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Development of an integrated data-acquisition system for Photovoltaic blocks mutualization monitoring using lab view

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Abstract *- The photovoltaic systems are often employed into micro-grids; Micro-grids are small power grids designed to provide a reliable and better power supply to a small number of consumers using renewable energy sources. These papers deals with DC micro-grids and present a new system of monitoring and sharing electricity between homes equipped with photovoltaic panels (PV) in the goal to reduce the electrical energy waste. The system is based on dynamic sharing of photovoltaic blocks through homes in stand-alone areas, using an Arduino board for controlling the switching matrix. The LABVIEW program is used to further process and display collected data from the system in the PC screen. A small-scale prototype has been developed in a laboratory to proof the concept. This prototype demonstrates the feasibility and functionality of the system.*

Key Words: LabVIEW Monitoring Photovoltaic systems, Renewable energy sources Switching Matrix

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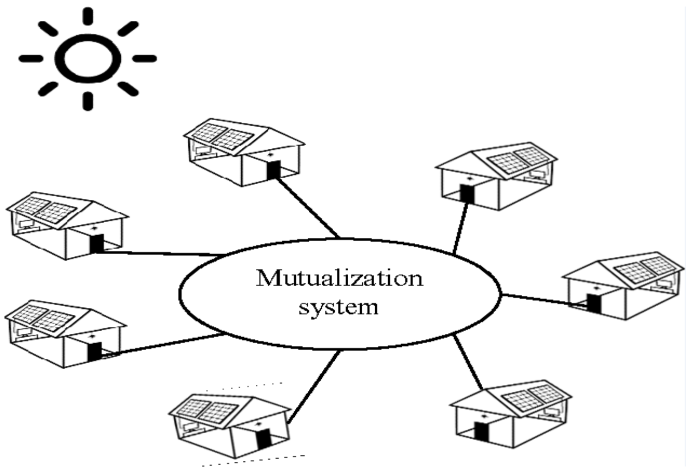
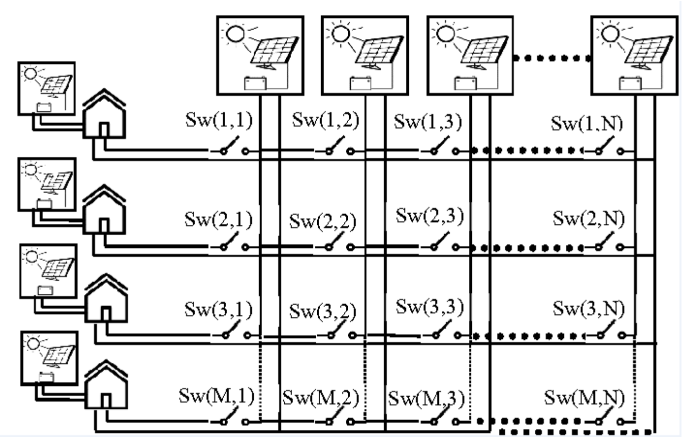
I. INTRODUCTION

In several parts of the world, lot of citizens are poor and they have no access to electricity, it has become imperative to research, design and implement modern distributed power systems at low cost to curb the shortage or absence of electric power in standalone areas. Therefore, the best solution is to use renewable energy sources (RES) [1], [2]. The most widely renewable energy source used in cities and in stand-alone locations is photovoltaic solar energy [3]. It is based on photovoltaic panel, which is a device for generating electrical energy by converting solar radiation into electrical energy. Photovoltaic solar energy is the most developed compared to other renewable energies. However, the behavior of the conversion systems of this type of renewable energy is strongly dependent on changes in climatic parameters, such as temperature and solar irradiation [4], [5]. Therefore, the major disadvantage of these systems is that the amount of energy produced varies with changes in weather conditions and is not perfectly predictable. The implementation of new grids must be flexible, reliable and efficient therefore, there is a necessity to control its behavior, demands, generation and transmission in real time, to avoid the electrical energy waste.



Fig–1: Synoptic diagram of the PVBM system between homes in standalone area



Fig–2: Schematic diagram of the PVBM switching Matrix

Many studies have been discussed the accommodation of RESs systems in smart grid through different energy management scheme. In the literature, two categories can be founded, the first one present the management aspect via predicting the electrical generation from RESs [6]. In addition, controlling the electricity generation and consumption by demand response management in micro-grids through decentralized, distributed and hierarchical control mechanisms [7], [8] In Additional, a number of study has explored several energy scheduling schemes for RESs by discussing operational management and planning of smart buildings [9], [10], optimization of integrated PV solar houses [11], and efficient building management via distributed predictive control [12].

II. RELATED WORK

The purpose of this paper is to present a new approach to managing and optimizing distribution of electricity coming from the photovoltaic system in standalone micro-grids and recovering the maximum of electrical energy waste using a new system of electrical power mutualization between homes in standalone areas. This approach draws upon the electrical energy required from each home. Moreover, it can respond to the high-energy requirements by each home in real time. The proposed system is used to control and share automatically the PV blocks among as many homes as possible.

In this work, we report the integration of monitoring, of PVBM system in an environment able to give information of the system behavior in real time. This solution allows the acquisition and control of all necessary data from the PVBM system. The features of this solution is evaluate main model parameters of photovoltaic blocks allocation on different homes, calculate the number of blocks connected to each home, simulate the switch matrix and visualize all these data and the dynamic system behavior in real time. The performance of this PVBM system and monitoring interface are tested using an experimental prototype.

Data-acquisition systems are widely used in renewable energy source applications in order to collect, control and process data regarding the installed system performance, for evaluation and supervision goals [14]. Koutroulis has proposed an integrated data-acquisition system for renewable energy source (RES) system monitoring [15]. The proposed system consists of a set of sensors for monitoring both meteorological data and RES system operational parameters. The collected data are first conditioned using precision electronic circuits and then interfaced to a PC using a data-acquisition card (microcontroller) and LabVIEW for monitoring.

LabVIEW (Laboratory Virtual Instrument Engineering Workbench) is a graphical programming language by National Instruments that uses icons in the place of text of programming instruction to create applications. Nowadays this programming environment has found its application in many scientific fields and technical engineering, so in this work we propose an integral LabVIEW platform of monitoring tools for photovoltaic blocks mutualization (PVBM) system.

III. 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.

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.

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.

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 (Thing speak). 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.

IV. PROPOSED SYSTEM

In the entire engineering studies, we have studied and used many systems for calculation and measurement of signals (analog and digital) like CRO (CATHODE RAY OSCILLOSCOPE) and DSO (DIGITAL STOARAGE OSCILLOSCOPE). But there are few limitations we have to face in these systems like for higher amplitude signal there is no convenient way to observe the waveform and due to circuit internal noise many fluctuations can be seen on the display of the oscilloscope which are undesirable for the minute sampling and data collection for samples, there is also the problem of external noise and there is no such facility to store the waveform So to overcome all this problems regarding traditional oscilloscope, we are going to implement a system which will be using the hardware and software together to calculate the waveforms, analyze and store the waveform. We are going to implement the new data acquisition system using LabVIEW software and AVR family platform. The system will be able to store the waveform also there won't be any noise generated in the circuitry (internal or external) as we are going to connect the computer having LabVIEW installed with the AVR Board with USB parallel port connection. Using "HIGH SPEED DATA ACQUISITION SYSTEM USING LABVIEW" we are going to make a DAQ as product which will be used to analyze the waveform and will generate minimum 30,000 samples at a second of the time, adding to it, the software gives us the facility to save the recorded 30,000 samples on the excel sheet.

Please refer Figure for basic Block Diagram.

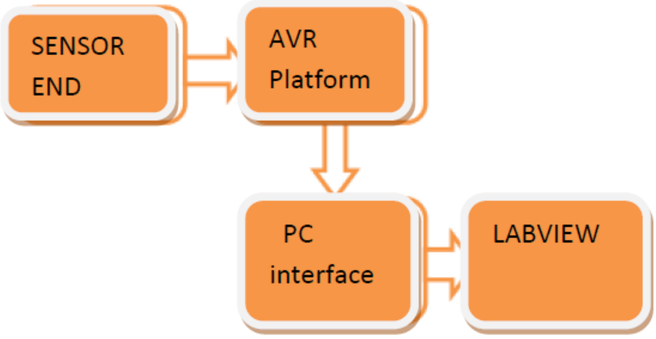


Fig – 3: Block Diagram of our project

V.CONCLUSION

This paper presents a PV blocks mutualization system that is able to self-adjust and allocate the blocks depending on the electrical power needs of each home. The mutualization of PV Blocks is achieved by using a switching matrix, which is controlled by an Arduino board in real time. The system can automatically optimize the PV blocks among homes using the topology aforementioned in this paper to minimize the lost electrical energy. A small-scale prototype of PVBM system containing two homes and six PV blocks has been built and tested for concept evidence. The experimental results proved the validity of the proposed algorithm and the mutualization system. In addition, for monitoring the PVBM system. The LABVIEW program is used to further process and display collected data in the PC screen. The design is successfully tested using an experimental set up. The results are stable and reliable and show the correct functionality.

REFERENCES

[1]. Muruganantham B, Gnanadass R, Padhy NP. Challenges with renewable energy sources and storage in practical distribution systems. *Renewable and Sustainable Energy Reviews*. vol. 73, pp. 125-134, 2017.
[2]. Kodanda R, Mannam V. Operation and Control of Grid Connected Hybrid AC/DC Microgrids using RES. *International Journal of Power Electronics and Drive Systems (IJPEDS)*. vol 5 (No 2) pp. 195-202. 2014.
[3]. Verschueren T, Mets K, Meersman B, Strobbe M, Develder C, & Vandevelde L. *Assessment and mitigation of voltage violations by solar panels in a residential distribution grid*. Smart Grid Communications (SmartGridComm), 2011 IEEE International Conference on. pp. 540-545, 2011.
[4]. Skoplaki E, Palyvos J. On the temperature dependence of photovoltaic module electrical performance: A review of efficiency/power correlations. *Solar energy*. vol 83 (No5) pp. 614-624. 2009
[5]. Singh, Kumar G. Solar power generation by PV (photovoltaic) technology: a review. *Energy*. vol 53 pp. 1-13. 2013
[6]. Kalogirou S, Mathioulakis E, Belessiotis V, Artificial neural networks for the performance prediction of large solar systems. *Elsevier Renewable Energy*, vol. 63, pp. 90–97. 2014.
[7]. Guerrero J, Vasquez J, Matas J, Vicu˜na L, Castilla M, "Hierarchical control of droop-controlled ac and dc microgrids–A general approach toward standardization, " *IEEE Trans. Ind. Electron.* vol. 58, (No1) pp. 158–172. 2011.
[8]. Hill C, Such M, Chen D, Gonzalez J, and Grady W. Battery energy storage for enabling integration of distributed solar power generation. *IEEE Trans. Smart Grid*, vol. 3, (No2) pp. 850–857.2012.
[9]. Zhang D, Shah N, and Papageorgiou L. Efficient energy consumption and operation management in a smart building with microgrid. *Energy Conversion and Management*, vol. 74, pp. 209–222, 2013.
[10]. Kanchev H, Lu D, Colas F., Lazarov V, Francois B. Energy management and operational planning of a microgrid with a PV-based active generator for smart grid applications, " *IEEE Trans. Ind. Electron.*, vol. 58,(No10) pp. 4583–4592, 2011.
[11]. Matrawy K, Mahrous A, Youssef M. Energy management and parametric optimization of an integrated PV solar house. *Energy Conversion and Management*, vol. 96, pp. 377–383, 2015.
[12]. Scherer H, Pasamontes M, Guzman J, Alvarez J, Camponogara E, Normey-Rico J. Efficient building energy management using distributed model predictive control. *Journal of Process Control*, vol. 24(No6) pp. 740–749,.2014.
[13]. Muratori M, Rizzoni G, "Residential demand response: Dynamic energy management and time-varying electricity pricing," *IEEE Transactions on Power Systems*, vol. 31 (No2) pp. 1108–1117. 2016.
[14]. Musa A, Samosir S, Yatim A. Modeling and simulation of a solar photovoltaic system, its dynamics and transient characteristics in LABVIEW. *International Journal of Power Electronics and Drive Systems (IJPEDS).* vol. 3, (No2) pp.185-192.2013
[15]. Koutroulis E and Kalaitzakis K, Development of an integrated data acquisition system for renewable energy sources systems monitoring. *Renewable Energy*, vol. 28 (No1), pp. 139–152, 2003.
[16]. Mezouari A, Mateur K, Alareqi M., Hlou L., and Elgouri R. *Development of an integrated data-acquisition system for photovoltaic blocks mutualization monitoring using LABVIEW.* In Wireless Technologies, Embedded and Intelligent Systems (WITS), 2017 International Conference on IEEE pp. 1-4, 2017.