate over the period of time. The solar energy monitoring is used to monitor the system and display the power usage of the solar energy as renewable energy based on the daily usage of the energy. The monitoring is done with help of raspberry pi using flask framework. This help to analysis the impact on the renewable energy usage and electricity issue.

Key words: IoT, Solar Energy, Raspberry Pi, Renewable Energy

I. INTRODUCTION

The Internet of Thing is a system that have been widely used in computing devices, digital machines, mechanical machines, objects, people or animals which has the unique identifiers and it is relate to data transfer over the network where it does not required human to human to human or human to machine or machine to machine interaction. There are widely connection to physical items from virtual world though remotely connection over the internet services. There are various facts depending on which the increasing of IoT is widely been used such as small size, reduces of prices and declining of consumption of energy. The processors, communication modules and other electronic components has been integrated and increased in everyday of object life. As the solar energy is been widely used and also it help in minimizing the energy imports throughout the world. Sunlight strikes the earth is enough for 90 minutes that can be used for over one year. The emission of the gas such as greenhouse gas (GHC) emitted during operation are less pollutants. The solar energy has wide advantages such as system- friendly deployment, improved operating strategies, such as advanced renewable energy forecasting and increased scheduling of power plants and also in addition flexible resources, comprising demand side resources, electricity storage, grid infrastructure and flexible generation. The monitoring system are used widely in application such as rooftop solar, Ground mounted solar, solar cities, smart villages, micro grids and solar street lights. The applications are used in solar water heating systems, solar home lighting systems, solar lanterns, solar pumps, solar mobile chargers, solar cookers, LED solar torch, solar RO plant, solar fan, solar Inverters etc.

II. LITERATURE SURVEY

To study and analyze more about ATM system using fingerprint, the following literature survey has be done.

In [1] the authors present various challenges that are faced in the fingerprint ATM systems that included misaligned and distorted of fingerprints due to environmental form such as oil, wrinkles, dry skin, dirt and displacement of the fingerprint template from the database during matching. To provide more security and protection the biometrics of fingerprint is used with facial biometrics to increase the performance of the financial infrastructure. As the fingerprint are in 2-D form of x-y image, to enhance and optimize the technique called Modified Gabor Filter-Hierarchal Structure Check (MGF-HSC) system is used. The benchmarked result of the MGF-HSC approach with the Gabor method is shown in Figure1. To remove completely the light noisy image of a fingerprint from 1%-60% the MGF-HSC method can used but limited to heavy noisy image. This method provides authentication performance with bank application. The advantages of using combination of face and fingerprint system are non-intrusive, robustness, acceptability, low cost and accuracy.

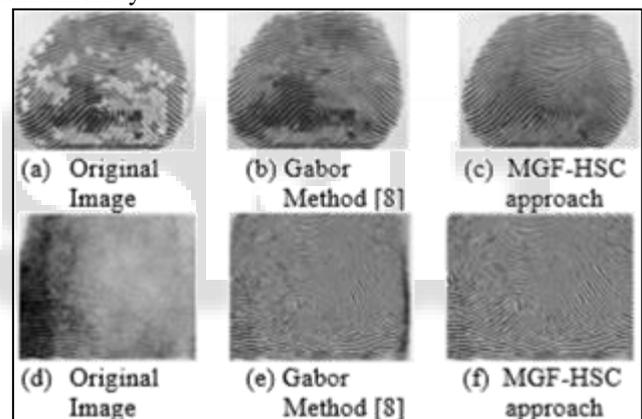


Fig. 1: Result of the MGF-HSC Approach with the Gabor Method.

In [2] the authors present the fingerprint recognition algorithm which cans increases the speed of verifying the fingerprint stored in the database. This uses the algorithm called Speeded-Up Robust Feature (SURF) algorithm which is used for detect the local feature point and extracts the robust features. SURF extracts the local robust features using a Hessian matrix-based measure for the detector, and a distribution-based descriptor. SURF approximates Laplacian of Gaussian (LoG) with Box Filter. SURF is a scale and rotation invariant algorithm, which shows better recognition of the fingerprint even if it is rotated, scaled or partially distorted in fingerprint recognition system.

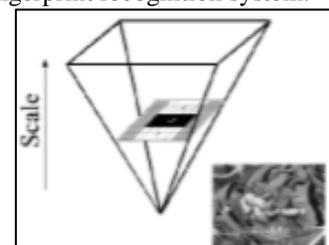


Fig. 2: SURF Uses Larger & Larger Filters

In [3] the authors present the encryption and decryption method. There are different types of fingerprint such as arch, tented arch, right loop, left loop, whorl, twin loop. The fingerprint image is identified using the specific core points called minutiae. The core points can be termination, bifurcation, lake, independent ridge, dot or island, spur, crossover. The encryption is carried out using the blowfish algorithm. There are two encryption techniques to get the minutiae extraction that are Binaized fingerprint images and gray scale fingerprint images. The encrypted image is transmitted to the server through secure network and at server the decryption is done.

In [4] the authors present a mechanism that combining the concepts of Cryptography and Steganography and the PIN and OTP are encrypted using AES 256. Here the encrypted fingerprint is called as the BASE image. There are 3 basic ridge patterns of fingerprint such as arch, loop and whorl pattern. The AES 256 encryption provides more security to the system.

In [5] the authors present the new approach for the ATM Banking System called IBIO (Iris recognition based BIOmetric verification). The approach uses two techniques called 2DGabor filter, hamming distance. The feature extraction of the Iris rectangular block is implemented using 2DGabor filter. To measure how many bits are same between two bit patterns it done by using hamming distance.

III. LITERATURE SURVEY

- 1) Mayamiko N., Zennaro M. and Bagula A., 2011. "SM 2: Solar monitoring system in Malawi." Kaleidoscope: The Fully Networked Human?-Innovations for Future Networks and Services (K-2011), Proceedings of ITU. IEEE, 2011.

This paper describes recent work on the development of a wireless based remote monitoring system for renewable energy plants in Malawi. The main goal was to develop a cost effective data acquisition system that continuously presents remote energy yields and performance measures. A test bed comprising of a solar photovoltaic (PV) power plant has been set up at Malawi Primary School and a central management system at Malawi Polytechnic. The project output gives direct access to generated electric power at the rural site through the use of wireless sensor boards and text message (SMS) transmission over cellular network. The proposed system could also be extended to allow a smooth switchover between electrical and solar power supply depending on time-of-the-day power needs.

- 2) Li W. and Liu K.-H., 2007. "Implementation of a web-based real-time monitoring and control system for a hybrid wind-PV-battery renewable energy system." Intelligent Systems Applications to Power Systems, ISAP 2007. International Conference on. IEEE, 2007.

The studied simulated wind-PV-battery system consists of two wind induction generators (IGs), an AC-to-DC converter, a DC-to-AC inverter, a PV module, and a battery unit. A novel fuzzy controller of the PLC is also designed to switch excitation capacitors of the IGs to control the performance of output voltage and power factor of the IGs. This paper has proposed and implemented a monitoring and control system through campus network of National Cheng Kung University

to integrate with an industrial PLC and digital power meters to form a supervisory control and data acquisition (SCADA) system for a hybrid wind-PV-battery renewable energy system.

- 3) Jiju K. et. al., 2014. "Development of Android based on-line monitoring and control system for Renewable Energy Sources." Computer, Communications, and Control Technology (I4CT), International Conference on. IEEE, 2014.

Renewable Energy Sources are becoming an entrusting factor and promising contributor in the electricity production. They are the major players in the electrification of rural areas which are still 'not wired' both electrically and geographically. The effective dissemination of such decentralized RES power plants can be accelerated by better monitoring and control. Grid integration of large RES power plants can be triggered by on-line monitoring & control of RES PCUs. More complex control methodologies can be developed for Grid integrated RES power plants instead complete shutdown of RES plants in case of grid failure as higher capacity RES plants are being installed.

IV. PROPOSED SYSTEM

The main objective of the system is to monitor the power using the current and voltage value sensed by the arduino. The system shows the monitoring of the system showing the power and energy performances and usage. It uses the smart grid for efficient usage of the system.

A. System Design

The proposed system of solar energy using IoT is for the monitoring. There are various devices that have been used in the system. First, is solar panel which helps in storing the energy in the battery. Next is, battery for the energy which is used for the electrical appliances. Arduino is used for battery connection. Sensor value is read by the Arduino, which is a micro controller. Current sensor and voltage divider are connecting to the Arduino.

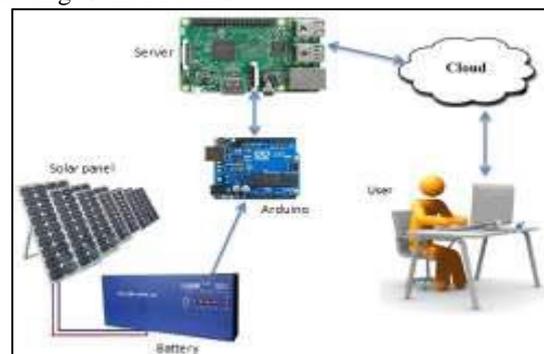


Fig. 1: System Design

Arduino is connected to server. The server is the Raspberry Pi (RPi) through the USB cable. With the help of the web page the data from arduino is displayed. And the data is stored in the data which has been monitored through RPI as shown in fig 1.

B. Arduino:

As the system should have economic constraints and should be simple, so arduino is used to reduce the programming complexity. Arduino uses the analog pins to note the current

and voltage value. Arduino programming calculates the power and energy with the help of values.

C. Raspberry Pi

The central monitoring system is the Raspberry Pi. Raspberry pi has advantages such as it is portable, have low cost and this make the system cost low. Raspberry pi uses python as the programming language because it is widely used high level, general purpose, interpreted, dynamic programming language. Python help in monitoring the data and upload it to the cloud. For the simple templates of the web development, flakes are used in the python programming language. RPI uses the wi-fi to store and display the data over the cloud and web page. The user can access the cloud for the knowing of the usage and availability of the battery as the cloud has the public access

D. Current & Voltage Acquisition Circuit

The arduino analog input is measured up to 5V. To protect the arduino from the short circuits or unexpected voltage surges it has to be connected to resistors

The circuit of voltage divider as shown in the fig 2.

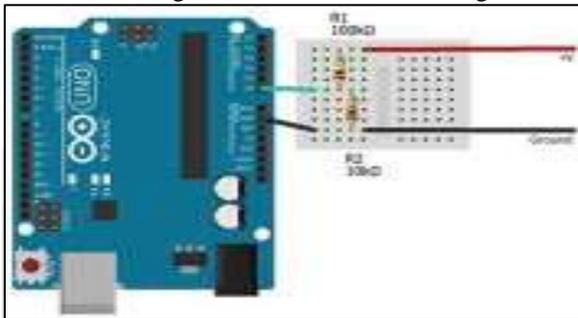


Fig 2: Voltage Divider

E. Cloud Setup

ThingSpeak is an open source IoT application and API to store and retrieve data from things using the HTTP protocol over the Internet or via a Local Area Network. ThingSpeak is used to create sensor logging applications, location tracking applications and social network of things with status updates

V. CONCLUSION

The renewable energy technology implementation is a way to reduce the environmental impact by implementation. Monitoring and analysing of renewable energy has been an important task as there is increase of the frequent power cut. It also helps to know the energy usage. The main advantage of the system is it is cost effective and analyse up to 95% of efficiency. It also enables in the efficient use of renewable energy and reduces the electric issues.

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