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Conference Paper

Scada Based Remote Monitoring and Data Acquisition for Energy Management

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Now a day in the power system, conservation of power plays an important role. In this work, it proposed to develop a system for monitoring and accessing the performance of remotely situated devices. For which data acquisition (SCADA) and PLC techniques to monitor and controlling the energy consumption for the entire EEE block SKIT College. The energy consumption details for the same is carried through simulation for the entire block and hardware implementation is carried out for a laboratory and real-time data is traced out. The data so obtained gives clear picture of energy consumption, which can be further used to conserve energy.

Key Words: supervisory control and data acquisition (SCADA), Programmable logic controller (PLC).

INTRODUCTION

Energy plays a vital role in daily life. It is very necessary to have knowledge about the consumption of energy. In many areas, people are facing the problem of load shedding. This is due to insufficient energy generation; intern generation has to increase to meet the demand. Generation of power is a complex process, just increasing the generation capacity would be of no use, if there is no proper energy management on the consumer side. As per the statistics it's been said that every unit of energy consumed on consumer end is equivalent to the three times energy generation.

There are many different techniques that can be employed for energy conservation. The main reason why in this work opted for SCADA and PLC techniques is because of the large amount of data that can be stored in memory and retrieved when required. This technique is more reliable, saves time, minimize risk and also reduce labour and maintenance cost.

Though the initial cost for SCADA system implement is more, but once installed can be used for a long time. Previously this work was accomplished by relays, timers etc. this are the bulky systems, chances of error are more, trouble shooting is difficult. This problem is overcome by PLC. RICHARD E. MORLEY invented the first PLC in 1969 (Gilbertop.azevdo and ayruL.oliveirafilho, 2001). As if till now the SCADA system operation is been only restricted to the generation, transmission and distribution side. In this work the concept of SCADA system in consumer side, so that this can be implemented in domestic sector.

A. Energy management:

An energy management is a system used for surveillance of energy consumption. It helps in optimizing the utility of energy. It reads numerous energy meters and simultaneously monitors different division to save bulk energy consumption. It can detect over loading from a section and enable control measures to against it.

B. Supervisory control and data acquisition:

Supervisory control and data acquisition (SCADA) works like a supervisor who supervises the entire plant area, also control the process as well as it converts the data segments for storing process value. The main function of the SCADA system is the collection of data and supervisory level (JimSee *et al*., 2008).

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SCADA is software designed to view an industrial process or real time environment in a much elaborated and simple way. So the end user can easily use it with graphical user interface. So SCADA can be classified as monitoring software. SCADA as mostly used in industrial process where a vast area of process is going on and sometimes even in small applications. It can communicate to any of the protocol. It runs on PC and conservation of data is possible. SCADA system is a branch of instrumentation engineering, which consists of input output signal hardware, controller and human machine interface (HMI), networks data bases, communications and software[K. Collins *et al*., 2012). It usually refers to centralized system which monitors and control the entire process.

C. Programmable logic controller:

Programmable logic controller (PLC) works by looking at its field inputs and depending on their state, and the user entered program, terns ON/OFF field output. PLC programming is written in high level language which is easier for understanding. This system perform many functions providing a variety of analog and digital input and output interfaces. Input stimuli are received from machines sensors or process events in the form of voltage and current. The PLC accurately must interpret and convert that stimulus for the CPU which intern defines a set of instructions to the output system (Theodora C *et al*., 2008). A single PLC can run many machine at same time if there working procedure is same. The PLC has capability for handling several inputs and outputs signals.

IMPLEMENTATION OF SCADA SYSTEM IN SKIT EEE BLOCK

The various classrooms and labs are connected to SCADA system as shown in figure 1. Monitoring and controlling is used to get details of the energy consumed and energy conservation can be done.

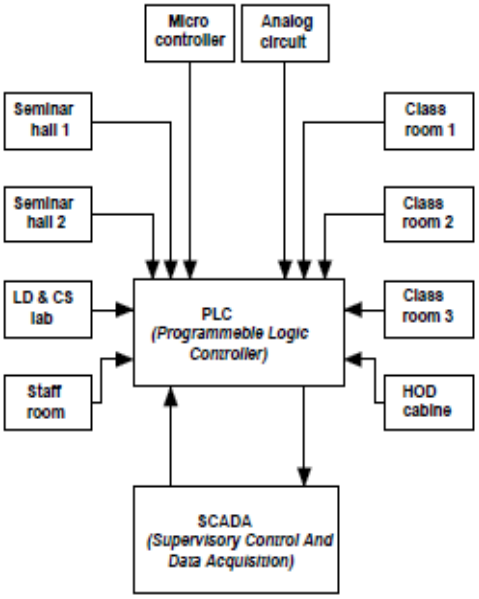

Fig 1: Layout of SKIT EEE block

In order to efficiently reduce the amount of the electricity usage in the residential area, the demand response (DR) of the consumers is of importance. The in-home display (IHD) system provides energy monitoring information for the consumer Demand Response (J. Barreiro-Gomez *et al*., 2015). Recently, we have a in home Display systems, There are situations like, we are going outside and power is not there. So we will forget to switch off all fans and lights. If the power comes, before we come back to our home leads to power wastage. By using our project we can reduce power wastage, by the same time data is maintained. the appropriate message to trip off those power, we can switch off all equipment and thereby reduce the power consumption, Using this project farmer can trip OFF & trip ON his pump set and also known current information about the remote place, by doing little modifications, it can be used as home appliances controller.

A. Operation of SCADA system:

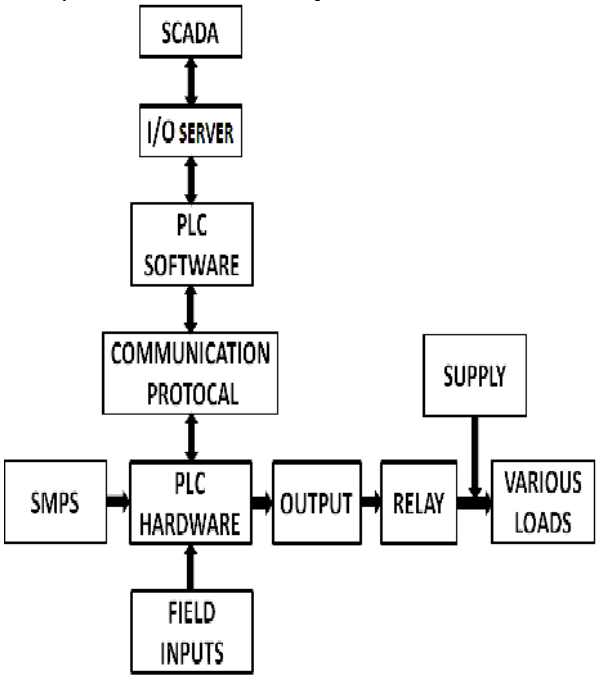

Fig 2: Flow chart of SCADA system

SCADA is used to monitor and control various operations in given system like college, hospitals, apartments etc. from a remote location.The figure2 shows the operation of SCADA system.SCADA alone is not sufficient to control the system hence it requires a controller. There are many types of controllers available in market, based on advantages obtained PLC is used (Xiaofeng He *et al*., 2005). I/O server is a link between SCADA and PLC software. PLC software is programmed in ladder logic to control PLC hardware. Communication protocol is medium used to connect the PLC hardware with software. This medium could be wired or wireless, here RS232 cable is used as a connecting medium. Switched mode power supply (SMPS) provides required voltage for operation of PLC hardware. Output of the hardware is fed to the relay, which energies or de-

energies the relay coil which intern controls the load (Jian Wu *et al*., 2006). Field input are the switches which operates the load in a given location. When the field input is switched on, there will be an indication in the SCADA, indication is received from the PLC hardware to SCADA through PLC software in a opposite direction.as per the indication received on SCADA appropriate action can be taken and also data recording the energy consumption is maintained, which mainly helps for the energy conservation.

SIMULATION

Simulation is the operation of the real world process or system overtime. The act of simulating something first require that a model be developed. This model represent the key characteristics, behavior and function of process. The use of simulation to design electrical system, components and devices is a practice that is quickly being adopted by electrical engineering community. Simulation lets the designer take many variables into account in one unified environment

Fig 3: log in page for security purpose

The login screen is provided with username and password as shown in fig3. this provides security and avoids illegal action carried by unauthorized people. Hence there is no chance of un excessing the data.

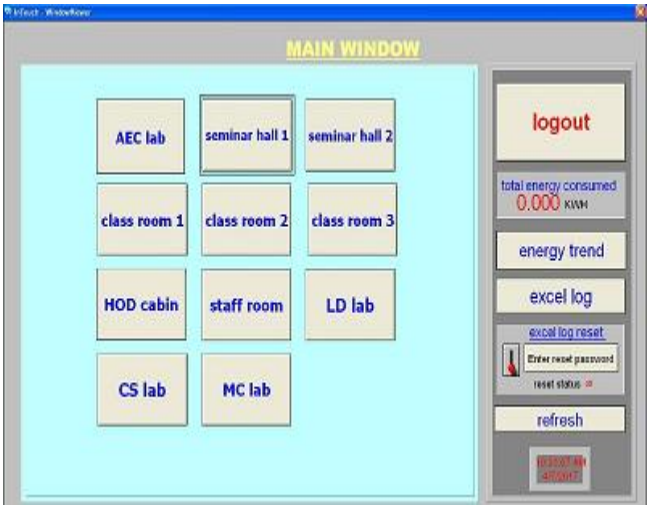

Fig 4: Representation of various classrooms and laboratories

The main screen is as shown in Fig 4, where all the classrooms and laboratories of SKIT EEE block are connected to the SCADA system. These areas are monitored by the SCADA system. Click on any icon to get into it. excel sheet and graph provided for real time data to store. And also there is a provision for RESET option.

Fig 5: Monitoring screen provided with loads in OFF condition

Fig 5 shows that the all loads in seminar hall1 are switched off, hence there is no energy is calculated, it is showing 000kwh.

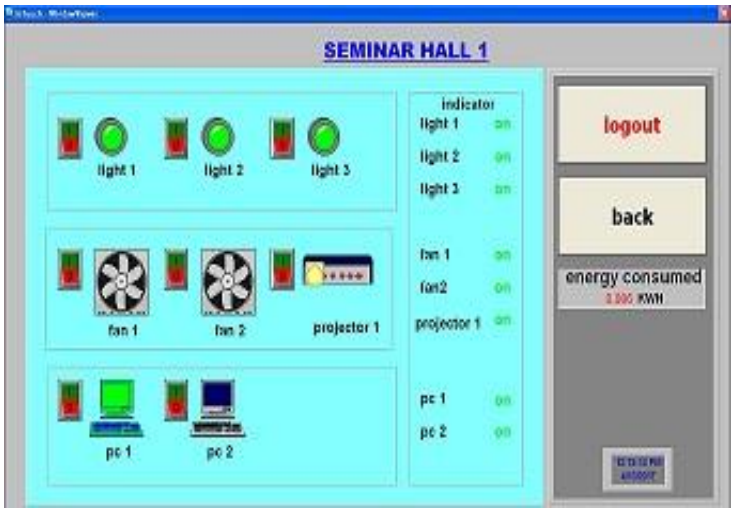

Fig 6: Monitoring screen provided with loads in ON condition

Here there is a provision for controlling and monitoring the different loads. Fig 6 shows that the loads in seminar hall 1 switched on hence calculation of energy has been started.

HARDWARE IMPLEMENTATION

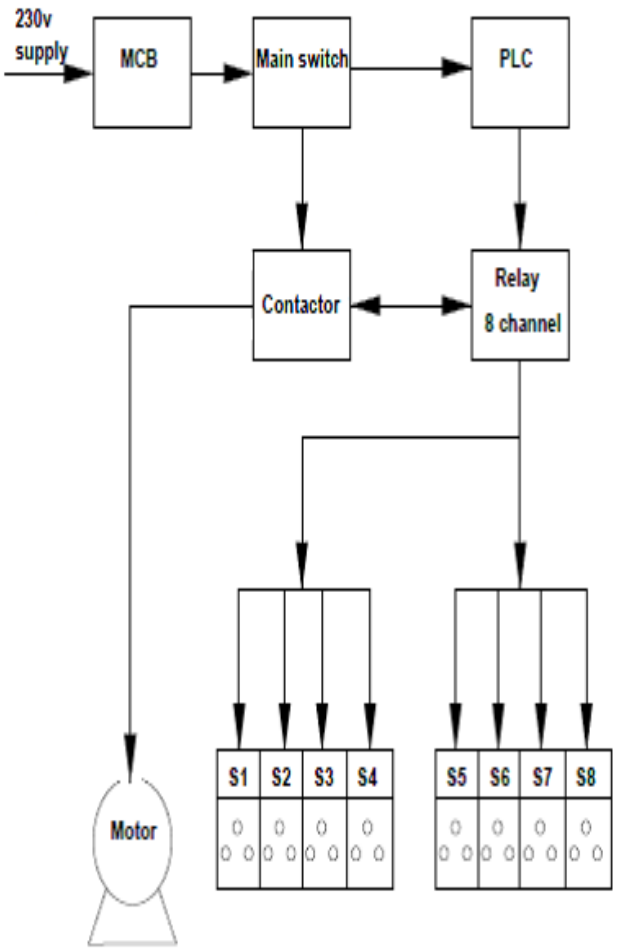

Fig 7: layout of hardware kit

Fig 8: Controlling and monitoring the hardware kit through SCADA system.

The controlling and monitoring through SCADA system is done by interconnecting the PLC and that layout representation as shown in fig 7. Once the program is been dumped to the PLC the controlling can be done through SCADA. Initially all the field inputs should be in ON position this can be seen in monitoring display. The motor, fans and the lamp glows only when the switch is ON in SCADA system. The virtual glowing of lamp and other load conditions as shown in fig 8.

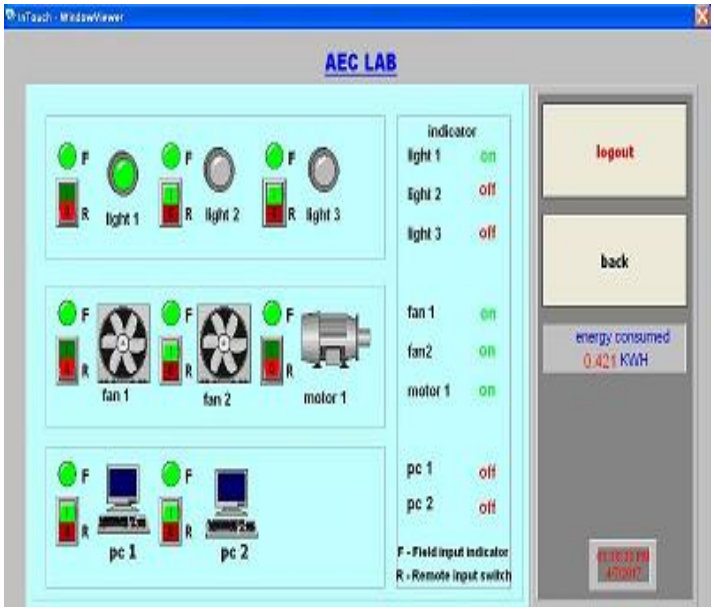

Fig 9: Monitoring of hardware kit with various loads

Figure 9, shows that the various of loads in AEC lab is monitored in SCADA and can be controlled. Energy consumed can be seen in the same screen.

HARDWARE AND SIMULATION RESULT

Table 1: SKIT EEE block daily energy consumption report

S/No	Device name	Rated power (kwh)	Last start time	Last stop time	Total up time(sec)	Total up time (hrs)	Energy consumed (kwh)
1	Light 1	0.020	13:25:52	13:38:18	111.00	0.031	0.00062
2	Light 2	0.020	13:26:51	13:37:18	108.09	0.033	0.00062
3	Light 3	0.020	13:27:50	13:36:18	105.06	0.035	0.00062
4	Fan 1	0.050	13:32:52	13:34:18	112.36	0.039	0.00153
5	Fan 2	0.050	13:30:53	13:32:18	119.52	0.041	0.00151
6	Projector	0.300	13:29:54	13:30:18	100.09	0.038	0.00900
7	Pc 1	0.250	13:28:56	13:33:18	102.65	0.032	0.00743
8	Pc 2	0.250	13:28:55	13:35:18	106.32	0.034	0.00743
						Energy consumed	0.02876

The Real time energy consumed by loads of various classrooms and labs in SKIT EEE block is displayed in excel sheet as shown in table1. The data can be accessed whenever it is required.

The total consumption of energy of various load is been calculated in KWH by a formula:
Total energy Consumption=Power rated in KW* Total up time in Hrs.

Table2: Power fluctuation in load

S/No	Device name	Rated power (kwh)	Voltage (v)	Current (A)	Frequency (hz)
1	Light 1	0.020	226.73	0.088	50.00
2	Light 2	0.020	226.73	0.088	50.00
3	Light 3	0.020	226.73	0.088	50.00
4	Fan 1	0.050	226.73	0.221	50.00
5	Fan 2	0.050	226.73	0.221	50.00
6	Projector	0.300	226.73	1.323	50.00
7	Pc 1	0.250	226.73	1.103	50.00
8	Pc 2	0.250	226.73	1.103	50.00

The voltage and current fluctuation in the various load which is connected to hardware kit is recorded in excel sheet as shown in table 2.

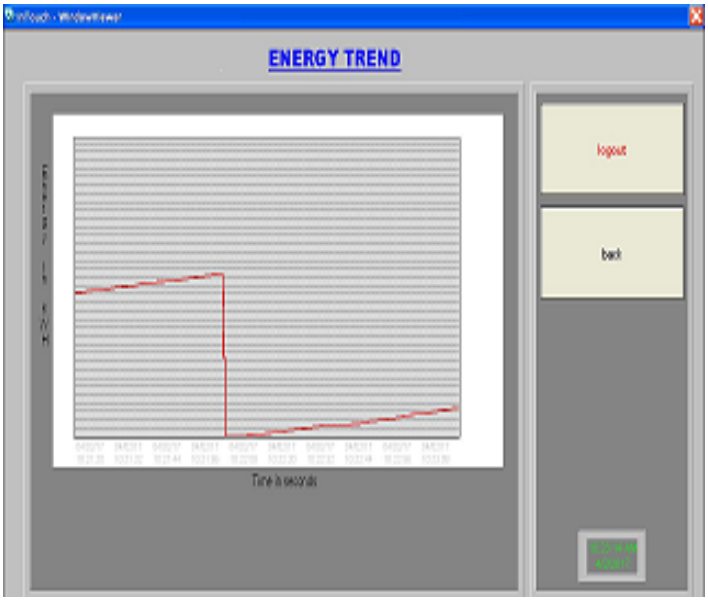

Fig 10: A plot of total energy consumed versus time

The fig10 shows the graphical representation of total energy consumed in SKIT EEE block versus time

CONCLUSION

The energy efficiency improvement is a significant way to reduce the cost and to increases predictable earning, especially in times of high energy price volatility. Since the system operation mainly dependent on PLC & SCADA, it helps in monitoring the energy uses in different sections of the plant and generates the reports as per the requirement by the customer. Extension can be provided to the system as our interest and requirements. This system is time saving, consumes less power and can be also made easily available. So, that the small-scale industry, large scale industry can use this system. In real time applications whenever and wherever with small investment.

Future SCOPE

This project works on remote control based SCADA system using PLC as a controller. It can be further implemented using wireless communication or using internet and also it can be implemented on commercial fields.

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