Industrial Automation, Control and Monitoring using PC-based SCADA

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Abstract

SCADA is the abbreviation of "Supervisory Control and Data Acquisition." SCADA system basically used in industry for process automation. Process automation is in the sense of data acquisition as well as controlling. Conventional SCADA system working with PC, and mobile phones as the client. This project is representing a PC for supervisory control, using LabView software and a connection via USB-TTL module. The test result has indicated that the PC-based SCADA integration using USB-TTL data transfer scheme could enhance the performance of Plant and Machinery in a day without causing an increase in the response time of SCADA function. Therefore, this system reduces the maintenance cost and necessity of continuous monitoring. This system increases the productivity and performance of the Plant.

Introduction

Supervisory Control and Data Acquisition (SCADA) is a process control system used in industrial automation. It allows to site operator to monitor and control processes which are placed at remote locations. A well-designed SCADA system eliminates the complexity of monitoring and controlling of plants. It is time-saving and cost reducing system thereby eliminating the need for personal attention to visit each site for inspection, data acquisition or adjust. SCADA system performed both the operations such as data acquisition and supervisory control. The SCADA system has real-time data accessibility with different types of data communication protocols. Nowadays, SCADA system provided with rich Graphical User Interface (GUI) makes easy access and control of the system. SCADA system requires both hardware and software for successful operation.

Overview of PC-based SCADA

With the vast growth in technology and advanced development in software the supervisory control and data acquisition system is widely used in industrial process automation. The SCADA system having wide applications in industrial automation such as signal sensing, control, human-machine interface, management and networking. It is emphasized that with some basic knowledge of design considerations, it is easier to take the right automation approach and choose the right equipment for the task considered.

Advantages:

The advantages are as follows:

1. It is flexible as universal controllers are being used for industrial PCs.
2. Scalable and avoids downtimes.
3. High performance of system reactions and data processing.
4. Can be monitored and controlled from anywhere

Disadvantages:

The disadvantages are as follows:

1. Sometimes system faces delay in data acquisition.
2. Vulnerable to cyber-attacks.

System Outline

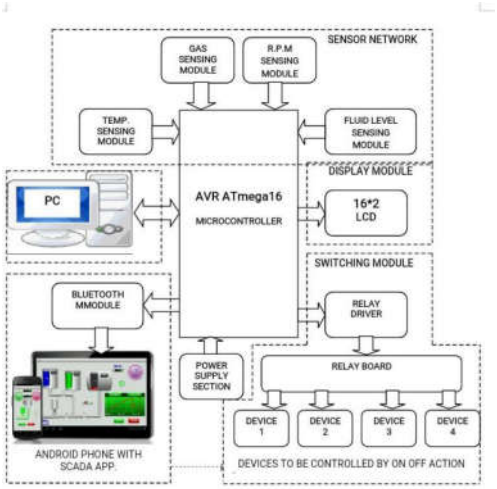

Fig. 1: Block Diagram of PC-based SCADA

Hardware Platform

The project will have four main components:

1. Master Unit: Master Unit consists of PC and Microcontroller. It is the main part of the system and located in the centre of the system. It is installed at the site of the plant where an actual process is running.

2. Remote Unit: This unit is installed at the remote location from where we can monitor and control actual process. The remote unit collects the required data about the process and sends it to the master unit.

3. Communication Mode: It works as a communication medium between Master Unit and Remote Unit. It transmitted required data between these two units. The proposed system uses Bluetooth as a communication medium.

4: Software: It is required for interfacing between hardware and user. It provides Graphical User Interface as a bridge.

Software Platform

The Arduino project provides the Arduino integrated development environment (IDE), which is a cross-platform application written in the programming language Java. It originated from the IDE for the languages Processing and Wiring. It is designed to introduce programming to artists and other newcomers unfamiliar with software development. It includes a code editor with features such as syntax highlighting, brace matching, and automatic indentation, and provides a simple one-click mechanism to compile and load programs to an Arduino board. The Arduino IDE supports the languages C and C++ using special rules to organize code. The Arduino IDE supplies a software library called Wiring from the Wiring project, which provides many common input and output procedures. A typical Arduino C/C++ sketch (program) consists of two functions that are compiled and linked with a program stub main() into an executable cyclic executive program:

• setup(): a function that runs once at the start of a program and that can initialize settings.

• loop(): a function called repeatedly until the board powers off. After compiling and linking with the GNU toolchain, the Arduino IDE employs the program to convert the executable code into a text file in hexadecimal coding that is loaded into the Arduino board by a loader program in the board's firmware. Arduino programs may be written in any programming language with a compiler that produces binary machine code. Atmel provides a development environment for their microcontrollers, AVR Studio and the newer Atmel Studio, which can be used for programming Arduino. Arduino can be controlled using C/C++ interpreter Ch without the binary code. Two textbooks "Learning Arduino with C Programming for the Absolute Beginner" and "Learning Arduino with C Programming" are freely available.

Implementation of PC-Based SCADA

All the devices to be controlled like fan and lights and the temperature sensor is connected to the PCB. USB to TTL converter is connected to this system to provide connectivity. A simple SCADA is designed through which the user can check the on/off status of the connected electrical devices and can switch them off in case they are left on by using their PC. One sensor is used here temperature sensor. In case of temperature rise, the sensor will receive the information of the event and send it to the controller which will then send a command which will be shown in the SCADA.

Fig 2: PC-Based SCADA

USB-TTL Module

Since latest computers and laptops don't come with serial ports because of the popularity of the USB. So, we are using USB to serial converter. That makes our project ultra-portable. Its function is to create a comport on the computer or laptop and connect that comport to the external world.

Fig 3: USB-TTL Hardware

Hardware Implementation

We are now going to make the hardware connections of industrial devices which we want to control using SCADA.

For this, following steps are followed:

1. Connect the sensors to the input ports and the devices which must be controlled to the output of relay ports.
2. Connect USB to TTL to PC.
3. Now, connect the relays with relay drivers connected to the PCB and solder them.
4. Devices must be connected to the other ends of the relays.
5. Connect main supply to all the appliances through the relays and we can now control electrical devices by using SCADA.

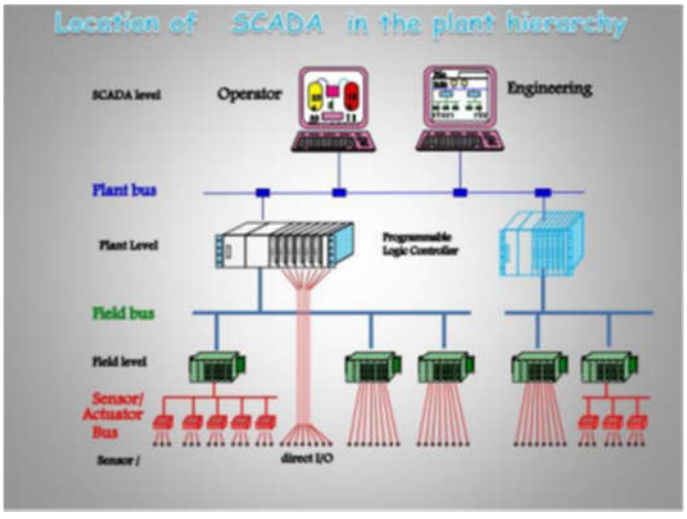

Fig 4: Location of SCADA in the plant hierarchy

Result and Conclusion

SCADA systems are designed to follow the latest technological developments. In this system, when there is a temperature rise more than the required threshold in the electrical device. PC gets a warning notification by using SCADA and the operator can thus control the temperature conditions.

Acknowledgement

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