Wireless Communication for Remote Power Monitoring on Utility Electric

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Wireless Communication for Remote Power Monitoring on Utility Electric

Azhar[1], M Kamal[1] and Subhan[1]

Electrical Engineering Department, Politeknik Negeri Lhokseumawe, Lhokseumawe, Indonesia.

Email: azhar@pnl.ac.id

Abstract. One of the results of the monitoring of electric power is to perform monitoring and security analyses. among others. a power utility electricity namely electric parameter monitor way such as voltage, current. power factor. frequency, apparent power. real power. reactive power and electric energy, Operation power remote monitoring this work based on data or electrical parameter information displayed by the power meter PM9C then forwarded to ethernet gateway, In this research the method of electrical parameter data communication that is by utilizing the device wireless ADSL2+modem router to transmit electrical parameters and data received by the personal computer, Powerlogic EGX300 software displays two groups of electrical parameter data is real time page and device logging, On the real time page consists of a single device pages. trending and device summary, Device intended for logging access each measuring device which is connected to utility power, The results of the communication data without wires. in the monitoring of the powerlogic EGX300 software can display data parameters in the form of electricity metering. electrical parameter data and trending curve. Electrical parameter data include voltage. current. power factor. frequency. apparent power. real power. reactive power and electric energy (kWh. kVARh. kVAh).

1. Introduction

Generally, in the measurement instrument is needed as a way to specify a physical quantity or variable, These instruments help to the improvement of human skills, and in many cases allows one to determine the value of an unknown quantity. Development of measurement technology, equipment instruments electric has been able to do measurements and acquired data on the real time scale. Instrumentation system was designed using digital technology. where this equipment has the ability of multifunctional data acquisition that can switch from a variety of measurements to the measurement of the variation of other quantities.

Measurement of electric parameters in an electrical system is indispensable, where every change of the load will be followed by a change of generation. Fluctuating load variation based on change of time is extremely affecting electrical parameter contains. Its impact is the increase in loss-loss of heat and the declining age of usage equipment is concerned. Electrical power monitoring is important in electrical system of an industry providing electrical energy or/and the manufacturing industry, therefore monitoring electrical power is significant to the work process and results in its production.

Application for monitoring system on electric power control center is designed with attention to the needs of the various purposes of analysis operations by using some software. The required application on the management system of energy and distribution management systems or automation for the

needs of customers must be appropriate to the needs of the electrical system. The software made modular so that it can be developed and tailored to devices-other application software that may be required at the time of the upcoming development of electrical networks.

Energy management is defined as the process of managing resources and energy consumers in a network to improve the performance and lifetime of the network [1]. A system of modern energy management system platfom most can implement application software for automatic generation control that can transmit signals N to raise or lower the power output per plant who participated in setting a balance between load by the amount of the active power generated power generation units [2]. The N signals are made flexible so that it can be modified to follow the criteria which are used to obtain the balance of power system between the load with a power resurrected the system achieved with the most economical cost and operation optimum fit with the network and power generation units [2].

The software used to carry out the reading of each meter customers automatically. These data include the amount of energy used, the range of loading, the highest peak loads and periods of peak load loss of large, active power and reactive power consumed [3]. For every two times the readings that are not successful then the reading that is considered valid is the reading of the latter expressed with "last good data" [4]. This application must have the ability to make scheduling a reading of meter customers. Scheduling a reading of meter-a meter must be able to run automatically on the date and time that can be programmed in advance. The values of energy (kVAh, kWh, kVARh) read placed on real time database so that the operator can edit the appropriate requirements.

In this research software powerlogic EGX300 is used to monitor the electrical parameters in the form of tabulated data and metering, trending curve of electric energy. Any change of parameters due to changes in electricity load of electric motor of 1, 2, 3 and 4 in electrical power utilities, detected with the help of a current sensing element in the form of current transformers and forwarded to the power meter PM9C. Power meter measuring instrument PM9C integrated technology-based information and are able to pass on electrical parameter data in the form of digital signals to the device Ethernet gateway and monitored through a personal computer. Utilization of data communication method without this cable is allocated in order to access the electrical parameter data provide different distances and in real time. The electrical data shown powerlogic EGX300 software in the form of voltage, current, real power, reactive power and electrical parameters such as kVAh, kWh and kVARh.

2. The monitoring of electrical power

The monitoring of power, in fact, is to manage costs and make the system features high reliability. By doing the monitoring of the quality of power is expected to reduce the cost of power generation, improve services and repair utility. One of the results of monitoring is to perform monitoring, among others, to analyze the security of a power system that is, by the way, the monitor power flow quantities and voltage-the voltage on each bus. With a simple measurement of the quantities can easily be compared to the limits the ability of the elements of the power system, where the results can be used to anticipate actions that need to be done before disturbances develop into serious. In general the measuring system can be seen in Figure 1.

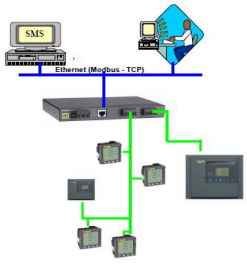

Figure 1. System topology monitoring of electrical power [5]

2.1. Data communication system

The need for a network of data varies significantly depending on the desired application [6]. At this point a breakthrough decision has done is a network that can be used are general and can connect with the various terminals with an unlimited number of users. Data communication system between the two terminals, there are two basic essentials [6]:

1) The components of a data channel
2) protocols and procedures in a data communication system that is used

The basic component of a channel data between several terminals can be seen in Figure 2. shows each terminal consists of data communication devices connected to each other using a funnel or channel data. One of the components of a data channel is called the Data Terminal Equipment (DTE), serves as an interface for sending and receiving data to and from the terminal to terminal communication data sources. This communication can be done either in parallel or in series [7]. If there is no network activity, the computer transmits data, if there is another cable in transmission, the computer will wait and retry the transmission of data. When two computers perform transmission at the same time, each computer will be back and will wait for a random chance to transmit the data back. This method is known as the coalition and will have no effect on the transmission speed of the network. This bus Ethernet model can be seen in Figure 2.

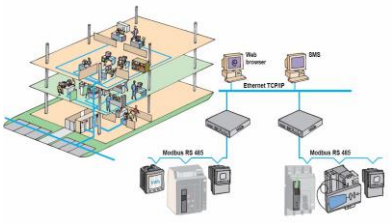

Figure 2. The concept of data communication system inter-terminal [7]

2.2. Power meter

Power meter is a tool that is able to monitor the power on electrical installations. In a module or electrical system. In General, power meters can measure and monitor electrical system 1 phase and 3 phase [3]. There are many parameters that can be measured by the power meter. Power meter can work with the electric quantity sensor called a current transformer (CT). Electric quantity measurement result by CT will be arriving by the power meter to the next calculated with a base voltage read by the power meter, so that the results of a particular gauge can be displayed on the screen or reading of indicators. The base of the power meter is the kWH meter in the form of digital only on power meters there is the addition of some features PM9C measurements [5]. In Figure 3 shows the PM9C meter power used in electric power monitoring utility.

Figure 3. Power meter PM9C [5]

2.3. Powerlogic Ethernet gate way EGX300

PowerLogic EGX300 Ethernet Gate Way is the gate integrated server only needs a web browser from an Ethernet network to login and display real-time data and trend plots up to 64 PowerLogic System devices [8]. To be able to communicate with other devices have to use modbus RS485 Protocol [8]. In

the PowerLogic EGX300 Ethernet Gate Way there is the function of a web page and has 256 Mb of onboard memory which allows to display the page as well as view the data from the stored electrical system on a web page [8]. The document data of the electrical power measurement results can be monitored in real-time during the system continues to run. Physical form PowerLogic EGX300 Ethernet gate way can be seen in Figure 4.

Figure 4. PowerLogic Ethernet gate way EGX 300 [8]

2.4. Wireless ADSL2+ modem router

54Mbps Wireless ADSL2 + Modem Router is the router modem which has high performance and have a full rate ADSL2 + standards with high reliability and relatively low cost [9]. 54Mbps Wireless ADSL2 + Modem Router is the 3-in-1 device that combines the functions of high speed DSL modem, 4-Port 10/100Mbps NAT router and wireless G access point [9]. Wireless Network or a wireless network is a technology that is already in common use by all parties. Used by your ISP (Internet Service Provider).

Data transfer rate of 11 Mbps, starting 54 Mbps, 108 Mbps, 300 Mbps even more [9]. With the higher speed of data transfer is what makes the users or users feel quite fulfilled the needs of data access (particularly for Corporate) so that there is no longer doubt the speed of data transfer because as soon as the transfer UTP cable using the data in the range reaches 50 meters both indoors and outside room with unobstructed and not the wall of the building [9]. In Figure 5 shows 54Mbps Wireless ADSL2 + Modem Router.

Figure 5. 54Mbps wireless ADSL2+modem router [9]

3. The method of monitoring the utility electrical power over long distances

The concept was developed to monitor electrical power over long distances is by applying the method of communication without wires. Application of monitoring of electric power is based on the standard IEEE and IEC, raw and become part of multilevel measurement information to help get into various issues of electric power. The flexibility of monitoring for the count, sort and estimate energy based traits, helping the energy policy makers for managing and lower total energy costs, so that at any time can be displayed and stored energy data with more freely and accurately. Figure 6 shows the architecture of a monitoring system of electric power.

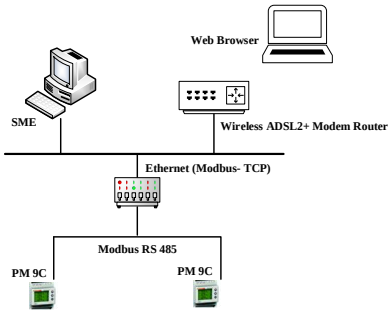

Figure 6. The architecture of monitoring system of electric power

3.1. Configuration address wireless ADSL2 + modem Router

Wireless ADSL2 + Modem Router is used to make settings for network traffic from mobile radio to a wired network connection or from being the main path (backbone) wireless network client/server. This is radio based equipment namely receiver and transmitter are connected with a LAN cable or broadband Ethernet. Setting the address of the Wireless ADSL2 + Modem Router can be done by connecting the personal computer through the cable UTP. The address of the IP address entered is the address 192.168.1.1 the default gateway of the router. The other settings are the IP address 192.168.1.100 and End IP Address 192.168.1.199. In Figure 7 shows the setting of the Wireless ADSL2 + Modem Router that is used to power communications on monitoring electric power.

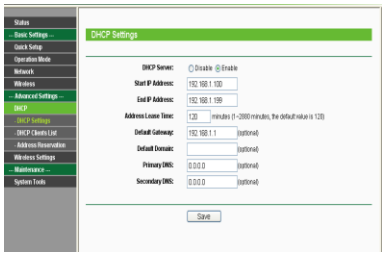

Figure 7. Setting wireless ADSL2 + modem router

3.2. The Electrical power monitoring operating mode

On a personal computer in the PowerLogic EGX300 software install to display the parameters of the virtual power such as voltage, current, power, power, all real, reactive power, power factor, frequency, energy and electrical energy needs either a single-phase or three-phase. To be able to display the parameters of electrical power, the need for access to the pages of the website by entering the address 192.168.1.3. Figure 8 shows the page of the website to access the PowerLogic EGX300.

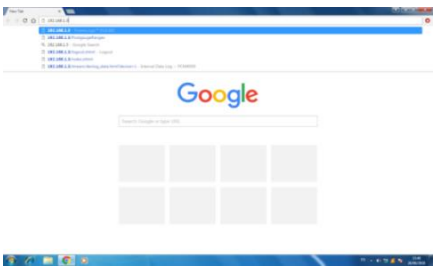

Figure 8. Page website address 192.168.1.3

Generally, power logic EGX300 has five start menu i.e monitoring, control, diagnostic, maintenance and setup. Operation power remote monitoring this work based on electric power information or data displayed by the PM9C is then forwarded to the PowerLogic EGX300 Ethernet Gate Way. Wireless ADSL2 + Modem Router serves to transmit electrical power and data received by the personal computer. Figure 9 shows the powerLogic EGX300 software display with start menu monitoring, control, diagnostic, maintenance, and setup.

Figure 9. PowerLogic EGX300 basic display

To be able to display the monitoring power i.e. by clicking menu monitoring. Monitoring menu will feature two groups of electrical parameter data i.e real-time page and device logging. On the real-time page consists of a single device page, trending, and device summary. While the device logging contains a device that is accessible to the powerlogic EGX300. On. Figure 10 shows the real-time display of the page and device logging.

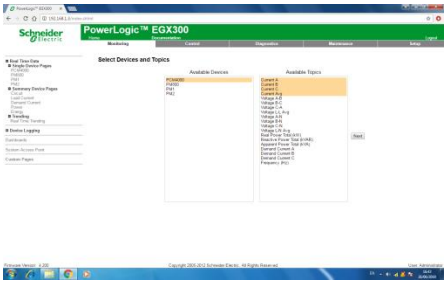

Figure 10. Display real time data and device logging

Single data devices pages include measuring equipment setup with powerLogic EGX300 software, in this study i.e. PCM 4000 and PM800. For summary devices pages i.e. circuit, load current, demand current, power and energy. While trending includes real time trending. Device logging is a menu to display a single device page measuring device and summary device pages. In Figure 11 indicates the display device logging on software EGX300 logging power.

Figure 11. Display device logging

3.3. The electric power utilities

In this study, the utility electrical power is an electric motor load control center three phases. Each has an electric motor power 0.4 kW kW, 0.3, 0.9 kW and 1.0 kW. The electric motor is operated manually as needed such as water pumps, conveyor, elevators and lighting. Control Panel utility electrical power is complemented by an integrated electrical power monitoring systems namely power monitoring (PM) 1 and 2 which have the ability to forward the digital data to another monitoring system at the location different in the range distances. Wireless data communication is done using wireless communication equipment Wireless ADSL2 + Modem Router. In Figure 12 shows a diagram of a line of utility power system load electric motor three phase.

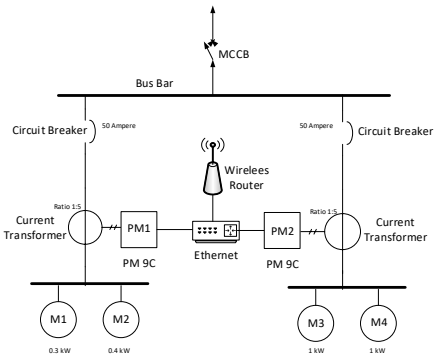

Figure 12. Diagram a line of electric power utility system

Electrical power parameters such as voltage and current sensed by current transformers 1 and 2. This voltage and current parameters passed to the power monitoring 1 and 2 on the side of the input voltage and current. Power monitoring 1 and 2 to calculate the voltage and current parameters and digitally displays voltage, current, power factor, frequency, apparent power, real power, reactive power and electric energy (kWh, kVARh). In Figure 13 control panel utility electric power electric motor, 1.2, 3 and 4.

Figure 13. Control Panel utility

4. Result

Utility electrical power is made of two parts namely monitoring power 1 and 2. Electrical power monitoring results can be displayed by running electric motor 1.2 3 and 4. On the utility power 3 phase 380 volts, there is a certain amount of control equipment and measuring instruments. Series 3 phase electric motor control assembled in the hyphen. For the measuring instruments installed PM9C for PM1 and PM2, PM9C.

Powerlogic EGX300 software, the monitoring menu showing two groups of electrical parameter data IE real time page and device logging. On the real-time page consists of a single device pages, trending and device summary. While the device logging contains a device that is accessible to the powerlogic EGX300 in the shape of the curve. The electrical parameter that is displayed i.e. voltage,

current, power factor, frequency, apparent power, real power, reactive power and electric energy (kWh, kVARh).

4.1 Electric parameter measurement PM9C

Electrical parameters of PM1 for electric motor 1 and 2. Table 1 shows the results of the measurement of electrical parameters using PM1.

Table 1. Electric parameter measurement results PM1.

Load Electric Motor 1 and 2							
Load Current (A)			**Power**			**Power Factor Total**	**Frequency**
I_a	**I_B**	**I_C**	**Apparent (VA)**	**Real (Watt)**	**Reactive (VAR)**	**Cos φ**	**Hz**
2.62	2.47	2.61	1.77 K	0.76K	1.61K	0.42	50.2
Voltage (Volt)						**Energy**	
V_{ab}	**V_{bc}**	**V_{ca}**	**V_{an}**	**V_{bn}**	**V_{cn}**	**Real (Watth)**	**Reactive (VARh)**
397.6	398.7	401.2	232.6	229.5	229.2	21.0K	59.7K

While the electric motor for PM2 3 and 4. Electric parameter measurement results using PM2 is shown in Table 2.

Table 2. Electric parameter measurement of PM2 results.

Load Electric Motor 3 and 4							
Load Current (A)			**Power**			**Power Factor Total**	**Frequency**
I_a	**I_B**	**I_C**	**Apparent (VA)**	**Real (Watt)**	**Reactive (VAR)**	**Cos φ**	**Hz**
2.84	2.77	2.78	0.64K	0.17K	0.62K	0.28	50.2
Voltage (Volt)						**Energy**	
V_{ab}	**V_{bc}**	**V_{ca}**	**V_{an}**	**V_{bn}**	**V_{cn}**	**Real (Watth)**	**Reactive (VARh)**
392.3	393.9	402.5	233.5	221.3	229.7	36.14K	42.03K

4.2 Real time data

Basically, the powerlogic EGX300 software can display the electrical parameters in the form of tabulated data metering, and curves. Electrical parameters displayed by the software EGX300 i.e. voltage, current, power factor, frequency, apparent power, real power, reactive power and electric energy (kVAh, kWh, kVARh). These electrical parameter data is data the electrical parameters is updated based on the time of measurement and at any time can be changed according to changes in load and time. Real time display of data results in the form of tabulated data and metering of electric parameter can be seen in Figure 14.

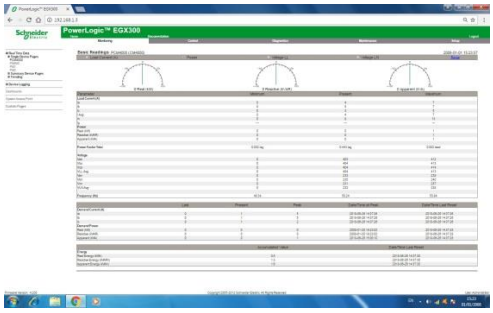

Figure 14. Real time electrical parameter data

4.2.1 Summary devices

Summary of electrical parameter measuring devices is based on each unit parameters such as the load circuit, current demand, current, power and energy. On circuit shows the equipment connected to the electric power utilities. For load current shows the current value of each load. Demand factor is the amount of current that needs by any load. Power is the power that is consumed by any load on the electric power utility. And for electric power consumption i.e. energy per load of unity of time. In Figure 15 shows the electrical parameter data summary display device current a, b, c and the current average.

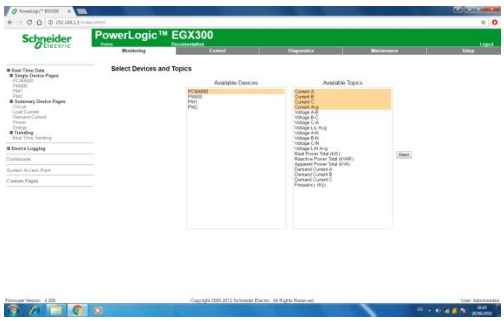

Figure 15. Summary device current a, b, c and current average

4.2.3 Trending

Trending is a tendency any time-based electric parameter. Each electric parameter is displayed in the form of curves. Trending curve parameters this includes all electrical loads connected to the electrical power utilities, namely electric motors of 1, 2, 3 and 4. Change the load at all times and spur of the moment can occur in electrical power utilities. Powerlogic EGX300 software has capability display each electric parameter behavior in a certain time. The curve of these electrical parameters, trending for each energy policy makers in taking actions or decisions about the management and control of electric energy. Electric parameter trending curve shown i.e. demand current A, B and C. Whereas energy i.e. the total apparent power (kVA), real total power (kW) and reactive power (kVAR) total. Figure 16 shows the trending curve parameters of electrical energy.

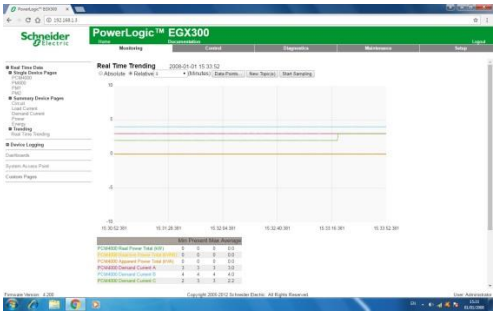

Figure 16. Trending parameters of electric demand current and energy

4.2.4 Device Logging

Device logging is intended to access each measuring equipment connected or used to perform measurements of the electrical parameters in electric power utilities. Electrical measuring equipment is generally mounted on the control panels and spread in every location the distance not allow access by operators of electricity. Powerlogic EGX300 software makes it possible to display any electrical parameter measuring equipment of what is different. The electrical parameter that is displayed i.e. voltage, current, power factor, frequency, apparent power, real power, reactive power and electric energy (kWh, kVARh). Figure 16 shows the device logging apparent energy of PCM4000.

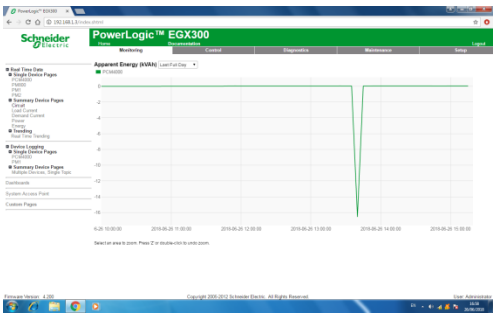

Figure 3. Device logging apparent energy from PCM4000

5. Conclusion

The measurement of power, in fact, is to manage costs and make the system features high reliability. By monitoring the electrical power generation is expected to reduce costs, improve service and repair utility. One of the results of the monitoring of electric power is to perform monitoring, among others, to analyze the security of electric power utilities, namely by means of monitoring any electrical parameters on the bus.

Operation power remote monitoring this work based on the method of communication without wires. Any data or information the electrical parameter that is displayed by the measuring instrument integrated PM9C, then routed to Ethernet gateway. Wireless ADSL2 + Modem Router that serves to transmit the electrical parameters and data received by the personal computer. Powerlogic EGX300 software, the monitoring menu showing two groups of electrical parameter data i.e real-time page and device logging. On the real-time page consists of a single device page, trending and device summary. While in the device logging contains a device that is accessible to the powerlogic EGX300 in form in the shape of the curve. The electrical parameter that is displayed i.e. voltage, current, power factor, frequency, apparent power, real power, reactive power and electric energy (kVA, kWh, kVARh).

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