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Data Logging System for Solar Energy Analysis and Monitoring

Ashok Kumar[1], Junaid Khalid[1], Abdul Rafiah[1], Imran Ali[1]

[1]Department of Electronic Engineering,
Quaid-e-Awam University of Engineering, Science & Technology Nawabshah, Sindh, Pakistan

*Corresponding Author

Abstract: Data logging is widely used in renewable energy source RES applications in order to collect data regarding the installed system for collection purpose. In this project the development of Lab VIEW based system for renewable energy source systems collecting is described. The proposed system consists of Arduino for measuring voltage. The collected data are first conditioned using precision electronic circuits and then interfaced to a PC using Arduino. The Lab View program is used to further process, display and store the collected data in the PC disk. The proposed architecture permits the rapid system development and has the advantage of flexibility in the case of changes, while it can easily extended for controlling the RES system operation.

Keywords: Solar Panels, Microcontroller, Arduino, AC, DC, Data logging, voltages.

1. Introduction

Energy crisis is quite evident [1] now and it will haunt far more to each nation in coming future [2] if we don't adopt one or more renewable energy sources [3] and exploit them combined to get maximum output [4]. Solar energy is definitely one of the most reliable renewable energy sources [5], there are many benefits of solar energy such as non-polluting [6], low maintenance require etc [7-8].

Various types of solar energy panels are utilized to provide the electricity in households and various other places around the world [9-10]. Their reliable data is available for the various developing countries, but in Pakistan there is no reliable data is provided for the solar panel on the bases of various environmental changes [11-13]. For this purpose, we have developed a system to measure the record of energy of solar panels for various different situations. The system will be helpful in many aspects such as having the data collection from the solar energy at many different places for many different applications. The system is specially designed to collect the data and analyze for the proper utilization of energy from the solar.

*Corresponding author:

2. Methodology

The system is used to measure voltage through data logging with the help of Arduino and LabVIEW. Solar panel of 20 W generate open circuit voltage of 22.30V and maximum power voltage is 18.70V and maximum power current is 1.07A as shown in Fig. 1. The voltage divider rule is used between the Arduino and solar panel for providing desire voltage for Arduino, it is equivalent to 5V by using voltage divider rule. PC is interfaced using smart plug principle. LabVIEW software is used for interfacing the PC with Arduino for incoming data from solar panel.

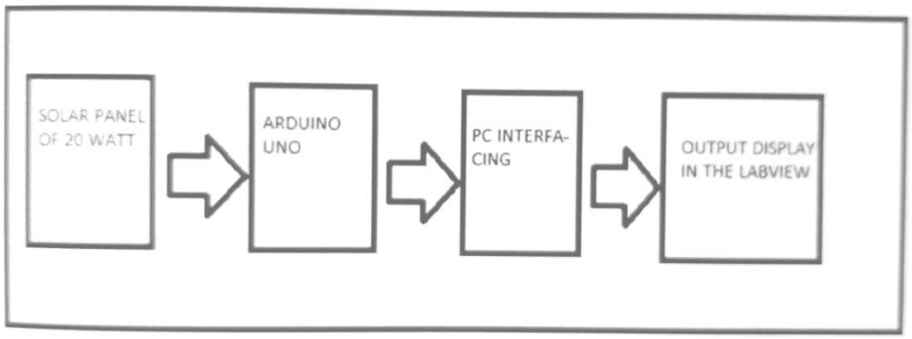

Fig.1- Block Diagram

The system is design and developed in the systematic way. From the Fig. 1, it can be seem that the in the beginning the solar panels are attached to the system after that they connected to central system such as Arduino and after that using the LAB view is utilized to observe the output for the designed system.

3. Hardware and Software Description

The hardware part consists of Arduino UNO, solar panel, PC and LabVIEW for display.

Arduino UNO: Arduino is open source computer hardware and Software Company, project and user community that designs and manufactures microcontroller based kits for building digital devices and interactive objects that can sense and control objects in the physical world. Arduino UNO has 6 analog pins, 14 digital IOs, USB port connector and power connector as shown in Fig. 2.

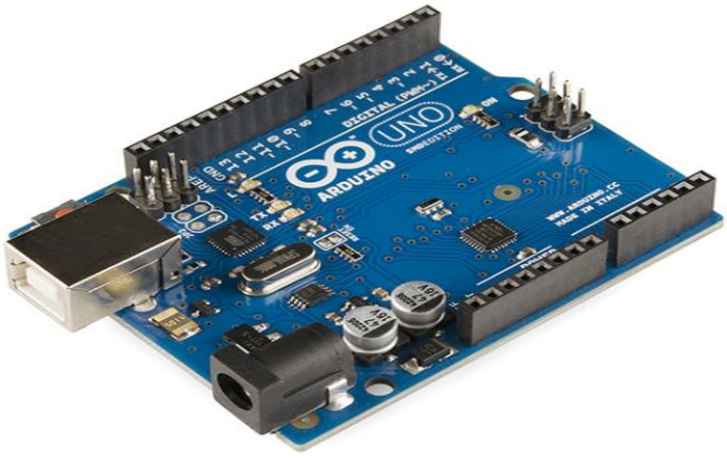

Fig. 2 – Arduino UNO Board

The reason for choosing the Arduino is that it is low cost board with multi-functional features of designing the electronic system for different application. The board need to be operate with supply, the analog and digital IO pins are already included. The Atmel microcontroller is already attached to it and for connecting with computer different connectors are there. Using the USB jack the programming can be transferred to the microcontroller. The software is easy to use and it very functional in many aspects.

Solar Panel: Solar plate is light sensitized steel backed polymer material used as an alternative to hazardous printing technique. It is a simple, safer and faster approach than traditional etching and relief printing. It is exposed to UV light (sun) to generate the DC voltages as shown in Fig. 3.

Fig. 3 – Solar Panel

LABVIEW: LabView is mostly used in the latest world. It is unique because it makes this wide variety of tools available in a single environment, ensuring that compatibility is as simple as drawing wires between functions. Labview itself a software development environment that contains numerous components, several of which are required for any type of test, measurement or control application.

4. Result And Discussions

Data logging is the measuring and recording of physical or electrical of over a period of time. Data loggers are used in a variety of applications. In this project want to measure voltage through LabVIEW. We use arduino COM3 for data input VISA serial configure port to set baud rate of 9600 and serial monitor. VISA serial puts the data in the form of bytes then data is sent to VISA read, it counts the number of bytes and VISA resource name where data is connected where it sends data in the string form towards splitting string.

Here two split strings are given, one has two inputs like string and character, character is used as & and strings are sent to split string which have character of *. After the split strings, all the strings are combined to gather to form concatenate string then all concatenate strings are converted into numbers in string-to-number function. After this whole data are sent to write to text file for storing and recoding as output in the MS Excel as well as it is shown by using Dial type meter and graph.

The system is specially design for data collection and measurement from the solar energy for various period of time and the measurements are performed using Labview. For the data processing the Aurdino is playing its important role and after collecting the data, the solar data is analyzed and based on different requirement that data will be analyzed.

It is important to note that this data will be very much helpful to get the insight form the solar data from the 24 hours a day. Also the measurement of having the maximum energy and minimum energy at different time instant of the day can be analyzed for different cities and locations, it is also important that the system can enlist strong energy consumption and utilization for the energy.

The GUI is developed and design in the Labview for Data logging and measuring and recording of solar data received from the designed system. Fig. 4 defines the beginning of the day when there is no Sun or early in the morning when the solar energy is too low.

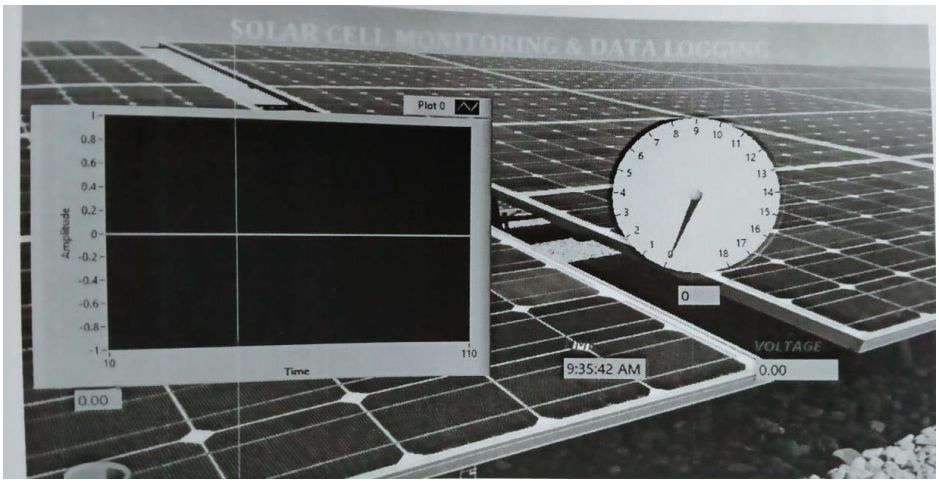

Fig. 4 – LABVIEW Display

It can be seen in Fig. 4 that there is no measurement of the energy is there and no measurement is recorded and it is important to note that time is 9.35 AM and no data is logged. As the time risen and energy is getting more and more the time will be changed in GUI and after that energy data recording will be managed. In Fig. 5 the GUI records the energy measurements.

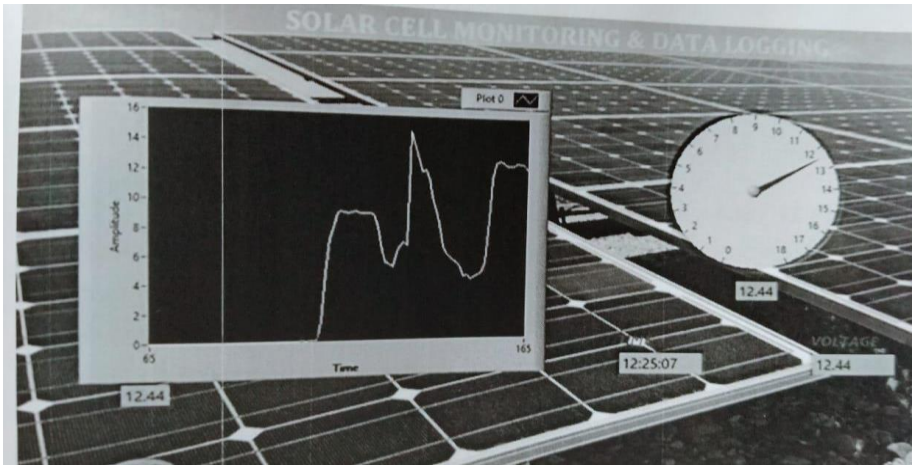

Fig. 5 – Display of data received from solar panel

Fig. 5 defines the GUI data based on the time of 12.25 PM and it and measurement of the energy is also recorded. The measurement is Physical or electrical of over a period of time. The data logged will be beneficial for various applications. The data collect form the sensors and given to microcontroller for the next processing and after that using the ports is given to other devices. VISA serial puts the data in the form of bytes then data is sent to VISA read, it counts the number of bytes and VISA resource name where data is connected where it sends data in the string form towards splitting string. The 2 split strings are arranged in such a manner that first one have to take the input an after as string and character, and after that these separated accordingly with character of *. All the information is collected and combined form the both of the strings and after that a function. After that text file is generated and managed in excel and from that GUI is implemented to forecast all the energy.

5. CONCLUSION

Pakistan has been facing electrical energy crisis and the electricity rate have a greatly and are expected to continue to climb in a speedy rate. Due to advantage of solar panel for the solar energy we measure voltage of solar panel in this way that we have designed arduino based data logging system through LabVIEW. For optimum solar energy utilization which we can be used in variety of places such as school, colleges, home, universities, offices and daily need base energy utilization.

6. Future Recommendation

To acquire the data from solar panels for locality then compare it with the data provided in data sheet for the different manufacturer. Add extra sensor such as temperature, luminosity to make the data analysis and comparison study more sense full. If tracking system is added in the solar panels it would increase the system efficiency.

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