DEVELOPMENT OF DATA ACQUISITION SOFTWARE FOR CENTRALIZED RADIATION MONITORING SYSTEM

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Abstract

Nowadays, with the growth of technology, many devices and equipments can be connected to the network and internet to enable online data acquisition. Centralized radiation monitoring system utilizes a Local Area Network (LAN) as a communication media for data acquisition of the area radiation levels from radiation detectors in Malaysian Nuclear Agency (Nuklear Malaysia). The development of the system involves device configuration, wiring, network and hardware installation, software and web development. This paper describes the software development on the system server that is responsible to acquire and record the area radiation readings from the detectors. Then the recorded readings are called in a web programming to be displayed on a website. The readings with the time stamp are stored in the system database for query. Besides acquiring the area radiation levels in Nuclear Malaysia centrally, additional features such as data conversion from milliRoentgen (mR) to microSievert (µSv) and line chart display are developed in the software for effective radiation level trend observation and studies.

Abstrak

Pada masa kini, dengan perkembangan teknologi, banyak kelengkapan dan peralatan yang boleh dihubungkan ke rangkaian dan internet bagi membolehkan perolehan data atas talian. Sistem pengawasan radiasi berpusat menggunakan rangkaian kawasan setempat (LAN) sebagai media komunikasi untuk perolehan data kadar radiasi kawasan daripada pengesan radiasi di Agensi Nuklear Malaysia (Nuklear Malaysia). Pembangunan sistem ini melibatkan konfigurasi alatan, pemasangan wayar, rangkaian dan perkakasan serta pembangunan perisian dan laman sesawang. Kertas kerja ini menerangkan pembangunan perisian di pelayan sistem yang bertanggungjawab untuk mengambil dan merekod bacaan radiasi kawasan daripada alat pengesan. Bacaan yang direkod ini kemudian dipanggil oleh pengaturcaraan sesawang untuk dipaparkan di laman sesawang. Bacaan dengan setem masa disimpan di dalam pengkalan data untuk carian. Di samping memperoleh kadar radiasi kawasan di Nuklear Malaysia secara berpusat, fungsi tambahan seperti penukaran data daripada miliRoentgen (mR) kepada mikroSievert (µSv) dan paparan carta garisan dibangunkan di dalam perisian untuk kajian dan pemerhatian aliran kadar radiasi yang berkesan.

Keywords: area monitoring, centralized system, server, data acquisition

INTRODUCTION

Currently, internet is widely used in real-time data monitoring and control from monitoring devices located at remote sites. The introduction of computer networking and internet communication technology has enabled data and control signal to be transmitted to any place and location directly and faster without needs of specialized wiring or communication media where the cost was relatively high. The utilization of internet communication permits user to monitor the data and gather the information by using an internet explorer application without needs to install any special software. Besides, the number of the user that can monitor the data is not limited. As long as the users are connected to the network and internet explorer is installed in their computer, they can easily monitor the data by using the provided address or link.

The link to monitor the reading of the centralized radiation monitoring system in Nuklear Malaysia is provided in the Nuklear Malaysia's local web. Therefore, the user needs to connect to network and intranet to access the system website and monitor the reading of the radiation level. In order to enable the data acquisition from the radiation detector monitoring devices or area monitors and display the reading on the website, software that is responsible to collect and record the data needs to be developed. This software basically acts like a buffer and interface between the remote device and the website on internet which can be browsed using computer. The remote device is composed of area monitor that is connected to serial server. Serial server hardware or also known as serial to Ethernet adapter is connected to the area monitor via RS-232 serial interfacing. The data acquisition from area monitor that originally carried out using RS-232 serial interfacing is then convert to LAN interfacing by using the serial server. Hence, the system server where the developed software is installed can be anywhere as long as it is connected to LAN. The overview of the centralized radiation monitoring system is illustrated in Figure 1.

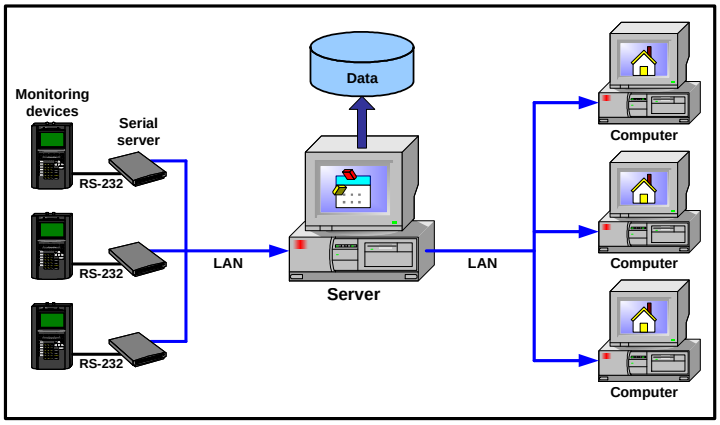

Figure 1. Overview of the system.

METHODOLOGY

On the system server, a graphical user interface (GUI) software is developed to enable the area monitor connection to Nuklear Malaysia LAN, acquire the data, display the acquired data and record the reading. The development is carried out using Microsoft Visual Basic 6.0 (VB6) development package software. The software design is performed by categorizing the elements in terms of function and performance. Three major functions are identified which are data acquisition, data display and data storage.

The hierarchy chart for the top down structure of the program is shown in Figure 2. There are at least five sub or function procedures involve in the GUI programming.

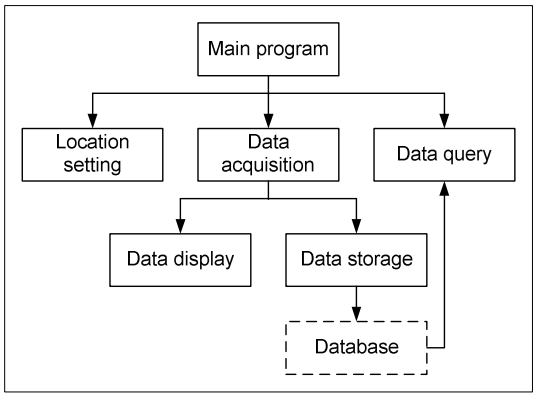

Figure 2. The hierarchy chart for software development.

Before the connection between area monitors and system server can be establish via LAN using serial server device, the location IP address and port needs to be set. Every location in centralized radiation monitoring system is given a static IP address. The IP address is assigned to the serial server connected to the monitoring devices as the location ID for data communication over LAN. The port number is depended on the serial server and the protocol used to transmit the data from the area monitor to server software for display and storage. Currently, the port number for all locations is 10001. Port 1001 uses the Transmission Control Protocol (TCP).

Data is only acquired when the connection with the serial sever connected to area monitor is established. The connection is established using VB6 Winsock control. Winsock control allows implementation of any Internet network protocol in the application. It enables the data acquisition between the monitor device and the server computer via the network. The area monitors used in the system implementation are Ludlum model 375/2. It transmits RS-232 data out every two seconds. For each serial data packet, 14 bytes are transmitted. The first six bytes represent the reading data while the rest of the bytes left represent the status, error and packet footer as shown in Figure 3. Currently only the first six bytes are displayed as the reading transmitted from the area monitor.

BYTE1	*0*
BYTE2	*x*
BYTE3	*x*
BYTE4	*x*
BYTE5	.
BYTE6	*x*
BYTE7	*Audio status = 1 = ON*
BYTE8	*High alarm status = 1 = ON*
BYTE9	*Low alarm status = 1 =ON*
BYTE10	*Over range status = 1 = ON*
BYTE11	*Monitor status = 1 = ON*
BYTE12	*Error code*
BYTE13	*Carriage return*
BYTE14	*Line feed*

Figure 3. RS232 data format [1].

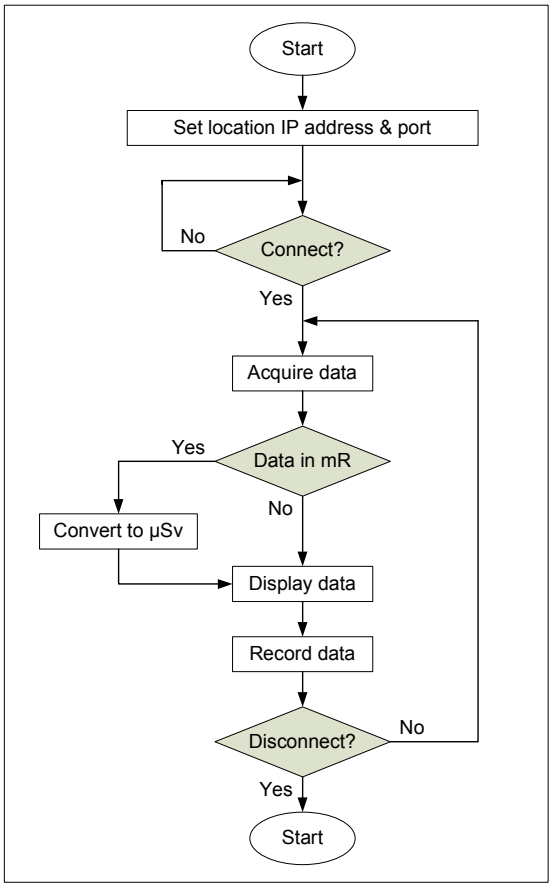

Figure 4. Data acquisition flow chart.

The flow chart of data acquisition procedure is shown in Figure 4 above. The location IP address and port needs to be determined prior to initiating connection for data acquisition. When the area monitors are connected to LAN via serial server using Winsock control, the data is acquired for every two seconds. There are 13 locations are installed with the remote devices which five of them consist of area monitor with measurement unit of mR/hr. Instead of displaying the reading as it is, the reading is converted to µSv/hr for uniformity. The reading for each location in µSv/hr is then displayed and recorded in a database.

Microsoft Access is used as the database of the system. The tables in the database are created based on the number of the system locations. There are three columns in each table in order to store the data ID, time stamp of the reading and the reading itself. The row is generated when a new data is stored. Currently only when the reading is changed, it is stored in the database along with the time stamp. Therefore, there is no constant frequency for the recorded data.

ADO Data Control (ADODC) component of VB6 is used to create a database application. In this system the ADODC component is utilized for data query function implementation. The recorded data in the database is queried by determining the period of the desired data to be queried and displayed. The data is displayed in table and chart form. Besides VB6 Common Control, Chart Control is also used in the software development in order to display the acquired reading in a chart form. Chart control lets a two-dimensional graphical representation of data displayed to be created.

RESULTS AND DISCUSSION

The GUI of the system server software is shown in Figure 5.

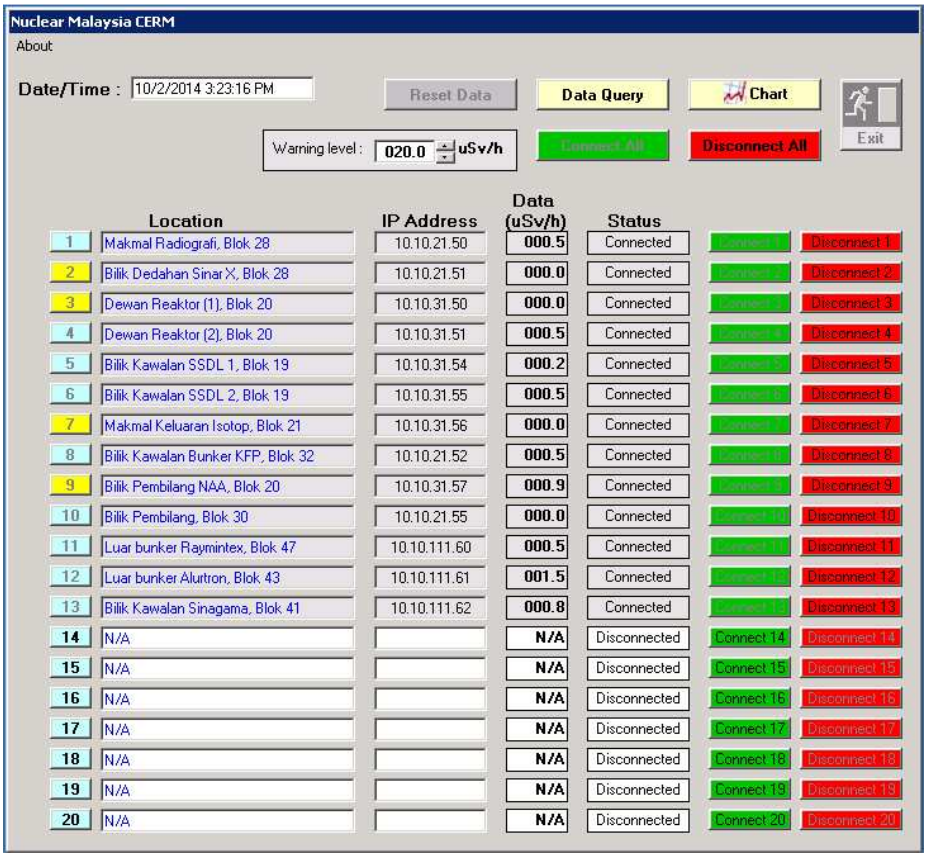

Figure 5. Main GUI of the system server software.

The area monitors located at various locations in Nuklear Malaysia are connected to LAN when the connect button on the server software is clicked. There are two options either connect all locations simultaneously or connect each location one by one manually. Therefore, it is recommended to assign dedicated safety personnel to monitor the server software, reset the location configuration if there is any change and reconnect the location when the communication fails.

Besides basic function like data display and storage, the software can also notified the user by displaying a message box if the acquired data exceeds the configured warning level as shown in Figure 6. More features can be added to the server software to maximize the utilization and potential of the centralized system. As described in the methodology section, only the first six bytes are programmed to be displayed on the developed software. The software can be upgraded by monitoring the device status and error by taking into the account the rest of the bytes in the software programming.

The acquired data is recorded in the database only if there is a change in the reading of the area monitor. Hence, the use of space in a database is optimized. However, based on user request, a uniform data recording frequency can be

implemented. Data plotting versus time is easier when the recording frequency is uniform. The safety personnel can query the recorded data to analyze the trend using the data query form that is shown in Figure 7. The recorded data of any location for a certain period can be retrieved and displayed in a table and chart format. The option to view the real-time data in a line chart format is also provided in the software up to five locations in order to view the real-time data trend as shown in Figure 8.

Figure 6. Warning message box.

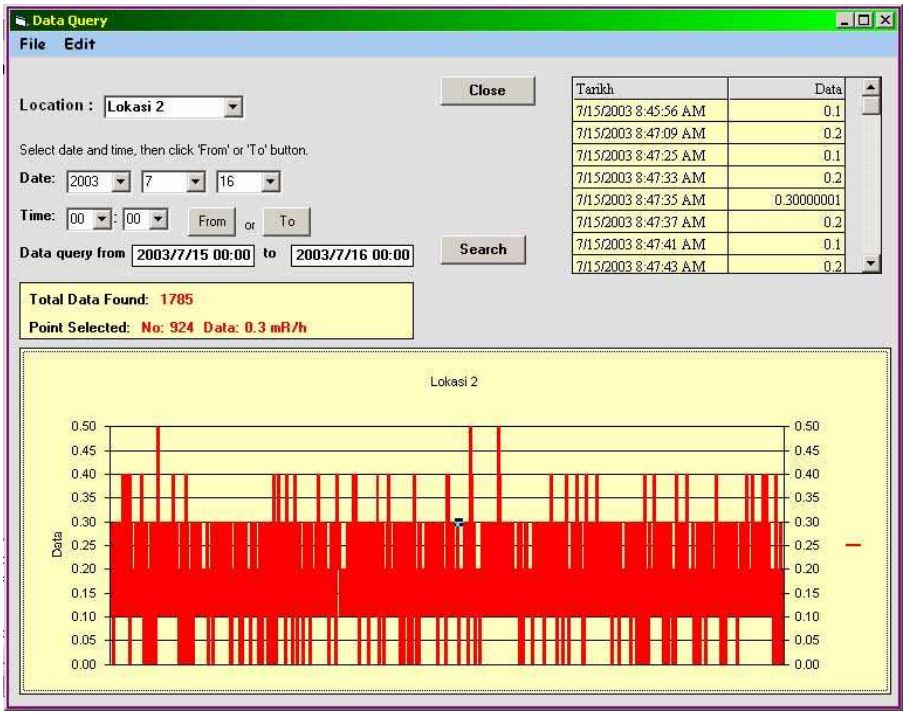

Figure 7. Data query form.

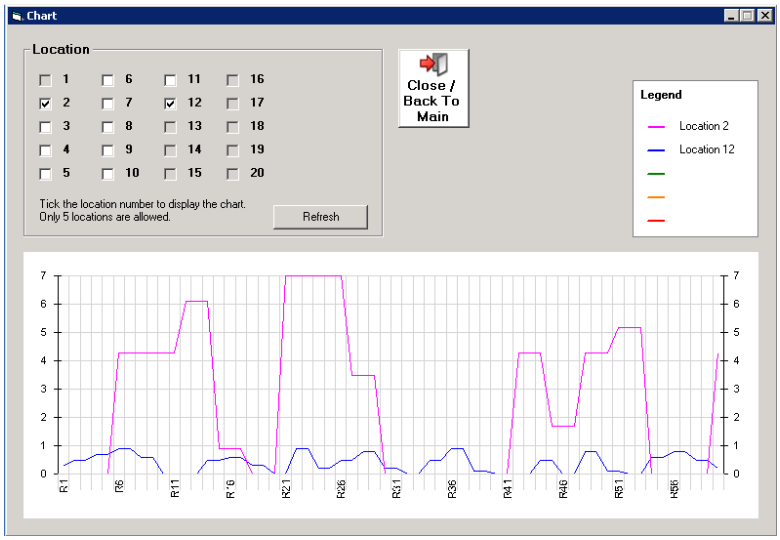

Figure 8. Real-time data trend using line chart.

In future it is planned that Microsoft Access is replaced by MySQL (Structured Query Language) as a database system handler for bigger spaces in data storing. MySQL is an open-source relational database management system (RDBMS). Hence, it is a popular choice of database for use in web applications. In additional, the system will be less dependent on the Microsoft product and it will easier to maintain and upgrade. Regarding to the dependent issue, VB6 is actually outdated development package software and can only be installed on the server with Windows Server 2003 or below. However, the developed software using VB6 is still able to serve the purpose of the system and meet the user requirements for the time being.

CONCLUSIONS

Since the real-time data can easily be viewed online, the main responsibility of the server software is acquiring the data and stores it in the database for record and analysis. For analysis, accurate data is important. When dealing with a real-time data acquisition via network, the network itself and software connection needs to be stable in order to maintain the acquired data reliability and accuracy. Besides, several parameters like electronic noise and background reading of the area monitor needs to be considered. The acquired data in the developed server software can be manipulated based on the user requirement for meticulous analysis.

References

1. Ludlum Measurement, Inc. 2004. “Ludlum Model 375 (375/2 & 375/4) Digital Wall Mount Area Monitor ”

2. M. A. Khalid, M. Omar, M. S. Mohd Yusuf and R. Hamzah, 2002. “Web-Based MINT On-Line Area Radiation Monitoring System”, Prosiding Seminar MINT R&D 2002, MINT, Malaysia, Page 339 – 341.