

# International Conference on High Voltage Engineering and Power Systems ICHVEPS 2017

2-5 October 2017  
Inna Grand Bali Beach, Bali, Indonesia



***The 72<sup>nd</sup> National Electricity Day 2017***

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# **2017 International Conference on High Voltage Engineering and Power Systems (ICHVEPS 2017)**

**Denpasar, Bali, Indonesia  
2-5 October 2017**



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# ICHVEPS 2017

October 2-5, 2017, Bali, Indonesia



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2. High Voltage Insulation System
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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
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17. Power system planning, operation and control
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## Invitation

International Conference on High Voltage Engineering and Power Systems 2017 (ICHVEPS 2017) will be held in Sanur-Denpasar, Bali, Indonesia on October 2-5, 2017. The Organizing Committee of ICHVEPS 2017 cordially invites you to participate in the conference.

## About Bali

Bali lies between the islands of Java and Lombok and is one of more than 17,000 islands that makes up the Indonesian Archipelago. Lying just 8° south of the Equator, Bali boasts a tropical climate with just two seasons, wet and dry, a year and an average annual temperature of around 28° C.

The Balinese people have strong spiritual roots and despite the large influx of tourists over the years, their culture is still very much alive inspired by stories from the Ramayana and other Hindu epics. With a reputation as being one of the most beautiful and diverse tourist spots in the world, Bali attracts more than 4.5 million visitors a year, from all around the world.



Conference venue of ICHVEPS 2017 is Inna Grand Bali Beach Hotel. It is located on a wide stretch and white sand of Sanur beach, the most complete and competitive resort in Bali. Only 12 miles from Denpasar Ngurah Rai International Airport.

# ICHVEPS 2017

**International Conference on High Voltage Engineering and Power Systems 2017**

**October 2-5, 2017  
Bali, Indonesia**

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### Cultural tour

Cultural tour will be arranged for conference participants and spouses. The tour will be done after the closure of the conference. The places and attractions to be seen during the cultural tour and its registration will be announced later via the conference web site.

### Sightseeing tours

Bali Island is famous with variety of sightseeing spots. During the conference there will be a desk to help to arrange sightseeing tours participated by participants and or spouses/family. Details of this sightseeing tours will be released on the conference web site later.

### Language

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

### Registration Fee

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| <b>IEEE Member</b>    | USD 300          |
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| <b>Student</b>        | USD 250          |
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The registration fee includes conference kit, conference proceedings, admission to all sessions, welcoming reception, banquet, lunches, and coffee breaks.

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### Abstract submission

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**Abstract Submission:** July 1, 2017  
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**CONFERENCE DAYS:** October 2-5, 2017





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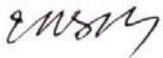
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IN-1



09.00 – 09.30

**Ir. Amir Rosidin, MM.**

*PT. PLN (Persero)*

"High Voltage Engineering and Power Systems Challenge in Indonesia Power Network"

IN-2



09.30 – 10.15

**Prof. Masayuki Hikita**

*Kyushu Institute of Technology, Japan*

"High Voltage Electrical Insulation in Next Generation Power Module"

IN-3



10.45 – 11.30

**Dr. Nurhidajat Sisworahardjo**

*University of Tennessee at Chattanooga, USA*

"Data Analytics-Based Anomaly Detection in Smart Distribution Network"

IN-4



11.30 – 12.00

**Mr. Kazuhiro Akima**

*PT. Honda R&D Indonesia*

Honda Electric Vehicle Technology

IN-5



12.00 – 12.45

**Prof. Ahmed Abu Siada**

*Curtin University, Australia*

"Review of Flexible AC Transmission Systems; Enabling Technologies for Future Smart Grids"

IN-6



08.30 – 09.15

**Dr. Muhammad Aziz**

*Tokyo Institute of Technology, Japan*

"Extended Utilization of Electric Vehicles in Electrical Grid Services"

IN-7



09.15 – 10.00

**Prof. Mohammad Masoum**

*Curtin University, Australia*

"Coordination of Plug-In Electric Vehicle Charging in Smart Grid: Challenges and Opportunities"

IN-8



10.15 – 11.00

**Prof. Guan-Jun Zhang**

*Xi'an Jiaotong University, China*

"Separation of Multiple Partial Discharge Sources in Power Transformer"

IN-9



11.00 – 11.45

**Prof. Yanuarsyah Haroen**

*Bandung Institute of Technology, Indonesia*

"Past, present and future in Indonesian Public  
Mass Transportation. Perspective - Traction  
Control Systems"

IN-10



11.45 – 12.30

**Dr. Robert Saers**

*ABB Corporate Research, Sweden*

"Digitalization of Electric Power System"

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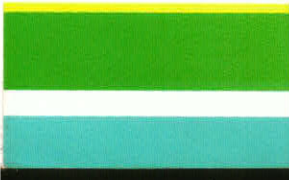


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# International Conference on High Voltage Engineering and Power Systems, ICHVEPS 2017 - Proceeding

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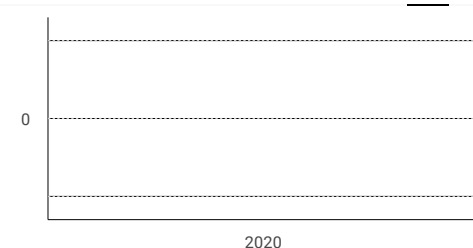


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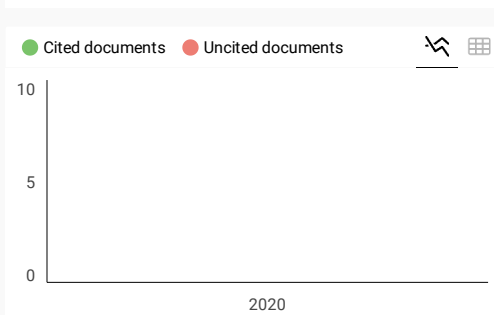
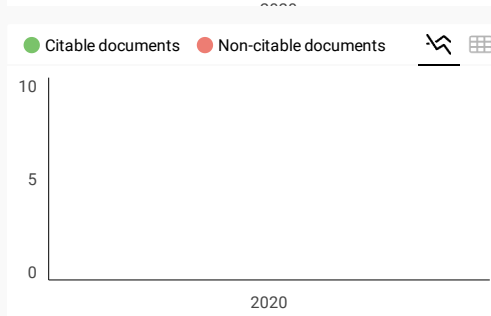
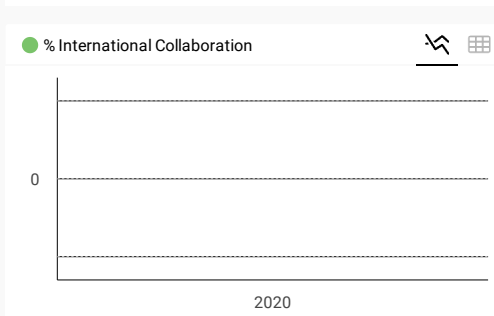
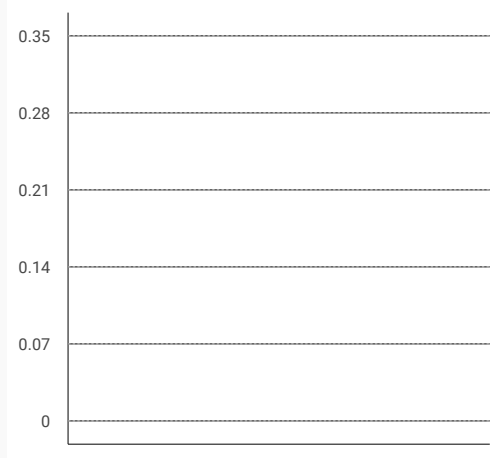
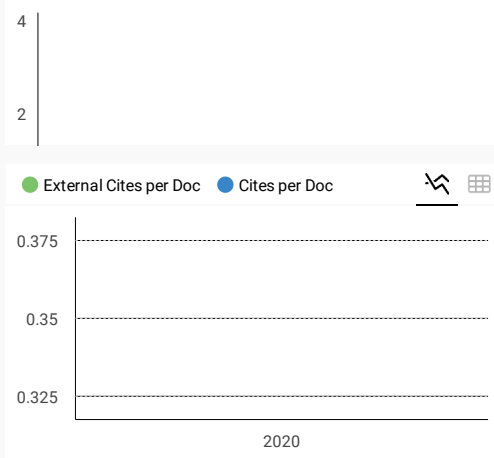


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# Implementation of wireless temperature, humidity, lighting and active power online monitoring using PLC for early stage of miniature energy savings

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**Abstract:**

This research would be the early stage in saving and managing energy, especially electrical energy in a miniature. The research has been done in the assembly of components, namely temperature, humidity, lighting and electric active power sensors, where they were equipped by 4–20 mA transmitters. These transmitters entered to the four channel analog module of programmable logic controller (PLC). From the PLC, using a router, the signals were transmitted to the computer in wireless remotely. Thus, besides the parameter quantities could be read in the panel, they also could be read in the computer in an online wireless remotely. Based on the testing results, for the humidity 58–60% in range, the error between the site display and PLC in the computer was only 0.3–0.4%, and for the temperature 28–30°C, the error between the site display and PLC in the computer was only 0.2–0.3°C. The error of active power depended on the power itself. For example, the rating load of 25 and 100 watts, the remote display were 23 and 96 watts respectively. While, the time for signal transmission was under 0.1 second.

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**I. Introduction**

Energy is a basic need to drive almost all economic and social activities. From time to time, energy need is necessary to human being, while the increasingly scarce global energy reserves. Wasteful use of energy and the excess will have an impact on environmental degradation, decline in product competitiveness, and unemployment. Along with the increasingly complex energy problems, the management of energy use on the load side, especially at office buildings and industry, it is time becomes an important part in the company's

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# Implementation of Wireless Temperature, Humidity, Lighting and Active Power Online Monitoring Using PLC for Early Stage of Miniature Energy Savings

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**Abstract**— This research would be the early stage in saving and managing energy, especially electrical energy in a miniature. The research has been done in the assembly of components, namely temperature, humidity, lighting and electric active power sensors, where they were equipped by 4-20 mA transmitters. These transmitters entered to the four channel analog module of programmable logic controller (PLC). From the PLC, using a router, the signals were transmitted to the computer in wireless remotely. Thus, besides the parameter quantities could be read in the panel, they also could be read in the computer in an online wireless remotely. Based on the testing results, for the humidity 58-60% in range, the error between the site display and PLC in the computer was only 0.3-0.4%, and for the temperature 28-30°C, the error between the site display and PLC in the computer was only 0.2-0.3°C. The error of active power depended on the power itself. For example, the rating load of 25 and 100 watts, the remote display were 23 and 96 watts respectively. While, the time for signal transmission was under 0.1 second.

**Keywords**—PLC; transmitter; analog module; wireless; temperature; humidity; lighting; active power

## I. INTRODUCTION

Energy is a basic need to drive almost all economic and social activities. From time to time, energy need is necessary to human being, while the increasingly scarce global energy reserves. Wasteful use of energy and the excess will have an impact on environmental degradation, decline in product competitiveness and long-term socio-economic upheavals. Along with the increasingly complex energy problems, the management of energy use on the load side, especially at office buildings and industry, it is time becomes an important part in the company's management structure [1].

A creation of new paradigm of changing times is one way to maintain growth and increase customer value in a fast paced business environment today. Therefore, it is necessary to play an important role in the development of industry and proactively addressing dynamic market [2]. Non-residential buildings have shown a rapid increase in the use of advanced technology and control systems with a variety of drivers, many of which are labeled 'smart'. If the term of smart building represented a separate thing, more advanced group, it will provide an opportunity to focus forward to the future

development of non-domestic buildings [3]. Smart buildings have been researched and developed over the last three decades. This seems to be the case in all aspects of the built environment sector; smart sensors, smart materials and smart meters in the building looks to be the latest and most advanced technology in our efforts to develop high-performance buildings. Smart cities are commonly seen built into future urban environment, with a growing number of inhabitants, demanding more functionality than the limited resources and tighter building regulations. By focusing on the main driver behind the construction of the past and the present, it is necessary to assess the meaning of smart or intelligent building and bringing together the definitions for smart building which is a more advanced group, learned from building upon the success and limitations of terminology previously and meet the criteria in where the building is worth a high performance. It is clear that the design of the expected performance of non-domestic buildings change throughout history. In order for the changes that would be described as progress, it is necessary that the produced drivers of evolution have met to a higher level than before. Drivers for building development can be said to revolve around adding value to a building. This value will depend on the context and building category, but has traditionally been formed of a theme related to the cost of building throughout life, and performance, comfort and satisfaction of their building. Reduction in energy consumption has now become the driving force in him, as increasingly stringent regulations and awareness of climate change. It is recognized that the modern building as a significant design criteria. With the cost of operating a non-domestic buildings were significant when compared to the cost of capital. It is suggested that a more suitable representation of the driver is capable to retain its value over long periods of time under changing conditions of use and externally. Therefore, three different drivers to build on the progress is long life, energy efficiency and comfort and satisfaction. A building that serves forward would have minimized energy consumption, although consistently enable maximization of performance, comfort and satisfaction of its inhabitants during the long lifetime [4].

The purpose of research was to design of monitoring system on the environmental parameters (temperature, humidity and lighting), and electrical power consumption in wireless, and

analysis of electrical power consumption associated with existing standards.

## II. RESEARCH METHOD

Fig. 1 shows a plan for the design diagram of monitoring system. In the design, the plan was installed sensors and / or measuring parameters of the environment and electrical power. The measurement data was sent to the computer wirelessly. The stored data in the computer were processed and analyzed for the use of electrical energy.

In the design, 4-20 mA transmitters were installed for temperature, humidity, lighting and electrical power. Furthermore, the data came into the input analog module of PLC. From PLC, the data sent to the Router, then sent in wireless, and finally into the computer.

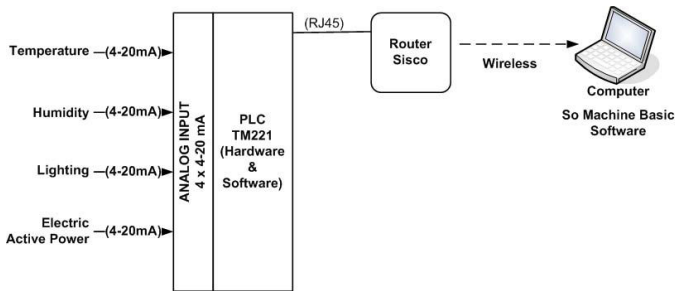


Fig. 1. Circuit diagram of monitoring system

The wiring diagram of electric power measurement was equipped by 4-20 mA transmitter as shown in Fig. 2. The supply was from source 220 V, single phase. While the current could set as maximum of 5 A. The display could be set as wattmeter or amperemeter. The 4-20 mA transmitter.

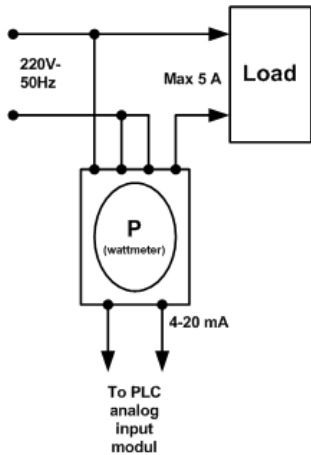


Fig. 2. Wiring diagram of electric power measurement equipped by 4-20 mA transmitter

## III. RESULTS AND DISCUSSION

Fig. 3 shows the monitoring kits of environmental parameters, which were temperature, humidity and lighting sensors, and electric power meter, where they were equipped by 4-20 mA

on every equipment those connected to the analog input modul of PLC. From the analog input module, the data came to the PLC controller, where the data would be processed. Furthermore, the data were sent to the router, and from the router, they were sent to the computer in wireless. The power supply 24 Vdc was for supplying the temperature and humidity sensors. The electric power meter was loaded by a lamp.



Fig. 3. Monitoring kits of environmental parameters and electric power

Fig. 4 shows the configuration processes of PLC type and the analog module selection. For this case, the PLC was TM221 type, and using the four channel analog module. The used PLC TM221CE16R series, 16 I/O (9inputs and 7 output). While, the used input analog module was TM3T14 series, where it was 4 (four) inputs.

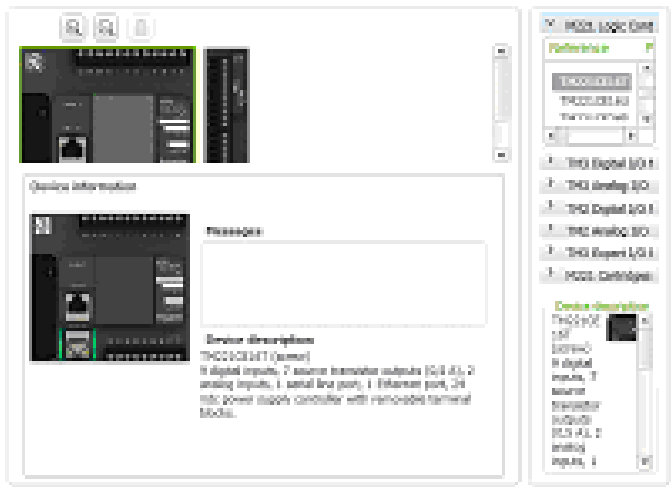


Fig. 4. Configuration processes of PLC and analog module selection

Fig. 5 shows the configuration processes of software for the analog inputs. The analog input addresses were %I1.0, %I1.1, %I1.2 and %I1.3 for lighting, temperature, humidity and power parameters respectively. The lighting, temperature, humidity and power ranges were 0-2000 lux, -20-60 centigrade, 0-100% and 0-1300 watt respectively. The analog types were 4-20 mA. These ranges were adjusted to the real measuring ranges of equipment.

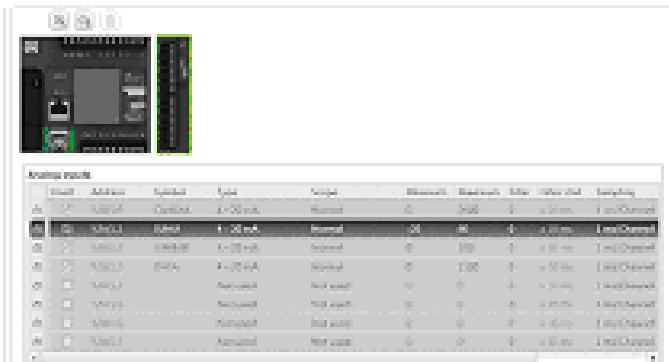


Fig. 5. Configuration process of analog input addressing

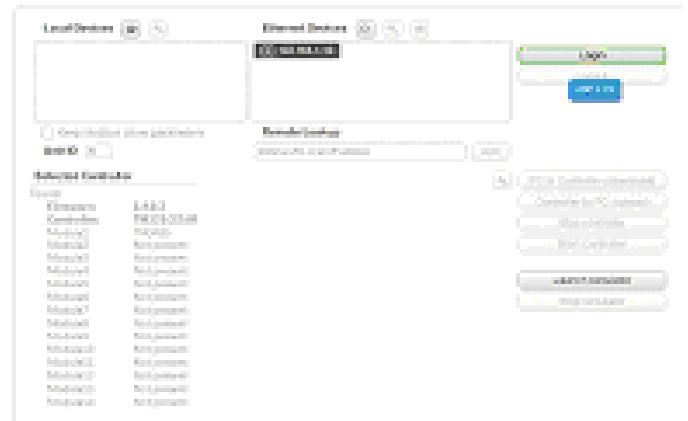


Fig. 8. Program running

Fig. 6 shows the configuration processes of IP address selection. For this case, the address was 192.168.1.10 and the subnet mask was 255.255.255.0. This address should be unique.



Fig. 6. Configuration process of IP address selection

Fig. 7 shows the programming processes for analog diagram. This figure indicates the design of ladder diagram for four analog inputs. The instruction was used %MW and followed by the address numbers.

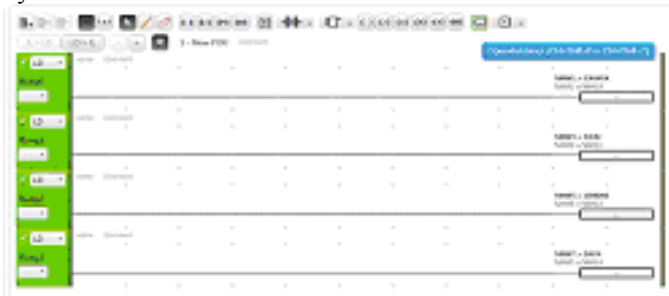


Fig. 7. Ladder logic diagram

Fig. 8 shows the programming for running. For running program, it should be login the program, and the IP address would appear.

Fig. 9 shows the wireless connection. For this case, the name wireless connection was 'PLC1' and it should be 'connected'.

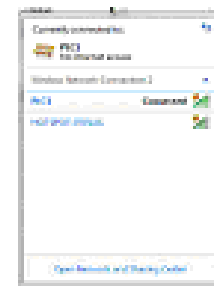


Fig. 9. Wireless connection

Fig. 10 shows the running program online display, where running in real time. The real numerical numbers would displayed on the laptop screen. The time different between the equipment display and the screen display were in order of milliseconds (ms).



Fig. 10. Running program online display

Table 1 lists the samples for humidity and temperature measurements. There were different values, between on the equipment and monitor display, both for humidity and temperature. Nevertheless, the different values were very small values. The average different value of humidity was only 0.62% and the average different value of temperature was only 0.255°C.



TABLE 1. HUMIDITY AND TEMPERATURE MEASUREMENT RESULTS

| Hours | Humidity (%) |           | Temperature (oC) |           |
|-------|--------------|-----------|------------------|-----------|
|       | Display      | SoMachine | Display          | SoMachine |
| 11.12 | 59.7         | 59.3      | 29.7             | 29.4      |
| 11.14 | 59.7         | 59.3      | 29.7             | 29.4      |
| 11.16 | 59.6         | 59.2      | 29.6             | 29.3      |
| 11.18 | 59.6         | 56.2      | 29.7             | 29.4      |
| 11.20 | 59.1         | 58.7      | 29.7             | 29.4      |
| 11.22 | 59.8         | 59.3      | 29.6             | 29.3      |
| 11.24 | 59.1         | 59.7      | 29.5             | 29.2      |
| 11.26 | 59.4         | 60.0      | 29.4             | 29.2      |
| 11.28 | 59.6         | 60.2      | 29.4             | 29.2      |
| 11.30 | 59.7         | 60.3      | 29.4             | 29.2      |
| 11.32 | 59.6         | 60.3      | 29.5             | 29.2      |
| 11.34 | 59.1         | 59.8      | 29.5             | 29.3      |
| 11.36 | 59.6         | 59.2      | 29.5             | 29.2      |
| 11.38 | 59.1         | 58.9      | 29.5             | 29.3      |
| 11.40 | 59.1         | 58.4      | 29.5             | 29.3      |
| 11.42 | 59.6         | 58.3      | 29.5             | 29.2      |
| 11.44 | 59.4         | 58.1      | 29.5             | 29.2      |
| 11.46 | 59.4         | 58.0      | 29.4             | 29.2      |
| 11.48 | 59.2         | 58.5      | 29.4             | 29.2      |
| 11.50 | 58.0         | 57.7      | 29.4             | 29.2      |

Table 2 lists the samples for lighting measurements. The lighting sensor did not have display on the equipment. Therefore, to make sure on the proper operation, it was tested in the outdoor and indoor locations. Fortunately, the sensor operated well, when conducted the lighting measurement. In outdoor measurements, the results were between 176 and 190 lux, and the measurement results for indoor location were between 87 and 89 lux.

TABLE 2. SAMPLE OF LIGHTING MEASUREMENT

| Outdoor | Indoor |
|---------|--------|
| 190     | 89     |
| 189     | 88     |
| 188     | 87     |
| 187     | 88     |
| 186     | 87     |
| 187     | 88     |
| 186     | 87     |
| 185     | 88     |
| 184     | 87     |
| 183     | 88     |
| 182     | 89     |
| 191     | 88     |
| 189     | 89     |
| 188     | 88     |
| 187     | 88     |
| 186     | 88     |
| 185     | 88     |
| 184     | 88     |
| 183     | 88     |
| 182     | 87     |
| 181     | 88     |
| 180     | 87     |
| 179     | 88     |
| 178     | 87     |
| 177     | 88     |
| 176     | 87     |

Table 3 lists the samples for electric power measurements. The meant power was active power, with unit of watt. There are small values of different measurements between SoMachine measurement on the monitor and the display measurement on the equipment. The differences were between 1.2 and 2 watt, or 1.68 watt in average. Thus, it was reasonable as in accurate.

TABLE 3 ELECTRIC POWER MEASUREMENTS

| Load power (W) | SoMachine measurement (W) | Current display (A) | Power display (A) |
|----------------|---------------------------|---------------------|-------------------|
| 100            | 95                        | 0.424               | 93.3              |
| 200            | 186                       | 0.840               | 184.8             |
| 300            | 275                       | 1.241               | 273.0             |
| 400            | 370                       | 1.673               | 368.1             |
| 500            | 455                       | 2.061               | 453.4             |

The transmission speed of wireless was around 0.1 ms. The signal strength was influenced by barriers, such as walls. The maximum distance that could be reached was around 15 m. For vertical transmission, it could be reach only one floor higher level. This simulation of data transmission between devices wirelessly works well. All data packets were sent and received on each device.

#### IV. CONCLUSION

Based on the results of measurement and analysis of testing in this research activity, it can be concluded that the method used in the simulation of data transmission wirelessly can run well. The average different reading values between the equipment display and the monitor for the humidity and the temperature were only 0.62% and 0.255°C respectively. While, the active power one was only 1.68 watt in average. The signal strength was influenced by barriers.

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