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A Review on Photo Voltaic Monitoring and Data Logging System

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Abstract: Data logging are an important aspect in a modern day measurement and instrumentation system. Almost all the industrial process requires data logging. Nowadays, cheap and feasible solution of data logging in industrial and scientific process is a difficult task with proprietary data logger. Remote monitoring and recording of data is possible with this data logger. The importance of data logger is very wide in industrial and scientific work. It records the data of measurements over certain specified time. Data logger provides the monitoring and logging of data by using transducers, computer and sensors. The designed data logger records the value of real time, voltage, current, power and energy related to two PV solar panels simultaneously. USB based data loggers are reusable, compact and portable, and offer easy installation and low cost solution of data logging. Internal and external transducers can be used with USB data logger. Internal sensor model of USB data logger monitors the process near the data logger location while USB data loggers based on external sensors are used to monitor the process far distance from the data logger location. This paper gives various studies based for the solar monitoring and data logging system.

Keywords: Photo Voltaic, Solar, Monitoring, Data Logger

I. Literature Survey:

H.Bala Murugan (2013) et al. presented the future of energy in the world today is focusing more and more on alternative energy sources to remove the strain of fossil fuels which are becoming more and more costly.A naturally replenished energy known as renewable energy is promising to become the future energy source around the world. One of the most fascinating aspects of solar cells is their ability to convert the most abundant and free forms of energy into electricity without moving parts or components. Also, they do not produce any adverse forms of pollution that affect the ecosystem. An important part of the project is dedicated to current measurement and data acquisition systems dedicated for monitoring PV systems. Applied solutions and experimental results are discussed in terms of accuracy and optimization needs of the operation.

Meena Agrawal (2014) et al. proposed the concept of integration of distributed energy resources in configuration of microgrid is proving to be an excellent option contributing to the power grid evolution and for enabling a steady electricity service even to remote areas local loads with minimized pollution. In view of the fact that most renewable sources are intermittent in nature, their integration into the power grid infrastructure is a challenging task. Data Acquisition from renewable energy generators and their continuous monitoring play an extremely important role in overall supervision and the desired coordinated operation control of such diverse energy resources. This paper is a part publication from the Technical Project Report regarding the Research & Development project "Design & Development of Smart Micro- Grid" conceded in Energy Centre, MA National Institute of Technology, Bhopal. The main purpose of this paper is to present a computer based remote monitoring system for renewable energy system which is one amongst the primary footsteps taken for accomplishment of the microgrid Research & Development project.

N. N. Mahzan (2016) et al. proposed the design of a general data logger for Photovoltaic (PV) monitoring system that can store bulk data from input channels in large memory storage. It utilizes Arduino Mega 2560 board in conjunction with ATmega2560 chip. For monitoring the related parameters, a 240-W PV system is used where electrical parameters are tapped into the input channels of the data logger. The system will convert the acquired raw data to digital input for data acquisition and will store the data onto SD card. The data logger is also equipped with DS1307 Real Time Clock (RTC) chip for data stamping in the SD card every at the occurrence of the logging process. Results and findings are recorded and compared with the data that was taken by one commercial data logger DataTaker DT80 during the testing stage. This is to test the data reliability as well as to examine the performance of the proposed data logger throughout the testing process.

Chokri Belhadj Ahmed (2017) et al. proposed the performance evaluation, monitoring and analysis of a stand-alone Photovoltaic (PV) system. This experimental investigation achieves its objectives using Laboratory Virtual Instrument Engineering Workbench (LabVIEW) interface capabilities. The installed PV generator system operates in extreme and severe weather conditions. The local area is characterized by a high level of irradiation, high humidity variations, very high ambient temperature and frequent dust storms. Two PV panels of 150 W rating each are used. Each panel feeds a variable resistive load separately and simultaneously. The constructed LabVIEW engine displays environmental parameters and the associated electrical variables (voltage, current and power) on dedicated graph windows continuously in a real time manner. The current versus voltage (I-V) and power versus voltage (P-V) characteristics are taken for any chosen

panel, displayed and stored accurately. LabVIEW allows appending any characteristics for the sake of comparison, investigation and research purposes. LabVIEW has shown high performance in communicating with several devices simultaneously and high capability of displaying several variables behavior at a time. The designed virtual instrument (VI) filters are programmed to execute different tasks on a priority basis. The developed system reveals and stores the pronounced impact of dust, the variation of temperature and the irradiation changes on the PV panel power output behavior. The monitoring results are very satisfactory. The online data display in multi-scale window frame is very informative. The online efficiency evaluation is very useful for system operation and analysis. The developed system was found to be very supportive for research and educational purposes.

Shubhankar Mandal (2017) et al. presented the simulation of real time data acquisition of a solar panelin LabVIEW. A prototype model has been made where two Arduino were used. One is used for interfacing the solar panel with the PC for acquisition of data and the other one isused with the servomotor. The servomotor is linked with the solar panel with the help of a shaft and is rotated according to the LDR output. Two LDR is fixed on both the sides of the solar panel for tracing the sunlight. The whole simulation is performed with the help of LINX firmware wizard, which is available in LabVIEW Maker's Hub. Data were collected of different days in different duration of time. According to the collected data, behaviour and the voltage of the solar module was analysed. This paper describes the design of a low cost, solar tracking and real time data acquisition system.

Sofia Fanourakis (2017) et al. proposed the design of a low-cost DAS (data acquisition system) for monitoring a PV (photovoltaic) system's electrical quantities, battery temperatures, and state of charge of the battery. The electrical quantities are the voltages and currents of the solar panels, the battery, and the system loads. The system uses an Atmega328p microcontroller to acquire data from the PV system's charge controller. It also records individual load information using current sensing resistors along with a voltage amplification circuit and an analog to digital converter. The system is used in conjunction with a wall power DAS for the recording of regional power outages. Both DASs record data in microSD cards. The data have been successfully acquired from both systems and have been used to monitor the status of the PV system and the local power grid. As more data are gathered, it can be used for the maintenance and improvement of the PV system through analysis of the PV system's parameters and usage statistics.

Sourav Majumder (2017) et al. presented Solar Photovoltaic Plants, the traditional method of managing plenty of solar panels is very challenging and inefficient. Since each panel set needs a digital power meter, which is very expensive to use for collecting the data from the panel. To cope with this problem, a standalone monitoring system of solar panels had been proposed, which consists of DC Power Monitoring Node (DPMN), Panel Parameter Monitoring Nodes (PPMN) and an embedded web server. Instead of monitoring PV plants from the installed place which is very complex and time consuming in nature, this proposed system will help users to remotely monitor and access the real-time data via internet. All the parameters from each panel will be sent to the smart analysis database system which was developed and embedded into the web server. Clients can access this webserver for analyzing the performance of the solar plant by using any web browser with specified IP address from anywhere in the world. If the status of the solar panel becomes abnormal, the administrator will receive a message immediately, and necessary steps can be taken. Hence, this system will help the industry in a productive manner.

Amit Mazumder Shuvo (2019) et al presented the demand of electric power is increasing gradually with the advancement of modern technology & engineering. Because the demand of electricity in urban areas or in industrial zones is large in amount & also more important than the rural areas, there exists a shortage of electric power supply facilities for rural households or remote location from the cities. In this case, Solar Energy is a promising solution to meet the demand for electricity services of rural areas in developing countries like Bangladesh. The effectiveness & stability of small PV systems for rural development is needed to be monitored for successful installment of Solar Panel. In order to analyze the system & modify it for cost reduction a data capturing unit should be constructed that can store the voltages & currents at three different terminals. A microcontroller operated Smart Data Logger can perform this work with high accuracy & precision maintaining the system cost much less than the conventional system. This paper deals with the design and implementation of a low cost data logger for solar home system. An experimental set up is designed and implemented and the paper illustrates the working principle, data observation and analysis, limitations, and future aspects of a low cost data logger for solar home system.

Bojian Jiang (2019) et al. proposed monitoring the operation of an isolated photovoltaic (PV) system needs both data loggers and web transfer to collect the sensor data. The data includes the measurement of the voltage and current of the PV system and for local weather. The PV system in Memorial University of Newfoundland (MUN) is 5 m away from the window, where the weather data is collected. In reality, PV systems are approximately 25–50 m away from the weather sensors. It is, therefore, more meaningful to realize the sensor communications by wireless transfer than long cables, which can significantly reduce the cables of a large PV system with long distances among sensors. The PC receives all the sensor data and transfers hem to a web server (Thingspeak). A web server is applied to monitor the operation of the system instead of

a local server when its users are far away from the location, even though the local server allows more frequent data logging (once per second). The data transformation between the PC and the web server must guarantee the stability and robustness of the program. The system alarm that reports the disconnection failure is also necessary to notify the users. This paper first introduces the general system set up, then present each part of the system in detail, and finally, analyze the collected data.

Tarun Singh (2019) et al. presented the design and development of two channel data logger which provide the cheap and feasible solution for monitoring and recording the voltage, current, power and energy of two PV solar panels. The designed prototype data logger is based on Arduino UNO and facilitated the data logging on SD card or on the memory of Bluetooth enabled android mobile phone. Remote monitoring and recording of data is possible with this data logger. The design of this data logger is completely based on the open source software and hardware devices instead of proprietary hardware devices and commercial software. Measurement and monitoring of voltage, current, power and energy of two PV solar panels and its logging on suitable electronic medium are smart features of this data logger.

II. Conclusion:

This suggested work holds many future possibilities regarding the cheap data logging and monitoring of electrical and physical parameters. In future, we expect to provide an interfacing of internet of things, wireless sensors and wireless relays in the designed data logger which can perform the remote functions of monitoring, data logging and measurement of electrical and physical parameters of PV solar panel. Protection circuit operations with wireless relays could be examined in future work and different physical parameters like temperature; wind speed etc. could be analyzed in further research work. Automatic process control through wireless control could be examined in future research work. The effect of weather conditions was not considered in the design and development of data logger and its working in different weather condition could be examined. The programming of designed data logger is related to data logging of direct current quantity of PV solar panel only and in future, it could be easily modifying to measure the other physical quantity.

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