Towards sustainable and reliable power delivery

ICHVEPS 2021

Program Book

2021 3rd International Conference on High Voltage Engineering and Power Systems (ICHVEPS)

October 5th - 6th, 2021
Bandung, Indonesia

- Virtual Conference -

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THE 3RD INTERNATIONAL CONFERENCE ON HIGH VOLTAGE ENGINEERING AND POWER SYSTEMS

Bandung, 5 - 6 OCTOBER 2021

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ICHVEPS 2021

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Notification	:	June 25, 2021
Full Paper Submission	:	July 25, 2021

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(Kyushu Institute of Technology, Japan)


Prof. Guan-Jun Zhang
(Xi'an Jiaotong University (XJTU), Xi'an, China)


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(Institut Teknologi Bandung, Indonesia)


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(PT PLN (Indonesian Electric Power Company), Indonesia)


Prof. Eduard Mulyadi
(Auburn University, Alabama, US)

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1. High Voltage Generation, Measurement, and Instrumentation
2. High Voltage Insulation System
3. Condition monitoring and diagnosis for power equipments and power systems
4. Dielectric materials and their aging mechanisms
5. New and environmental friendly materials for high voltage application
6. Application of high voltage in industry
7. Degradation assessment for power equipment
8. Transients Phenomena
9. Outdoor Insulation: Insulator, Environmental Effects
10. High Voltage Insulation for UHV AC and HVDC System
11. High Voltage Apparatus: Reliability and Maintenance
12. Grounding system
13. Power Quality
14. Electromagnetic Compatibility
15. Smart Grid Technology
16. High Voltage Engineering Education
17. Power system planning, operation and control
18. Power system stability

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The 3rd International Conference on High Voltage Engineering and Power Systems 2021 (ICHVEPS 2021) will be held in Bandung (*Virtual Conference*), The Capital of West Java, Indonesia 5-6 October 2021. This is a biannual conference organized by the School of Electrical Engineering and Informatics, Institut Teknologi Bandung, Indonesia and technically sponsored by IEEE Indonesia Section , Power and Energy Society Indonesia Chapter and IEEE ITB Student Branch and supported by Indonesia Electrical Power Company (PT. PLN Persero). The conference is designed to be an international forum for exchange ideas, discussion and dissemination of research results and technologies in the field of High Voltage Engineering and Power Systems. The previous conference (The 1st ICHVEPS 2017) was held in Bali October 2017 and The 2nd ICHVEPS 2019 was held also in Bali October 2019. The previous conferences was typically attended by 250 participants from 15 countries such as Indonesia, Malaysia, India, Australia, China, Japan, Taiwan, Brunei Darussalam, France, Sweden, USA, Germany and Korea including a number of prominent invited speakers. 3rd ICHVEPS 2021 cordially invites researchers, professors, faculty members as well as students from universities and researchers and practitioners from power utilities and industries all over the world to submit abstracts and papers to this conference. All accepted papers will be sent to IEEE Xplore (and Scopus) and selected papers will be recommended for publication in International Journal on Electrical Engineering and Informatics and Journal of Engineering and Technological Sciences.

About Bandung

Bandung is Indonesia's second largest metropolis after the nation's capital city, Jakarta. It's also the capital of the West Java province. Bandung offers travellers a well-balanced mix of modernity, history, culture and some cool nature scenes. Right in the city hub, you'll find its commercial and business districts are alive with chic dining spots and boutique-lined streets. The trendy vibe of the city has helped give its famous moniker, the "Paris of Java". It even has dedicated streets favoured by local weekenders and visitors for top-quality fashion items.

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2021 ICHVEPS

The 3rd International Conference on High Voltage Engineering and Power Systems 2021

Virtual Conference

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The 3rd International Conference on High Voltage Engineering and Power Systems 2021

Main Gate of Institut Teknologi Bandung, Indonesia

ICHVEPS 2019 in Grand Inna Bali Beach, Bali, Indonesia

Language

The working language of the symposium is English. All printed matter will appear in English.

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Member-type	International Participant	Domestic Participant
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11. High Voltage Apparatus: Reliability and Maintenance
12. Grounding system
13. Power Quality
14. Electromagnetic Compatibility
15. Smart Grid Technology
16. High Voltage Engineering Education
17. Power system planning, operation and control
18. Power system stability
19. FACTS
20. Renewable energy and microgrid

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You are invited to submit your abstract(s) through the abstract submission system that can be reached from the conference web site. Abstract can be received by text only, no figures or graphs, with length of around 300 words. Detail of abstract submission can be seen in the conference web site.

Important Dates

Abstract Submission :	**June 1, 2021**
Notification :	**June 15, 2021**
Full Paper Submission :	**July 15, 2021**

CONFERENCE DAYS

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ICHVEPS 2021

05/10/2021 - 06/10/2021

This event has passed.

The 3rd International Conference on High Voltage Engineering and Power Systems 2021 (ICHVEPS 2021) will be held in Bandung (Virtual Conference), The Capital of West Java, Indonesia 5-6 October 2021. This is a biannual conference organized by the School of Electrical Engineering and Informatics, Institut Teknologi Bandung, Indonesia and technically sponsored by IEEE Indonesia Section , Power and Energy Society Indonesia Chapter and IEEE ITB Student Branch and supported by Indonesia Electrical Power Company (PT. PLN Persero).

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Abstract Submission :	August 5, 2021
Notification :	August 10, 2021
Full Paper Submission :	August 15, 2021

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A. P. Purnomoadi; A. Pharmatrisanti; S. Rositawati; M. P. Marbun; A. S. Surya; H. Nugraha; I. Arifianto; D. F. Hakam; A. M. J. Simatupang
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Suwarno
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An Effective Damping Control Scheme to Improve Inter-Area Power System Stability
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Heri Sutikno; Rahman Azis Prasojo; Suwarno

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Abstract HTML

Comparative Power and Energy Consumptions between Scheduled and Fuzzy Controlling on an IoT-based Vertical Farming

Publisher: IEEE Cite This PDF

Waluyo Waluyo ; Andre Widura ; Febrian Hadiatna ; Delvin Anugerah All Authors

Abstract:
Recently, one trend of research is an investigation on vertical farming based on the internet of things (IoT). It involves some methods of controlling system, physical parameters including sensors and transducers, both hardware and software, and energy consumption. Nevertheless, this paper focuses on electric power and energy consumption. The electrical quantities were voltage and current, which were sensed and entered to Arduino Mega 2560 to be processed, and further to a Node MCU ESP8266, smartphone, and Blynk to monitor and log the data of power based on the internet of things (IoT). The loads were LED lamps and pH pumps through a relay. The controlling systems were scheduled and fuzzy bases, to be compared. The power was directly monitored and logged in every one minute by using the Blynk of a smartphone, whereas the energy was computed by using trapezoidal and Simpson's composite rules. For one day, the fuzzy-based method could save 85.05 Wh (5.44%) and 84.32 Wh (5.42%) compared to the scheduled-based method, using the trapezoidal and Simpson's composite rules respectively. The hourly-absolute-based energy differences between the scheduled and fuzzy bases were 116.66 Wh and 116.03 Wh using trapezoidal and Simpson's composite rules respectively, for one day. While both computations yielded a deviation of 0.40% only. Thus, the fuzzy-base controlling method could considerably save consumed energy.

Published in: 2021 3rd International Conference on High Voltage Engineering and Power Systems (ICHVEPS)

Date of Conference: 05-06 October 2021

Date Added to IEEE *Xplore*: 18 November 2021

ISBN Information:

INSPEC Accession Number: 21439417

DOI: 10.1109/ICHVEPS53178.2021.9601038

Publisher: IEEE

Conference Location: Bandung, Indonesia

I. Introduction

Conventional farming is manual monitoring and labor-consuming and may be farmers' high loading [1]. Therefore, there have been some types of research concerning smart agriculture, farming, or hydroponics systems using a fuzzy system [1], fuzzy logic and wireless sensors [2] and fuzzy micro-climate controlling [3], fuzzy logic, and Nutrient Film Technique (NFT)-based system [4]. They also involved IoT [5] and IoT-automation bases [6], indoor IoT automation [7], IoT with artificial intelligence [8]. E[...] Sign in to Continue Reading [...]d automated IoT and fuzzy logic [9], IoT and fuzzy logic contr[...]ybrid [11]. They involved intelligent sensors [12] and automation concerns [13] too. The soil condition was investigated too, such as a minimized soil [14] and soil humidity [15] concerns. The researches were also conducted on irrigation concern of smart farming, such as precision irrigation [16], IoT-based

Comparative Power and Energy Consumptions between Scheduled and Fuzzy Controlling on an IoT-based Vertical Farming

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***Abstract*— Recently, one trend of research is an investigation on vertical farming based on the internet of things (IoT). It involves some methods of controlling system, physical parameters including sensors and transducers, both hardware and software, and energy consumption. Nevertheless, this paper focuses on electric power and energy consumption. The electrical quantities were voltage and current, which were sensed and entered to Arduino Mega 2560 to be processed, and further to a Node MCU ESP8266, smartphone, and Blynk to monitor and log the data of power based on the internet of things (IoT). The loads were LED lamps and pH pumps through a relay. The controlling systems were scheduled and fuzzy bases, to be compared. The power was directly monitored and logged in every one minute by using the Blynk of a smartphone, whereas the energy was computed by using trapezoidal and Simpson's composite rules. For one day, the fuzzy-based method could save 85.05 Wh (5.44%) and 84.32 Wh (5.42%) compared to the scheduled-based method, using the trapezoidal and Simpson's composite rules respectively. The hourly-absolute-based energy differences between the scheduled and fuzzy bases were 116.66 Wh and 116.03 Wh using trapezoidal and Simpson's composite rules respectively, for one day. While both computations yielded a deviation of 0.40% only. Thus, the fuzzy-base controlling method could considerably save consumed energy.**

Keywords*— *energy, fuzzy, power, Simpson's composite, trapezoidal composite

I. INTRODUCTION

Conventional farming is manual monitoring and labor-consuming and may be farmers' high loading [1]. Therefore, there have been some types of research concerning smart agriculture, farming, or hydroponics systems using a fuzzy system [1], fuzzy logic and wireless sensors [2] and fuzzy micro-climate controlling [3], fuzzy logic, and Nutrient Film Technique (NFT)-based system [4]. They also involved IoT [5] and IoT-automation bases [6], indoor IoT automation [7], IoT with artificial intelligence [8]. Besides that, smart farming involved automated IoT and fuzzy logic [9], IoT and fuzzy logic control [10], and IoT and fuzzy-based hybrid [11]. They involved intelligent sensors [12] and automation concerns [13] too. The soil condition was investigated too, such as a minimized soil [14] and soil humidity [15] concerns. The researches were also conducted on irrigation concern of smart farming, such as precision irrigation [16], IoT-based smart irrigation [17], IoT-based multi-agent irrigation [18], and automatic irrigation controlling [19]. Moreover, they also investigated energy efficiency [20] and clean energy [21] concerns.

Based on the literature reviews, the researches concerning smart farming which involved energy consumption are still rare. Therefore, this paper presents power and energy conditions in the research of smart farming.

II. RESEARCH METHOD

Fig. 1 shows the block diagram of the power system part in the designed smart farming prototype. The quantities of current and applied voltage were entered into an Arduino Mega 2560. Furthermore, the power entered to Node MCU ESP 8266, to be monitored and controlled by a smartphone, displayed and recorded by the Blynk application. The power supplied LEDs (light-emitting diodes) and pumps for controlling the plants.

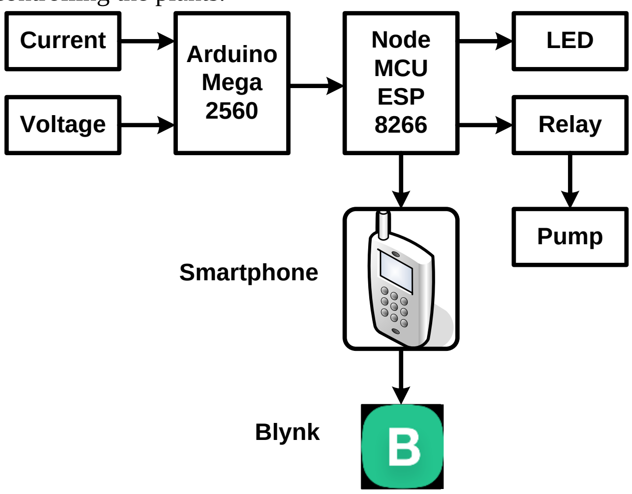

Fig. 1. Block diagram of power part on smart farming

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The program of voltage sensor for measurement is the flowchart, as shown in Fig. 2. The first was an initialization of the voltage sensor. In this stage, the system determined the communication line, used by the voltage. Furthermore, the voltage sensor received the ADC value from the Arduino and multiplied it with the results of the linear regression calibration with the ADC value in the program to get the voltage that passed through the sensor.

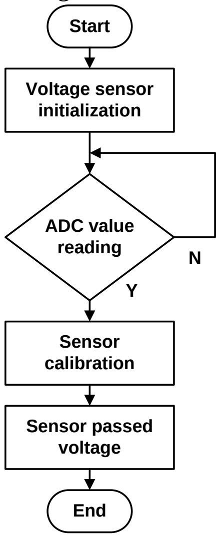


Fig. 2. Flowchart of voltage measurement

The current measurement used an ACS721 sensor. The run program followed the flowchart as shown in Fig. 3. At the stage of ACS721 sensor initialization, the system established a communication path and identified the sensor library. Furthermore, the microcontroller reading of the current sensor was carried out a calibration to get a current value of the ADC signal, to be entered into a linear regression equation from some of the data that has been sampled to get the value of a linear equation. Thus, the current sensor reading could approach the actual value to get the power in the program, by multiplying the current and voltage sensor readings.

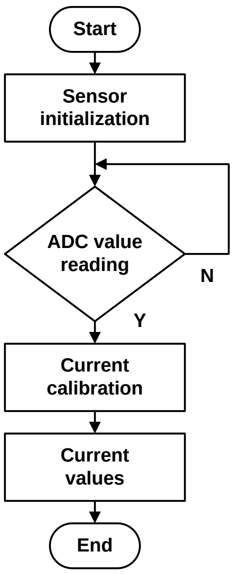


Fig. 3. Flowchart of current measurement

By using ACS721, the system establishes the communication path and the identity of the sensor library. The reading of the microcontroller for this current sensor is carried out by calibrating, to get the current value of the converted ADC signal in the program to generate the voltage value on the current sensor. Furthermore, the voltage result is carried out by multiplying the current sensor value and a constant.

After reading each parameter by the sensor, the reading results of the data were sent to the node MCU microcontroller. From the node MCU, the data were sent to the cloud Blynk server to store and monitor the results of the sensor readings on the smartphone. The program, to run this command, follows the flow chart is shown in Fig. 4. Starting from the Arduino, serial communication with the node MCU was carried out, where the results of Arduino sensor readings were sent to the node MCU, they were continued by sending sensor reading data to the cloud server Blynk, using an internet connection to store the data on the server and monitored on the Blynk application on the smartphone.

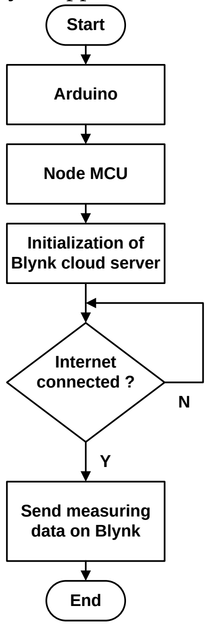
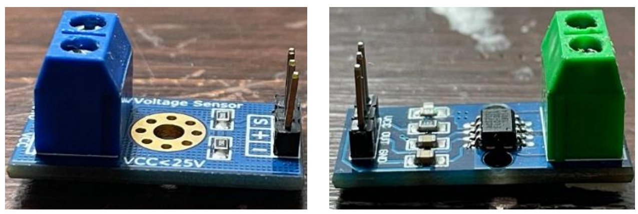


Fig. 4. Blynk storage flowchart

The power was computed by using (1).

$$P = vxi \tag{1}$$

Figs. 5(a) and 5(b) show voltage and current sensors which were used for the system. The system determines the communication line used by the voltage. The voltage sensor receives the ADC value from the Arduino and converts it by multiplying and dividing the analog value or ADC with the resistor value on the voltage sensor to get the voltage passes through the sensor.



(a) (b)

Fig. 5. (a) voltage and (b) current sensors

This system used a relay, a type of switch group which operates based on electromagnetic principles which are used to move contactors to connect the circuit indirectly. The closing and opening of the contactor are caused by the effect of magnetic induction generated from the inductor coil which is energized by an electric current. This study used a 5 volts relay, 6 channels connected to a water pump. Another specification is a contact current of 10 A, on 250 V ac or 30 V dc.

Fig. 6 shows the used grow light LEDs (light-emitting diodes) for the illuminance controlling as necessary on the smart farming. The grow light emitted color spectrum is dominant in red and blue, suitable for plant growth.

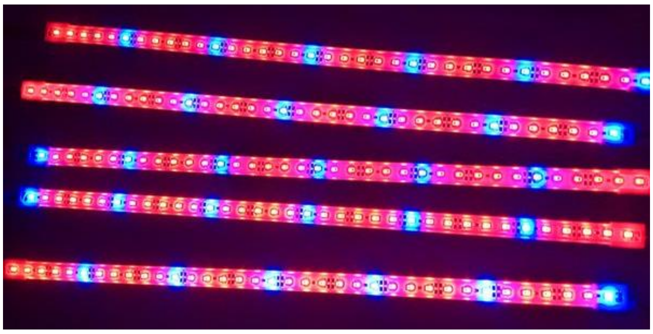


Fig. 6. Grow light LEDs

As a server service, Blynk is used to support the Internet of Things Based on Android and iOS, it can be used by smartphone users. It also allows designing interfaces with various output and input components that support sending and receiving data, and displaying it on the screen. The representations of data can be in the form of visual numbers or graphs. Blynk Server is a cloud-based backend service facility that is responsible for managing communication between applications and hardware [22].

The power was consumed by the grow light LEDs and peristaltic pumps. While the consumed energy was the integration of power as a time function. Nevertheless, the data recording of the power was intermittent, so that the consumed energy was computed by using numerical methods. The famous methods of numerical integration for many segments are trapezoidal and Simpson's composite rules [23]. Thus, the energy was computed by two methods, trapezoidal dan Simpson’s composite rules [23], as the basic formulae (2) and (3) respectively.

$$I = \frac{h}{2}[f(x_0 + 2\sum_{i=1}^{n-1} f(x_i) + f x_n)] \qquad (2)$$

$$I = \frac{h}{3}\left[f(x_0) + 4\sum_{i=1,3,5,..}^{n-1} f(x_i) + 2\sum_{i=2,4,6,..}^{n-2} f(x_i) + f(x_n)\right] \qquad (3)$$

There were two methods to run the system, namely scheduled and fuzzy-based methods. The former was a determining operation in a range of 18:30 and 05:30. While the latter was operated automatically for 24 hours. Both methods operated simultaneously.

III. Results and Discussion

Fig. 7 shows a sample display of monitoring parameter charts on Blynk. The charts consisted of PWM, fuzzy power, scheduled power, and illuminance. The scheduled power was the LEDs were turned from 18:30 until 05:30. It is seen that there was a slight difference between fuzzy power and scheduled power. Generally, at night, the fuzzy power was lower rather than that at noon. This occurrence was caused by not any illuminance in the night. However, in the noon, the fuzzy power was slightly higher than that scheduled power.

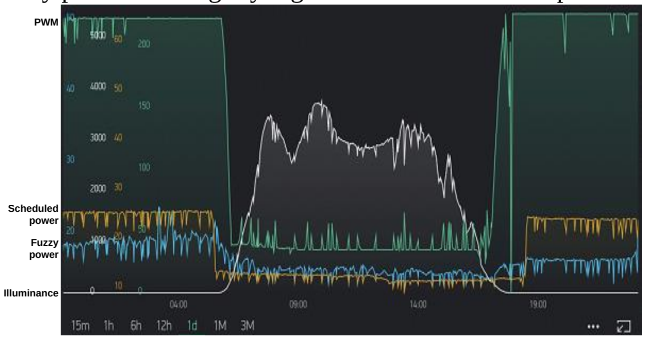


Fig. 7. Display of monitoring charts

Fig. 8 shows the current and PWM charts versus ADC binary codes. It is shown that both parameters approached to be linear and similar, to decrease as the ADC binary codes increased. Thus, the component operated properly. Besides that, the current tended to be linear. Thus, the current and PWM were linear.

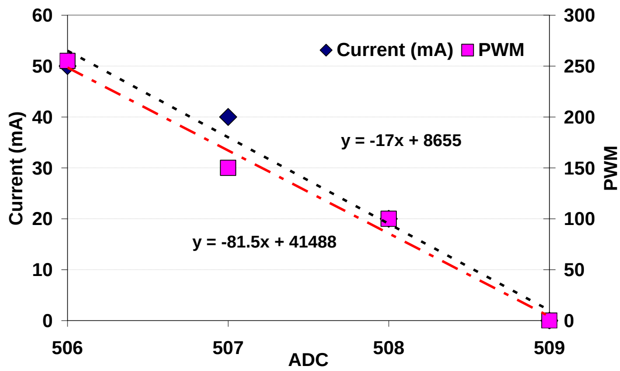


Fig. 8. Current and PWM versus ADC

Fig. 9 shows the consumed power at every hour both for fuzzy and scheduled methods. The scatter plots were based on the median values during one hour. No doubt, at night, the scheduled power was slightly higher than that using the fuzzy method. The average power of the scheduled method from 00:00 until 06:00 was 91.97 watts, whereas the fuzzy used power was 83.53 W. Therefore, the difference average power was 8.44 watts. While, from 18:00 until 00:00, the scheduled average power was 79.73 watts, and that the fuzzy method was 71.67 watts. Thus, the difference in the average power was 8.06 watts. Therefore, the night, before and after 00:00 o'clock, the average power difference was almost the same. While, in the noon, from 07:00 until 17:00, the fuzzy method power was visually slightly higher than that the scheduled power. The average fuzzy method power was 51.48 watts, whereas the average scheduled power was 49.84 watts. Therefore, the difference in average power for both methods was -1.64 watts. In the noon, both methods were almost the same. This case was probably caused by the illuminance of solar irradiance.

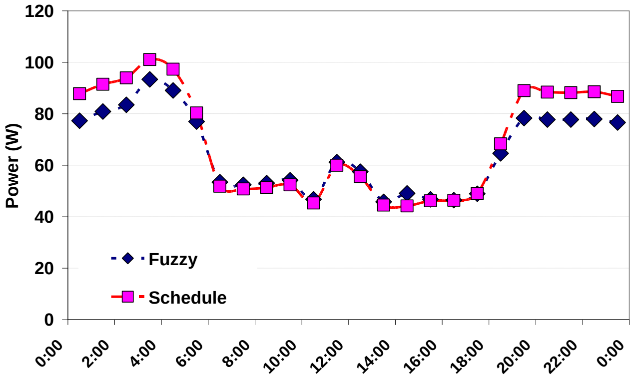


Fig. 9. A day consumed powers

Fig. 10 shows the every hour energy. Generally, it shows the consumed energy at the night was higher than that at the noon. This case was caused by the illuminance of the solar irradiance at the noon.

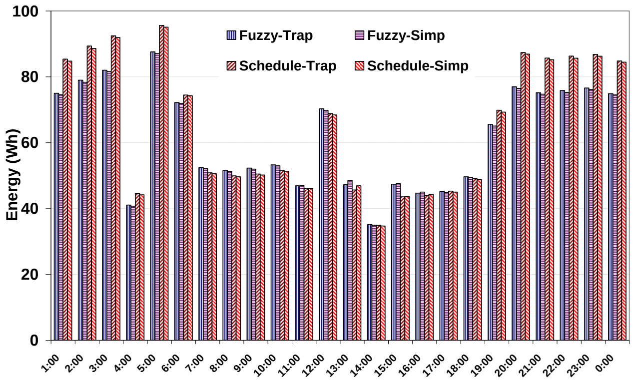


Fig. 10. A day consumed energies

Fig. 11 shows the scheduled-to-fuzzy method difference energy. The difference energy was positive at the noon and negative at the night. Nevertheless, the positive values of power difference were considerably higher, than that the negative values, as around five times. The used fuzzy method energy could be saved 85.05 Wh and 84.32 Wh compared to that the scheduled-based method, using trapezoidal and Simpson's composite rules respectively, or it is 5.44% and 5.42%.

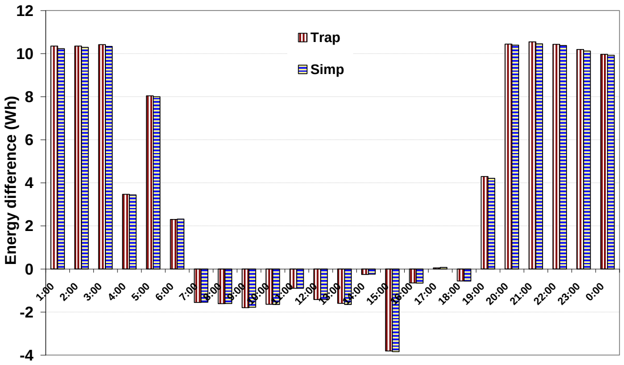


Fig. 11. A day scheduled-to-fuzzy difference energy

The hourly-absolute-based energy differences between the scheduled and fuzzy bases were 116.66 Wh and 116.03 Wh using trapezoidal and Simpson's composite rules respectively, for that day. While both computations yielded a deviation of 0.40% only. Thus, the fuzzy-base controlling method could considerably save consumed energy.

IV. Conclusion

The power part of the IoT-based vertical farming has been implemented. It involved some methods of control systems, including sensors, both hardware and software, and consumed-energy computations. The electrical quantities were voltage and current, which were sensed and entered to Arduino Mega 2560 to be processed, and further to a Node MCU ESP8266, smartphone, and Blynk to monitor and log the data of power based on the internet of things (IoT). The loads were LED lamps and pH pumps through a relay. The controlling systems were scheduled and fuzzy bases, to be compared. The power was directly monitored and logged in every one minute by using the Blynk of a smartphone, whereas the energy was computed by using trapezoidal and Simpson's composite rules. For one day, the fuzzy-based method could save 85.05 Wh (5.44%) and 84.32 Wh (5.42%) compared to the scheduled-based method, using the trapezoidal and Simpson's composite rules respectively. The hourly-absolute-based energy differences between the scheduled and fuzzy bases were 116.66 Wh and 116.03 Wh using trapezoidal and Simpson's composite rules respectively, for one day. While both computations yielded a deviation of 0.40% only. Thus, the fuzzy-base controlling method could considerably save consumed energy.

Acknowledgment

The authors would like to thank The Ministry of Education, Culture, Research and Technology (DRPM Kemenristek/BRIN), in the year 2021, contract number 457/B.05/LPPM-Itenas/IV/2021, for financial support.

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Comparative Power and Energy Consumptions between Scheduled and Fuzzy Controlling on an IoT-based Vertical Farming
Waluyo, Andre Widura, Febrian Hadiatna, Delvin Anugerah
2021 3rd International Conference on High Voltage Engineering and Power Systems (ICHVEPS)

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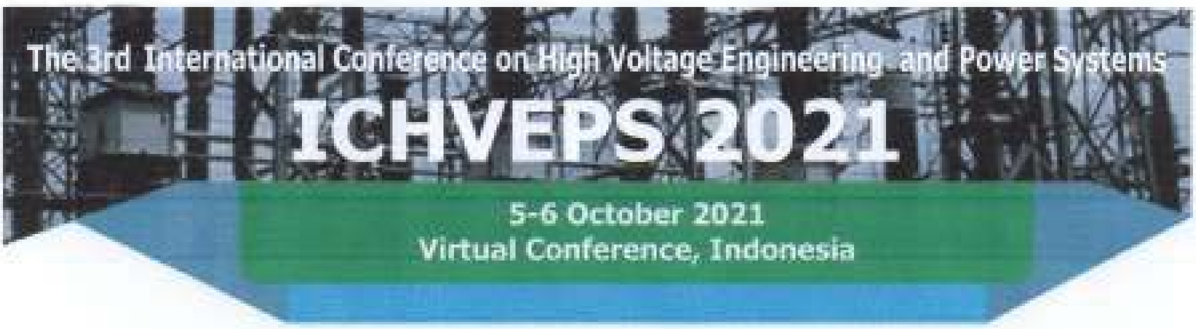

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