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Journal ID : TRKU-13-02-2023-11541 Total View : 8

Title : Site-Specific Nutrient Management for Paddy Fields – Integration of Fertilizer Recommendation Formula into GIS

Abstract :

MARDI developed the RiceFert formulation to assist in fertilizer recommendation rate for optimal paddy growth. The formulation followed an adjustable soil test–target yield equation (ST-TY) into dedicated software. The output from the RiceFert software includes a total rate of N, P2O5, and K2O fertilizer (kg/ha) and split application or straight fertilizer rate (kg/ha). Additionally, the output from RiceFert was integrated to GIS to produce maps according to the specific fertilizer recommendation rates. With interpolation techniques, thematic maps added more information, such as total area coverage according to individual classification classes. This paper discusses the overall process of fertilizer recommendation rate for paddy fields, starting with the RiceFert formulation, followed by map production using interpolation techniques according to the fertilizer recommendation output. The RiceFert strategy is expected to benefit local authorities because it offers vital information to farmers for optimal rice growth and output.

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Title : ANALYSIS OF FLUID TYPES AND MINERAL FUNCTION CLUSTERS IN THE GEOTHERMAL MANIFESTATION AREA OF GEOTHERMAL SPRINGS, TOLOK I VILLAGE, TOMPASO DISTRICT, MINAHASA REGENCY

Abstract :

Geothermal manifes-tations of hot springs are formed due to the flow of hot fluid that comes from rock fractures that are below the surface. The nature of various rocks and the heat produced from below the surface makes the characteristics of each geothermal system different. One of them has an impact on each chemical content of the fluid that appears on the surface varies. The purpose of this research was to find out more about the condition of existing hot springs as the object of study in determining the type of fluid and functional groups manifestation geothermal hot springs of Tolok I village, Tompaso, Minahasa Regency. For determining the type of fluid laboratory tests were carried out and the results of these laboratory tests were conducted by Liquid Chemistry Plotting on the ternary plot diagram. To analyze fluid functional groups, water samples were tested using FTIR spectroscopy. The measurement of physical parameters was also carried out to support this research. The results showed that the type of fluid in the study area was chloride type with a percentage of 51% and the functional groups obtained were functional groups of amides, ketenes and carbonates.

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Feasibility Study and Design of IoT-based Monitoring for Remote PV System

Ahmad Taqwa[1], Tresna Dewi[2], Andri Agus Sasmanto[3], Rusdianasari[4], Yohandri Bow[5]

Department of Renewable Energy Engineering, Politeknik Negeri Sriwijaya, Jalan Srijaya Negara, Palembang, 30139, Indonesia[1,4]
Department of Electrical Engineering, Politeknik Negeri Sriwijaya, Jalan Srijaya Negara, Pelambang, 30139, Indonesia[2]
Department of Energy Engineering, Politeknik Negeri Sriwijaya, Jalan Srijaya Negara, Palembang, 30139, Indonesia[5]
PT PLN Persero Distribution Control Center, Sumatera Selatan, Jambi, dan Bengkulu, Jalan Gub. H. A. Bastari, Jakabaring, Palembang, 30257, Indonesia[3]

ABSTRACT— Renewable energy comes with a great deal of hope for a better planet with low CO2 emissions and unlimited sources. One of these promising sources of energy is the one that comes from the sun. Solar energy harvesting can be combined with the ever famous IoT monitoring. The current internet connection and speed can meet the need for an online and up-to-date view of the performance of the PV system. This paper compares data from IoT monitoring and direct measurement of PV panels. The experiment was conducted by installing two panels with different means of output and efficiency monitoring. The difference in output between IoT-based monitoring and direct measurement is 2.9708 watt, and the efficiency difference is 3.085%. While the measurement is different, the graphic profiles are the same, indicating that the IoT monitoring and direct measurement can display the same data with the appropriate calibration and light sensor.

KEYWORDS: IoT-Monitoring; Photovoltaic; PV System; Renewable Energy.

1. INTRODUCTION

All facets of society, both government officials and community in general, are now conscious that traditional fossil-based energy is weak. This fact is certainly a condition that forces us to look for alternative energy sources called renewable energy because this type of energy can be renewed quickly without having to wait millions of years [1- 3], [27]. The example of this renewable energy application is solar power utilization for farm irrigation by [1], [3], [4] that investigated the application of wind turbine to harvest some energy in low wind-speed in Palembang, South Sumatra. The concept of renewable energy can be applied in every aspect of daily life, such as given by that discussed the possibility and idea of solar-powered automated transportation [5]. Indonesia, as is well known, is situated on the equator with weather that is always favorable to solar energy harvesting. Therefore, based on Indonesia’s geographical location, it is possible to use solar energy in Indonesia. Palembang and its surroundings are one of the areas that always get the most sunshine. Solar energy can be optimized to generate electricity in areas not covered by the State Electric Company. The feasibility studies have shown that the off-grid PV system is sufficient for the South Sumatra region, as discussed in [6-12]. The PV system installation is practically possible in all types of landscapes; it can be ground-mounted, roof mounted of urban buildings, flat surfaces, hills or mountains, and even the water body. Installing PV panels above the water body can provide positive benefits for both the PV panels and the aquatic ecosystem [8], [10]. PV panels can also reduce unwanted weed populations, such as water hyacinth. The closure of the water by PV panels will reduce water evaporation and prevent drought during the dry season, as presented by [8], who investigated the installation of PV panels on the body of Musi River. [9], [10] had studied the effect of floating PV panels on brackish water. Installing PV panels on the surface of a waterbody provides natural cooling benefits for PV panels, preventing the overheating of the PV panels’ surface. The installation of PV

Panels over waterbody is called Floating PV System [8], [9], [10]. The drawback of PV system installation in a tropical climate is that PV panels are prone to get overheated [11], [12]. The solar energy is also very susceptible to the weather changing [6]. Some efforts are made to increase the produced power such as installing solar tracker [13- 15], [25], [26], using the cooling system to reduce the risk of overheated solar panel's surface, and adjusting PV installation using flexible PV panel to ensure it received the maximum solar energy, such as [16] presents the bending of flexible solar panel in convex and cortex setting to ensure the system is able to receive the maximum solar energy. Installing solar panels for rural areas where electricity is not available in the remote area requires online monitoring to ensure that the PV system is in good shape and optimum performance. This online surveillance can be carried out using currently booming technology, the Internet of Things (IoT), Everyone can access the Internet and use it to monitor a lot of things remotely [17-20], [24]. IoT itself has become a custom in an age when the Internet has become an integral part of everyday life. The application of IoT monitoring in the PV system had been presented by [21- 23], such as [21] uses IoT for disaster management, [22] applied IoT for solar power irrigation system, and [23] discussed the IoT in the energy sector. This paper presents a feasibility study and a design of IoT based remote monitoring for the Floating PV system. The floating PV system discussed is introduced in our previous work [8- 10]. The data using IoT online monitoring is compared to the direct measurement of the PV system's electrical parameters. IoT monitoring is needed to ensure that the remote PV system works well and is monitored without being physically present. The objective of this study is to demonstrate that remote monitoring is possible and effective.

2. Method

The monitoring in this study relies on cellular network or WiFi to A solar power monitoring unit can facilitate the necessity to get online and current information of the installed PV system. By installing this monitoring system, the user can keep updated on what the system generates and how well it performs. Suppose the electricity is generated to fuel home or sell the extra power to a utility provider for a fixed price. In that case, the user has to know when something goes wrong to quickly address the issue and continue to profit to the full. This paper discusses the online monitoring of the PV system that is supposed to be installed remotely. In this paper, the remote setting is simulated by installing an IoT monitoring system for a PV panel. The PV system design is shown in (Figure 1), which are including controller Arduino Mega 2560, PIZM-017 module, WiFi ESP, internet modem, and volt and ampere meter, digital thermometer, digital multimeter, camera, 100 ω, 100 Watt 24 V DC Lamp, and 12 V battery. The PV panel considered is 100 WP Sankelux (SNI), which is supported by aluminum supporting reel. (Figure 2) shows the location where the IoT monitoring PV system is installed.

2.1 IoT Monitoring Design

IoT solutions consist of several elements: physical devices, such as sensors, actuators, and interactive devices, the network that links these devices and collects and analyzes the data from those devices, and the physical sense that users communicate with the solution. The user's physical sense to view and understand the data captured by IoT is called the user interface. Suppose a PV system installed remotely or roof mounting consists of hundreds of fo PV panels producing electric power simultaneously. The panels are connected in series and parallel to get optimized power outputs. The generated DC electricity is converted to AC by the converter and used to power a building or the entire village. Instead of direct monitoring that requires human resources and time, online monitoring is more beneficial than the conventional one.

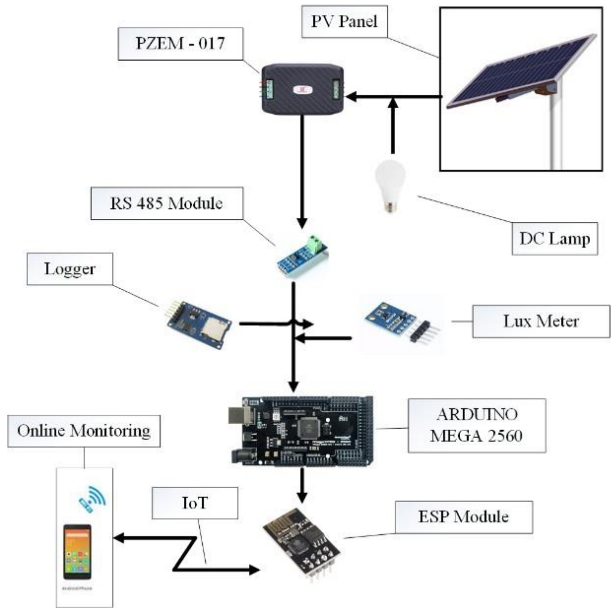

Figure 1. The proposed IoT monitoring system for a PV panel

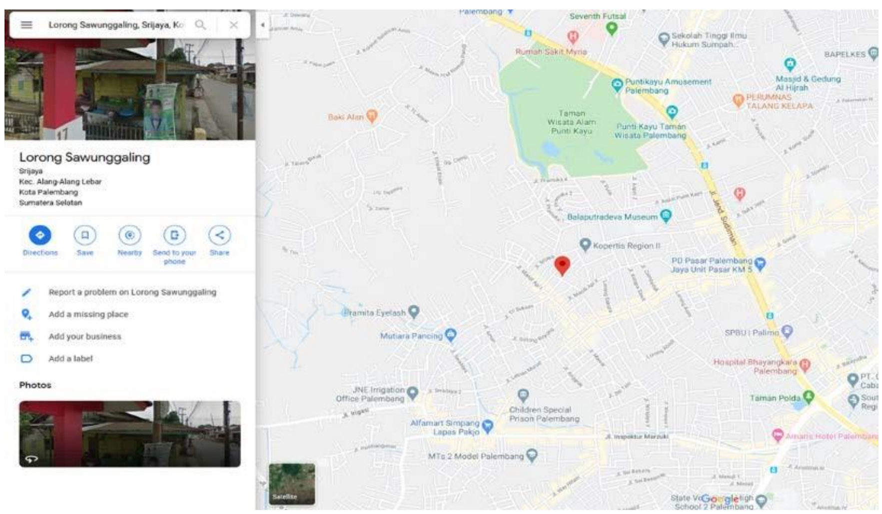

Figure 2. The location where the IoT monitoring PV system installed

The monitoring process highly dependent on the communication network, which is how well the gateway can transmit information to the cloud, as shown in (Figure 3). Most monitoring systems receive inputs from sensors attached to the system. The more inputs were given, the more expensive the system is, however in this study, only two data inputs are considered, the output data from PV panels and the lux measurement from lux meter as presented in (Figure 3).

Figure 3. The location where the IoT monitoring PV system installed

The monitoring in this study relies on cellular network or WiFi to communicate, which coverage enough up to the remote area where the PV panels are installed. The monitored parameters in this study are the amount of lux received by the panel, output data, and efficiency of PV panel. The IoT monitoring design considered in this study is given in (Figure 3).

2.2 PV Panel Efficiency

The electrical properties of PV panel are given in IV curve that shows the relationship between short circuit current (I_{sc}) and open-circuit voltage (V_{oc}) with the maximum power (P_{MP}) produced as illustrated in (Figure 4). Isc and Voc are produced when no load applied to the system. The produced current and voltage are given by

$$I = I_0\left[exp\left(\frac{qV}{nkT}\right) - 1\right] - I_L, \tag{1}$$

and

$$V = \frac{nkT}{q}\ In\left(\frac{I_L - I}{I_0}\right), \tag{2}$$

where I is the cell output current, V is the voltage across the cell terminals, $\frac{nkT}{q}$is the thermal voltage, I_0 is the initial current, T is the temperature, q and k are constants, n is the ideality factor, and I_L is the light generated current,

Solar panel efficiency refers to the portion of solar energy that can be converted into electricity by the panel. The cell efficiency is calculated by using Fill Factor (FF), which is the maximum conversion efficiency of a PV cell at the optimum voltage and current. The efficiency (η) is defined by

$$\eta = \frac{P_{MP}}{P_{in}} = \frac{I_{MP}V_{MP}}{P_{in}} = \frac{I_{sc}V_{oc}FF}{P_{in}}, \tag{3}$$

where P_{MP} is the maximum power produced by the panel, P_{in} is the input power, I_{MP} is the maximum current, and V_{MP} is the maximum voltage.

3. Result and Discussion

The data was collected two times, both Saturdays, July 11, and July 18, 2020. Two PV panels are installed, the data from one panel is collected directly, and IoT remotely monitors another panel. The wiring diagram of the PV system monitored by IoT is shown in (Figure 5). The data collected is irradiance, open circuit voltage, voltage and current during loading, and Lux data.

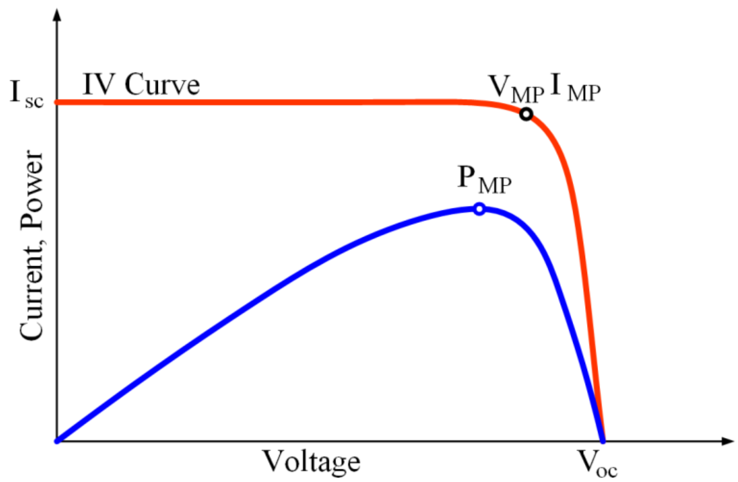

Figure 4. IV curve that shows the relationship among PV panel's parameters

In order to show the effectiveness of the IoT monitoring system, the data displayed on IoT monitoring, as illustrated in (Figure 6) and The display of IoT-based measurement is shown in (Figure 7) are compared with the data taken by direct measurement.

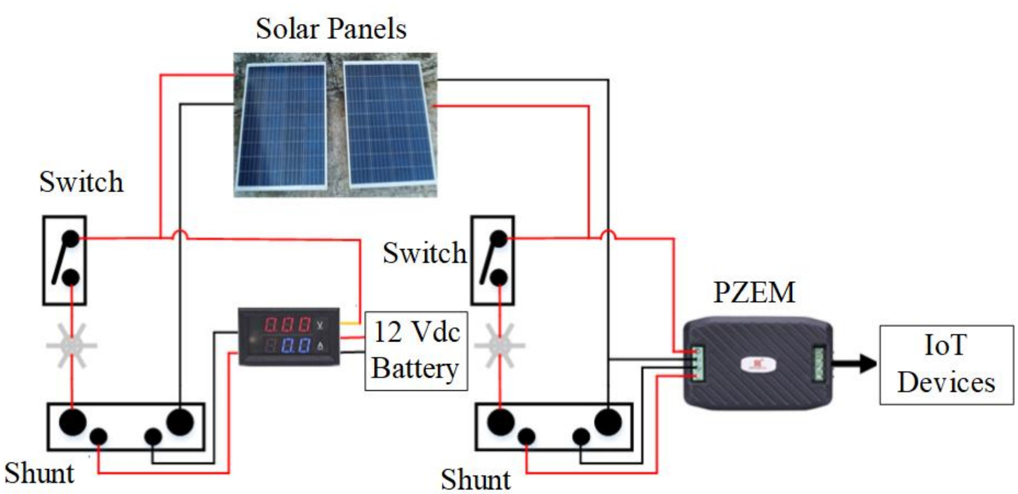

Figure 5. The wiring diagram of the PV system

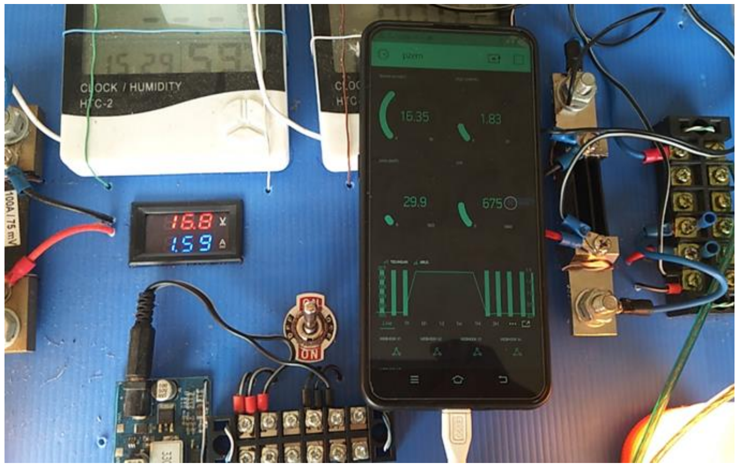

Figure 6. IoT monitoring devices considered in this study

In this study, measurements were carried out to see the difference in measurement results between IoT-based solar panel output and direct measurement. The measurements conducted using IoT can be remotely monitored using a cellphone or multiple cellphones at the same time. The research was conducted in a variety of weather conditions; sunny, cloudy, and rainy. This variation in weather conditions allows researchers to observe changes in power output and the resulting efficiency against these dynamic changes in weather conditions.

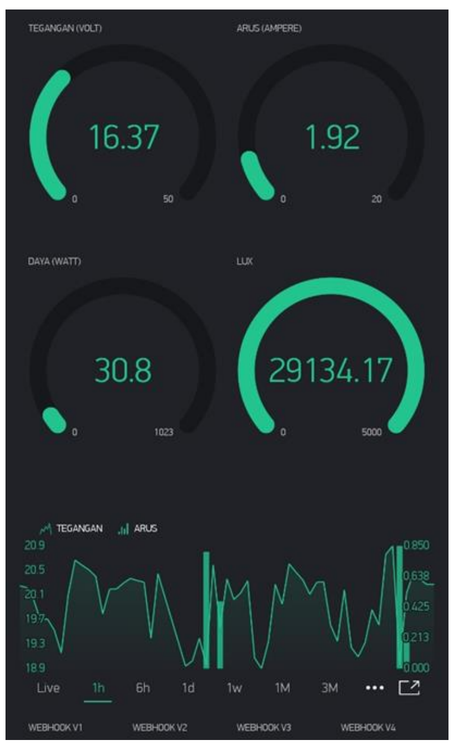

Figure 7. Display of IoT-based during the system connected to 24 Vdc load

The first data taken is the sunlight received by panels measured by a lux meter and irradiance meter. The lux meter is applied due to the IoT monitoring devices need lux data instead of irradiance. The IoT based measurement of electrical properties is carried out using a PZEM module equipped with a shunt resistor, which is converted to digital data and becomes an input to the Arduino Mega 2560 controller. The data processed by the controller is sent via the WiFi ESP module.

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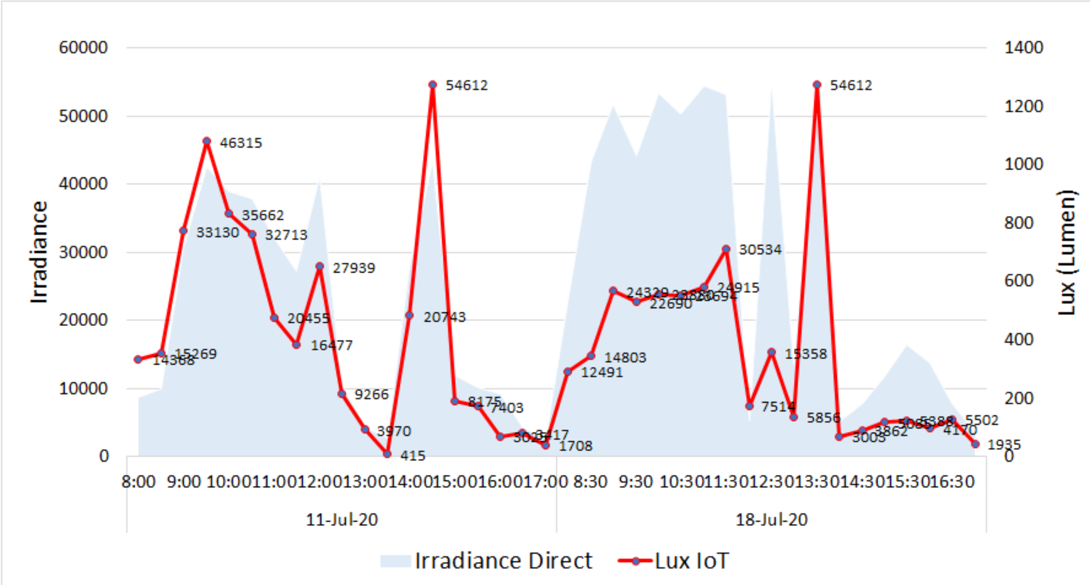

Figure 8. The comparison between Lux and Irradiance measurement

The sunlight received by the PV panels is given in (Figure 8), where irradiance direct means the irradiance data measured by direct measurement, and Lux IoT is the data displayed in the handphone shown in (Figure 6). (Figure 8) presents a comparison of the two measurement results. Although both data should not be compared, (Figure 8) shows that the sunlight received by the PV panels has the same profile both from IoT-based monitoring using a lux meter and direct measurement by using an irradiance meter. The data from (Figure 9) is sunlight data measured by a lux meter to show the PV output profile relative to solar energy received by the panel during a day that contains the variation of weather.

Open-circuit voltage Voc is produced when the PV panels are considered in total darkness and the maximum available voltage from the installed solar panel. The measured open-circuit voltage of the PV panel using IoT-based and direct measurement is given in (Figure 9). The legend in (Figure 9) is Lux IoT as the amount of sunlight received by the panel measured by lux meter, Voc IoT as the open-circuit voltage measured by IoT-based, and Voc Direct as achieved by direct measurement. The average difference between IoT-based and direct measurement is 0.3875 V; however, the graphic profiles are the same for both measurements.

The difference of voltage measurement between IoT-based and direct measurement when the system is connected to a 24 Vdc lamp is 0.5185 V as illustrated in (Figure 10). V_{load} IoT is the IoT-based and V_{load} Direct is from direct measurement. The comparison of measured P_{MP} between IoT-based and direct measurement is shown in (Figure 11). P_{MP} is the maximum power produced as shown in (Figure 4). The difference of P_{MP} between displayed in IoT-based monitoring system and direct measurement is 2.9708 Watt. P_{MP} measurement leads to the efficiency of the produced energy by PV panel, which is calculated by Eq (3) and the result is shown in (Figure 12). The difference of both measurement is 3.085%.

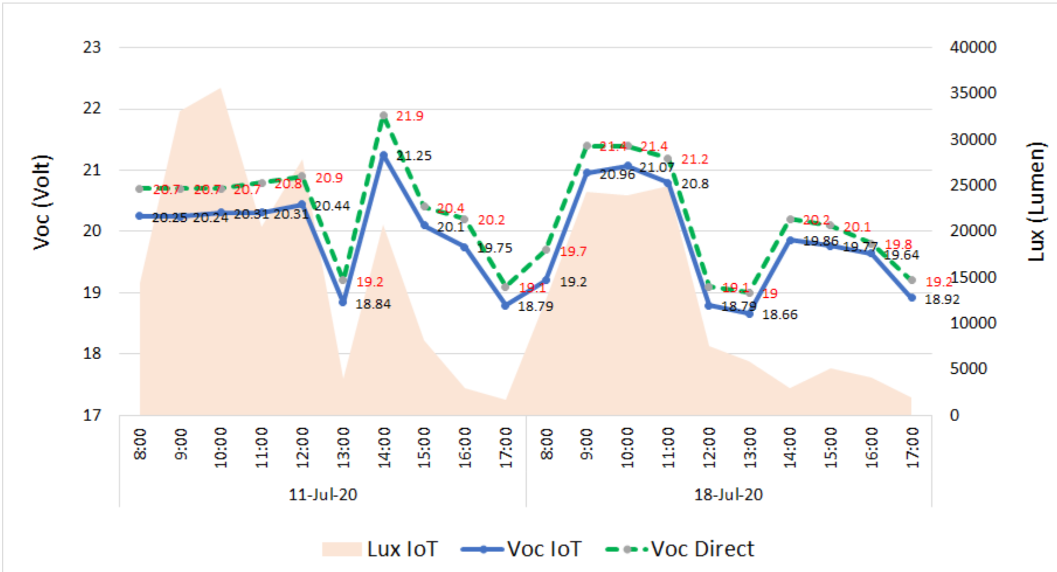

Figure 9. Voc comparison result between IoT based and direct measurement

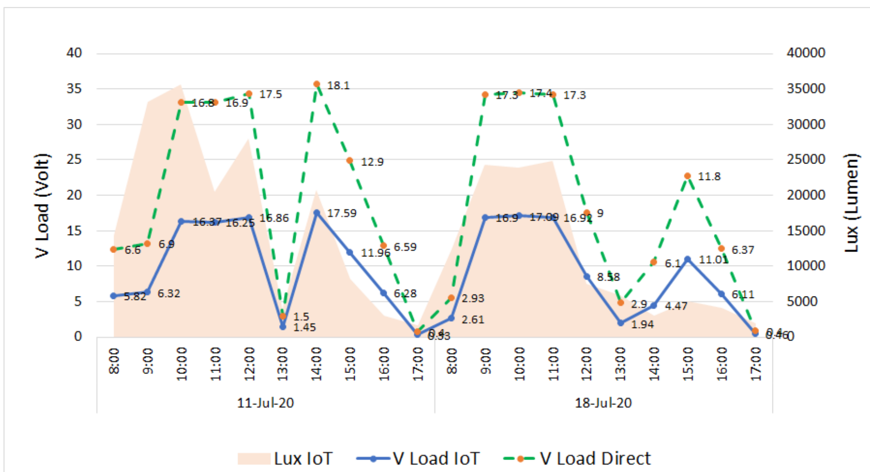

Figure 10. Vload comparison result between IoT-based and direct measurement

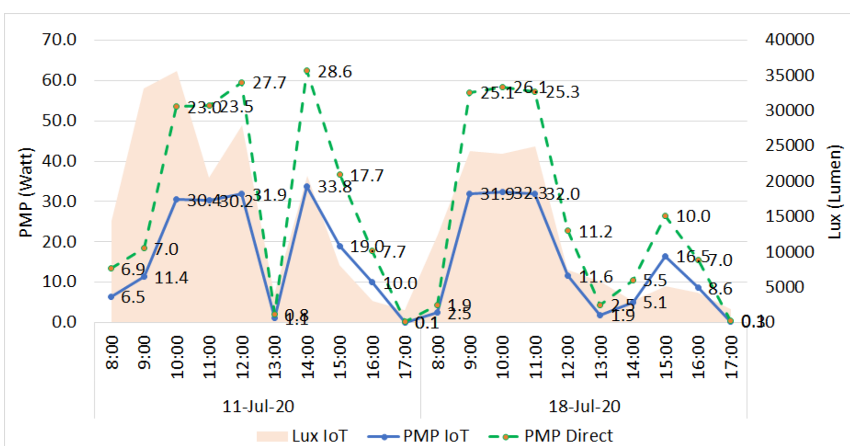

Figure 11. PMP comparison result between IoT-based and direct measurement

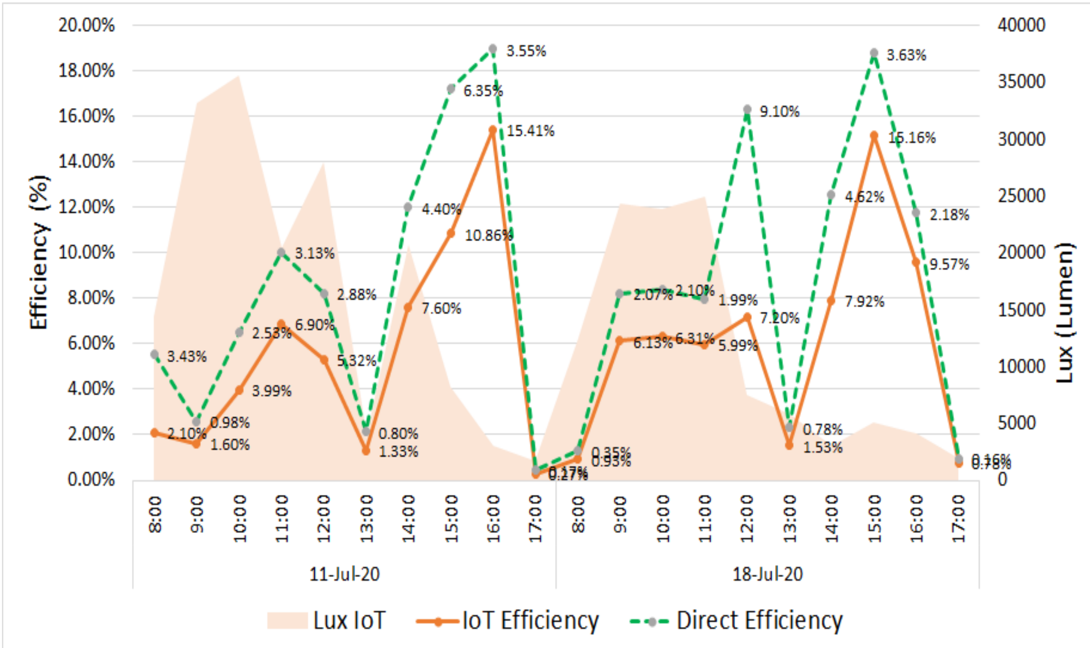

Figure 12. Efficiency comparison result between IoT-based and direct measurement

The IoT-based and direct measurements have a constant difference; however, the graphic profile is the same as shown in (Figure 8 to 12). The IoT-based and direct measurement compared in this study make it easier for operators to determine the output of floating solar panels online and real-time without having to go to the location of floating solar panels. The difference between IoT-based and direct measurement can be overcome by adding a light sensor compatible with Arduino.

4. Conclusion

Solar power can be an excellent solution for producing electricity in remote areas where public utilities have not yet entered the scene. Nonetheless, the PV system needs to be monitored to ensure maximum power output and efficiency are preserved. The application of IoT monitoring is the answer to this issue. The operator will remotely control the PV system. This research explores the distinction between IoT-based tracking and direct measurement. While the effect is very different, the graphic profiles are the same. The IoT monitoring and direct measurement will display the same data using an appropriate calibration and light sensor.

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