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Development of Smart Monitoring System for Wind Energy System

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Abstract— **The paper presents the development of monitoring system for a wind turbine prototype system. The proposed monitoring system is developed by the Labview computer programming. The system can connect to the wind turbine via the internet – as well as acquire monitored values and upload values into memories. Meanwhile, the system will show real-time values. Operating staffs can observe the wind turbine using the monitoring system and can take any actions on-time, if the wind turbine is not working properly. The results of the monitoring system indicate that the monitoring system is able to work properly and information can be used for investigation - the wind turbine and system analysis. The investigation process is very important for wind turbine operation in order to transmit energy to destinations.**

Keywords— Wind Turbine, Monitoring system

I. INTRODUCTION

Renewable energy sources provide realistic alternatives for electricity generation especially, in some remote areas. One of the most promising applications of renewable energy technology is the wind energy system. Current, The wind turbine system is widely used. To retain the wind system working reliably, it is necessary to have a monitoring system to continuously monitor the wind system. The goals of monitoring are normally to:

- Ensure that the system is operating properly.
- Assess the performance of system components, pinpoint faulty devices**.**
- Permit the calibration of tools**.**
- Reveal improvement to the design and increase the understanding of the designer**.**

In most monitoring systems, information is collected from a remote station and sends information to master station. Typically, systems in rural areas are supervised by yearly visits in conjunction with a data logger, but this method leads to the inefficiency of responding time for maintenance. There are some monitoring systems that have been widely used for example, Supervision Control and Data Acquisition: SCADA. However, problems of methods are high investment cost, need special software for client stations, and communication difficulty. These disadvantages make the hybrid system ineffective in economic performance

II. CONCEPT OF PROPOSED MONITORING SYSTEM

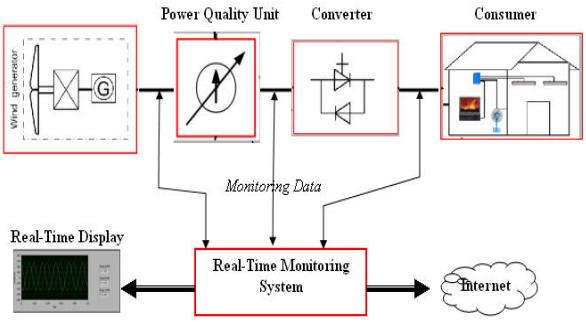

Fig. 1 The proposed monitoring system and the developed wind turbine system.

In Fig.1, the monitoring system will be connected to three points: wind turbine, PQ unit, and a converter which is the output supply of the wind energy system. All monitored data will be stored in a monitoring memory. Operators can access the data at the monitoring system - as well as able to observe the wind turbine by a visual display in Real-Time. Moreover, the monitoring system can provide the monitored data and send over the TCP/IP network or wireless network.

There is no need for any special software for viewing the system. The proposed monitoring system is composed of a monitoring unit (sensor unit), a data acquisition unit, and a communication unit. The data acquisition unit will collect the monitored data from the sensor unit and then stores the monitored data into its memory. After the determination of monitoring system, the system can be developed accordingly to the design.

III. System Development

Data monitoring software is written by Lab View programming tool.

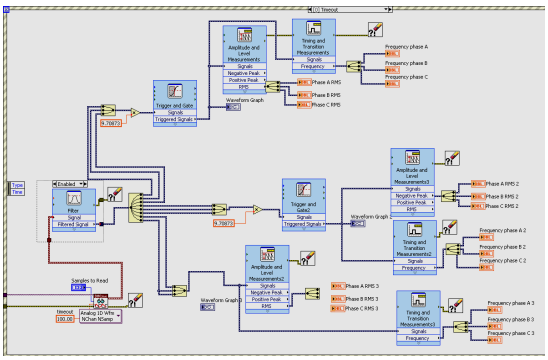

Fig.2 Circuit of data monitoring in LabView program.

The monitoring unit must be able to work with the developed hardware compatibly.Fig.3 shows the development of whole prototype wind system including monitoring system.

Fig 3: Developed prototype wind system including monitoring system

The prototype wind system as shown in Fig.3 is developed according to the design diagram in Fig.1. The wind speed simulator unit will simulate the wind situation and drive the generator accordingly to wind speed profile from operator. The PQ unit will control the power quality of wind turbine by using STATCOM configuration. The power from wind energy system will be connected to a developed converter, then supply to simulating load. The monitoring system is a key of whole system. All parameters will be observed by the monitoring system. The operator can analyze and investigate the wind energy system via the monitoring system. Therefore, the monitoring system must work properly and provide real-time data to operators.

IV. Implementation

The implementation of the system is simulated by a selected wind profile. After inputting the profile to the generator, the PQ unit will control the electric power quality and supply to loads via a converter. The monitoring system provides the visual display which can availably observe the electric power quality of the system. The monitoring system displays through the graphic user interface (GUI) for operators. The graph will show at the point of monitoring. The operator can open the program then the data will be immediately displayed. The feature of monitoring system is shown in Fig.4.

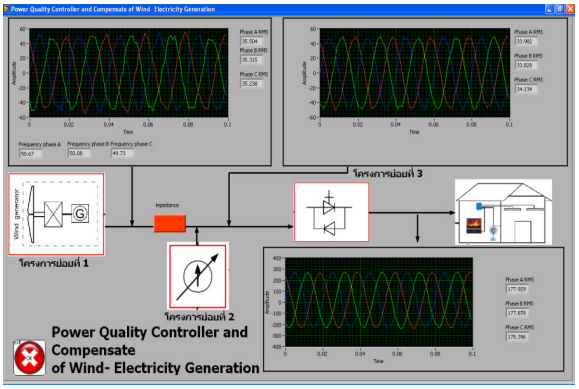

Fig 4. The monitoring system display

Fig.4 shows the test of the monitoring. The data analysis can be started as soon as the operator runs the wind system via real-time display. The operator can also point out at the values which want to investigate by clicking to the area of monitoring then the graph will be displayed as show in Fig. 5. The monitored data are also stored to the main station. Data analysis can be done on a routine basis, for example once a day or a week. This will help the operator to make sure that the system is working properly and when problems occur, the operators can enable an immediate action to the system at the right time.

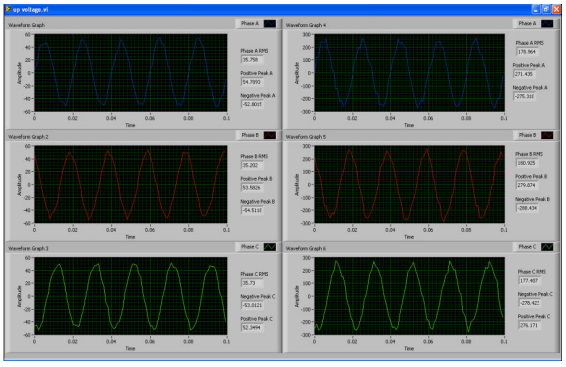

Fig.5. Display of real-time monitoring investigation

As mentioned, the monitored data, which is stored can be comfortably implemented with several programs such as Excel program tool. The operator can download the monitored data from the main station both directly and wirelessly. The monitoring system provides a communication link. The operator can access the data via internet, the operator need only a password to enter the download area. This is very useful for remote monitoring.

From the implantation as shown in Fig. 4,5 the results show that the wind prototype is working properly and the monitoring system can provide the correct data, the operator can investigate the characteristic of the system in order to analyze and for future applications.

V. Conclusion

The paper implemented the real-time internet web-based technology for monitoring of wind energy system. The concept of the proposed monitoring system is that the monitored data is stored into main memory at the site. The operators can access the monitored data directly or via internet. The monitoring system allows the operator to download the monitored data via internet. While at the station, the operator can observe the system as real-time via graphic display. The investigation can be done on time at the station. Moreover, the operator can collect the monitored data for future investigation. From the experiment, the results illustrate that the developed LabView based monitoring system shows itself to be a very suitable solution for wind energy monitoring system.

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