Preface

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The International Symposium on Nanoscience & Nanotechnology in Life Sciences 2017 (ISNNLS 2017) took place between 28-29 November 2017 at Hotel Santika Premiere, Surabaya, Indonesia. The symposium was organized by the Research Center for Quantum Engineering Design and Faculty of Science and Technology, Universitas Airlangga, Indonesia. ISNNLS 2017 was the fourth annual symposium that initiated and previously held by Research Center for Nanosciences and Nanotechnology (RCNN), Institut Teknologi Bandung, Indonesia.

In the last decade, nanotechnology has advanced, and nanoscale materials are used in everything from chemical catalyst to antibacterial agents. The scientific program of the symposium included many topics in the field of nanotechnology and its role in life sciences. The symposium presented keynote speakers from notable experts of nanoscience and nanotechnology, i.e., Kyle E. Cordova from University of California, USA, Prof. Yoshitada Morikawa from Osaka University, Japan, Prof. Heni Rachmawati from Institut Teknologi Bandung, Indonesia, Dr. Tommy Julianto Bustami Effendi from Universiti Teknologi MARA, Malaysia, and Mochamad Zakki Fahmi, Ph.D. from Universitas Airlangga, Indonesia. ISNNLS 2017 facilitated researchers, scientists, and engineers to exchange ideas and discuss progress in four main tracks, chapter of modeling, chapter of synthesis, chapter of treatment and chapter of supporting.

More than 100 participants took part in the symposium. We received 46 submissions to all main tracks. Papers were evaluated to the high standard. Two reviewers from Program Committee and additional reviewers were assigned to review each article. After the completion of the peer review process, 29 papers were selected for publication in the Journal of Physics: Conference Series (JPCS).

We would like to thank all authors, program committee members, reviewers, and fellow members of the symposium committee for their contribution to the symposium. We also greatly appreciated the publication support from Center for Journals Development and Scientific Publications, Universitas Airlangga, Indonesia.

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UA	Universitas Airlangga, Indonesia
OU	Osaka University, Japan
UM	Universiti Malaya, Malaysia
UiTM	Universiti Teknologi Mara, Malaysia
ITATS	Institut Teknologi Adhi Tama Surabaya, Indonesia

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Design Monitoring Electrical Power Consumtion at Computer Cluster

Design Monitoring Electrical Power Consumtion at Computer Cluster

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Abstract Electricity is one of the basic needs in the era of technological development, where all equipment must use electricity to operate such as computer, so that it requires a system that can monitor power consumption at computer cluster. To monitoring power consumption using WCS1800 to current sensor and microcontroller Atmega32 to data sensor process, and serial communication to send data to display at personal computer. From test system having two result, first is power consumption at computer cluster starting, where current value range is 0 to 38A with power consumption is 0 to 8360 watt. And second is power consumtion at computer cluster execution progran, current value is 27 to 40 A, with power consumption 5940 to 8800 watt. From this system has been design, the power consumption at computer cluster can be monitored and known value of energy consumption.

1. Introduction

Electricity is one of the basic needs in the era of technological development, where all equipment must use electricity to operate such as mobile phones, computers and others. Electrical power is energy value which is absorbed or produced a circuit, energy sources such as electricity will produce electrical power, while the load connected, the system will absorb the electricity. Electrical power is the level of energy consumption in an electric circuit, and the higher watt value will be effect to the grather of power consumed. While electric power is the amount of electrical energy consumtion used every second. And to calculation current, power and voltage using.[1]

$$I = \frac{P}{V} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 1$$
$$P = V \, x \, I \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 2$$
$$V = \frac{P}{I} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 3$$

Where:
I = Current (Ampere)
P = Power (Watt)
V = Voltage (Volt)

High performance computing (HPC) is a PC group that are strung together using local area network (LAN) with high-speed to getting better computer performance. The purpose of making HPC is for user to using multiple processor at once when computer is working, in this way computer performance becomes faster because it can working in parallel[2]. Computers-clusters are very closely related to parallel performance that uses multiple processors at once. Cluster performance improvements compared to the number of processors added by Gene Amdahl in 1967[3].

$$S_{laten}(s) \frac{1}{(1-p) + \frac{p}{s}} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (4)$$

Where SLaten is the addition of speed theoretically, while laten is addition speed at the time execution, and p is the percentage of execution time. The law provides that the number of additions to the processor is not linearly proportional to the increase in speed produced[4]. Excessive processor addition results in the high cost of computational processes[5]. So that efficiency is obtained, for some processes it should be calculated how many of the most efficient processors that can be used[6].

The Winson WCS1800 current sensor provides economical and precise solution for both DC and AC current sensing in industrial, commercial and communications systems. The unique package provides easy implementation without breaking original system and makes current sensing possible. Typical applications include motor control, load detection and management, over-current fault detection and any intelligent power management system.[7]

Microcontroller Atmega32 having flash memory capacity is 32kb (kilobyte), and microcontroller 10-bit CMOS series created by Atmel. In general, the AVR having several class, Attiny, AT-Mega and other. To identify AVR class is the memory, peripheral, function, from architecture and instruction all same AVR series[8]. Many aplication that use microcontroller like robotics[9], sensor instrumentation, temperature control and monitoring system[10].

Electronic equipment such as computers is very important in the world of industry and education, where all processes can be monitored and simulated in computers. The example is parallel computer cluster where the computer is able to process data very quickly, because used of computers in parallel, the consumes a lot of electricity. In this problem, how can the power consumption of cluster computers be known and monitored for power usage. From this, the researcher creates a system that can monitor electrical power consumption on a computer cluster.

2. Design and Method

Design system from this research having several parameters to getting characteristic and data, and figure 1 is design computer cluster.

Figure 1. Design computer cluster

Design system to electrical power consumtion at figure 2, the system has several components, including transformator AC to DC having fungtion to convert the AC voltage to DC voltage, minimum system Atmega32 as processor, current sensor WCS1800, Liquid crystal Display (LCD), Serial Communication to send data from system to display at personal computer (PC).

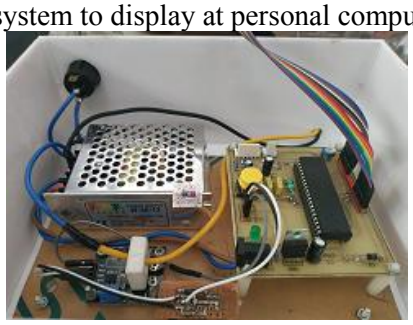

Figure 2. Design system

To optimally system of electrical power consumtion at computer cluster, the researcher makes a block system. And at the figure 3 is diagram block system of electrical power consumtion at computer cluster.

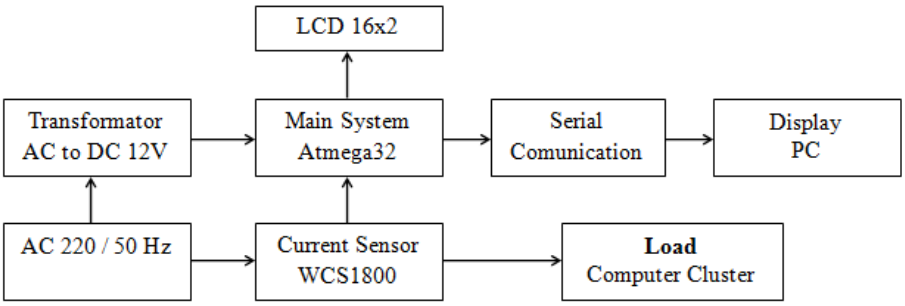

Figure 3. Diagram Block System

Diagram block system at figure 3, can giving information how to electrical power monitoring. Transformator AC to DC will convert AC voltage 220 to DC voltage 12, and the main system of minimum system Atmega32 will be active. Current sensor WCS1800 will capture the current from AC 220 to load computer cluster, sensor sending data information to main system Atmega32. Data will be process at main system, and the data will sending to LCD 16x2 to display current value, and serial communication to display graph at personal computer. And at figure 4 is flowchart from system of electrical power consumtion at computer cluster.

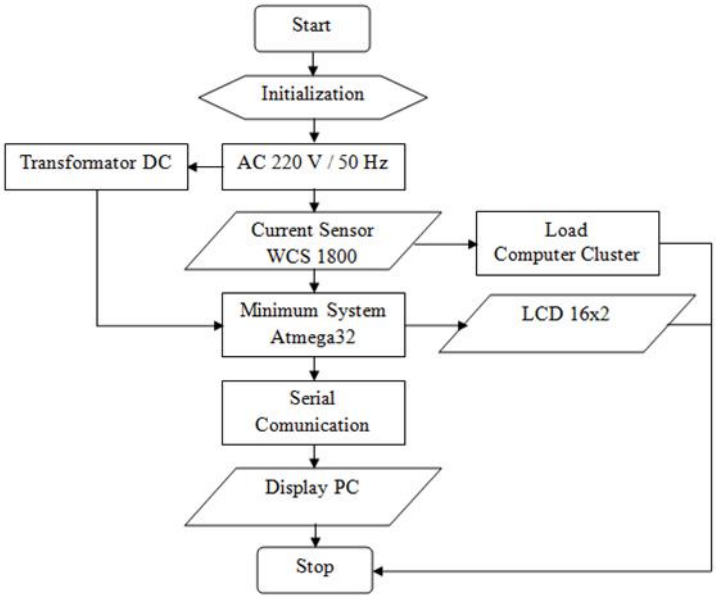

Figure 4. Flowchart System

From flowchart a figure 4, the current sensor getting value of current from cable AC 220 V to load computer cluster. Data will send to main system Atmega32, and data will process to getting electrical power value, main system will convert data from current to be power consumption. Data will display at LCD 16x2, and the data will send to serial communication to monitoring value of power consumption.

3. Result and Discussion

From this reseach having several result to optimally electrical power comsumption monitoring at computer cluster. First is WCS1800 sensor testing, from it to find out the current consumption, and find out difference batween calculation and measurement. To calculation current using formula 1. And at the tabel 1 is testing result.

Table 1. Difference current calculation and measurement

No	Input voltage (AC)	Power (Watt)	Current Calculation (Ampere)	Current Measurement (Ampere)	Difference Calculatin and Measurement (A)
1	220	5	0,023	0,019	0,004
2	220	10	0,045	0,038	0,007
3	220	40	0,182	0,174	0,008
4	220	100	0,455	0,451	0,004
5	220	350	1,591	1,588	0,003
6	220	600	2,727	2,717	0,010
7	220	1000	4,545	4,538	0,007
8	220	1800	8,182	8,185	0,003
9	220	6000	27,273	27,182	0,091

Result from table 1 is current calculation and measurement, where the greater power usage the more current is needed. Data result at the power is 5 watt, the current calculation is 0,023 A and from measurement is 0,019 A,difference current calculation and measurement is 0,004 A. and the power is 600 watt the current calculation is 2,72 A and current measurement is 2,717 A, and the all result can see at the table 1. Figure 5 is graph difference current calculation and measurement.

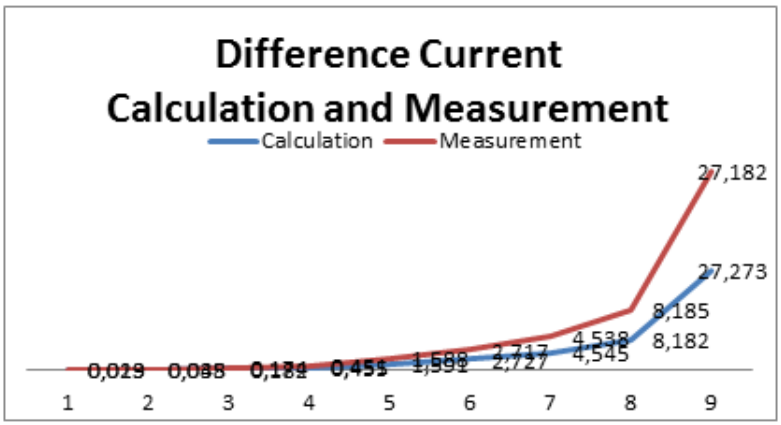

Figure 5. Graph current calculation and measurement

WCS1800 sensor measurement and calculation result, getting difference value between 0,003 to 0,091 A, this is caused by environmental factors such as, temperature and humidity which effect sensor read. The next test is computer starting, figure 6 is display monitoring power consumption at komputer starting.

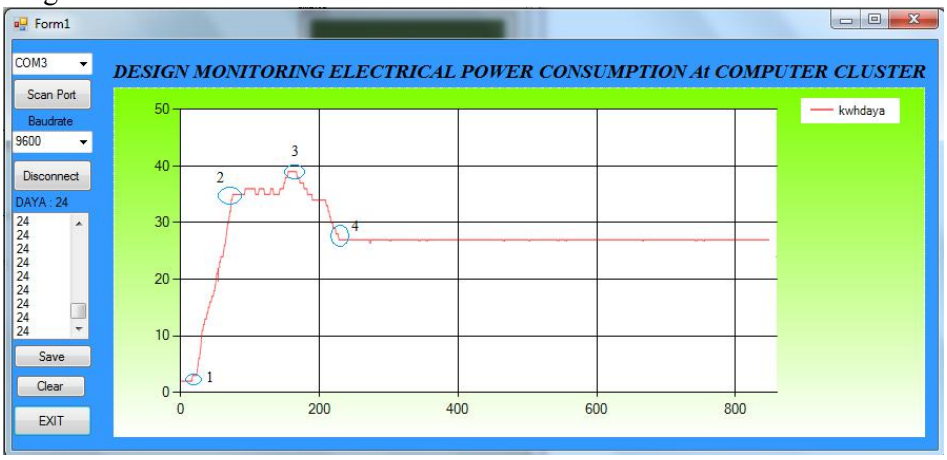

Figure 6. Graph at computer cluster starting

From result at the figure 6 is graph computer cluster starting, where number 1,2,3 and 4 is current value. Current value at computer cluster starting is 38 A, it because all the system computer is running. At the table 2 is the result of current, and to getting result power consumption using formula 2.

Table 2. value of current and power consumtion at computer starting

No	Computer Cluster (condition)	Current (A)	Power (Watt)	Keterangan
1	Off	0	0	Computer Off
2	Starting	34	7480	Computer first starting
3	Booting	38	8360	Booting computer
4	Ready	27	5940	Computer ready

Result current and power consumption at the table 2 is computer cluster condition starting, booting and ready. Where at starting condition current value is 34 A and power consumption 7480 watt, at computer booting, current value is 38 A and power consumption is 8360 watt. And current value 27 A and power consumption 5940 watt when computer is ready. The next test is computer cluster running or execution program, result can see at the figure 7 and table 3.

Figure 7. Graph execution program at computer cluster

From test getting several result, when computer cluster is ready position the current is 27A, and when computer cluster running program for executing program, current result is 37 to 40 A, wit power consumption is 8140 to 8800 watt. And table 3 is value of power consumption when computer cluster execution program.

Table 3. Value of curren and power consumption at computer cluster execution program

No	Computer Cluster (condition)	Current Consumtion (A)	Power (Watt)	Keterangan
1	Ready	27	5940	Computer ready
2	Running Program	37	8140	Computer execution program
3	Running Program	34	7480	Computer execution program
4	Running Program	40	8800	Computer execution program
5	Finish Running	25	5500	Finish execution program

From result at the table 3, value of current and power consumption at computer cluster execution program, where can see the greater the current, the greater the power consumption. From this system testing, the cluster computer power consumption is obtained when running and executing the program.

4. Conclusion

This research having several result to find out value of power consumption on computer custer, where using WCS1800 to current detector. From result getting current value at computer cluster ready is 27A and power consumption is 5940 watt, at computer starting current value is 38A and power consumption is 8360 watt, and at computer execution program current value is 40A with power consumption is 8800 watt. From this research, the system can monitor of power consumption at computer cluster.

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