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REVIEW ON MOBILE PHONE BASED SCADA FOR INDUSTRIAL AUTOMATION

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Abstract— **SCADA stands for "Supervisory Control and Data Acquisition." SCADA systems are widely used in industry for data acquisition and supervisory control of industrial processes. PC, notebook, thin client, and PDA are used byConventional SCADA systems as a client. In this paper, a Java-enabled mobile phone has been used as a client in a sample SCADA application in order to display and supervise the parameters like temperature, gas, fluid, speed. The paper presents an actual implementation of the controlling various parameters via mobile phone. It indicates that the mobile phone based SCADA integration using the GPRS or WAP transfer scheme could enhance the performance of the industrial equipment's. The operator can visualize and modify the plant parameters using his mobile phone, without reaching the site. In this way maintenance costs are abridged and productivity is increased.**

Index terms- **Android Application over Smart Phone or Tablet PC, Remote monitoring system, SCADA, Bluetooth, Sensors, Microcontroller.**

I. INTRODUCTION

The term supervisory control and data acquisition SCADA was earliest introduced inthe 1960s at Bonneville Power Administration and was first published in the PICA Power Industry Computer Applications Conference Proceedings. The SCADA system is used for monitoring and controlling of industrial processes from remote areas. The need to monitor the process and possibly control the operation of industrial systems from virtually anywhere is becoming an important issue. However, with different types of platforms used in present SCADA systems, incompatibility has be- come the main obstacle[1]. Other problems include cost, security, accessibility, system integration, data integrity, and consistency [2].

SCADA systems is used to provide access to real time data display, alarming, trending, and reporting from remote equipment by using different communication media. Communication media includes Internet, private leased line PLL dial-up connection, satellite, and radio modem. Recent technological advances have made location transparency achievable through the Internet at a relatively low cost and acceptable level of security. Some of the potentially valuable developments are Intranet and Extranet. Today, improvements in the visual interface of the SCADA GUI Graphical User Interface have fairly high- resolution graphical animations. In spite of all these improvements, a need has emerged to access system information instead of controlling it from precise control center's.

SCADA systems have been opened to the world via the Internet to meet this requirement. Despite all these improvements, the SCADA system needs a computer connected to the Internet. Recently there has been a growing trend towards personal computers and work stations becoming "portable" and "mobile." This has led to a big expansion of wireless networking, which is getting advanced in terms of technology and usage and penetration [3].

SCADA software generally exists in a computer, which carries out tasks of supervision and management of alarms, as well as data processing and process control. The communication is made by means of special buses or LAN networks. All these tools are executed normally in real time, and are considered to give the plant operator the opportunity of supervising and controlling of these processes.

SCADA system works with both hardware and software for their successful execution. User- designed control parameters, graphical system diagrams, alarm screens, and programmable control logic are some of the characteristics of the software program for the SCADA systems. This paper discusses the use of mobile phone as a client for an industrial SCADA computerization system. An attempt is made to grant some insight into design considerations for wireless mobile phone based automation as used in modern SCADA automation systems. It is emphasized that with some basic knowledge of design considerations, it is easier to take the right automation approach and prefer the right equipment for the task considered. The mobile based SCADA integration using the general packet radio service GPRS or wireless application protocol WAP transfer scheme could improve the performance of the system in a day without causing an increase in the response times of SCADA functions. As distance to remote sites increases, it becomes more difficult to access. In this case, SCADA becomes a better alternative to an operator visiting the site for adjustments and inspections. Distance and remoteness are two key factors for implementing the SCADA systems.

Data systems are on highest level, including the server and client used by the operator and system,are on the MMI level. The PLC and RTU level is responsible for the connection between sensors and actuators in shop floor[6,7].

II. REVIWE OF CONVENTIONAL SCADA SYSTEM

SCADA is used to perceive and supervise the shop floor equipment's in various industrial automation applications. SCADA software, working on DOS and UNIX operating systems used in the 1980s, was an alarm-based program, which has a impartially modest visual interface.

SCADA systems using a variety of RTUs remote terminal units are used for industrial control and supervision all over the world. These systems drastically cut operating costs and allow the automatic supervision and reporting needed in today's regulatory environments. The main components of a conventional SCADA system [3–5] are RTUs at substations and plants, data processing units, andman-machine interfaces MMIs. Dedicated channels are required to assurance the time receptiveness of the system.

In earlier days, an alarm sounding at control room meant that a crew would be dispatched to the trouble site to assess the problem. Based on their assessment, other crews would be called in, and those crews often would discover that yet an additional work crew was needed. Insufficient data with no control meant that all alarms were treated as urgent, since there was no knowledge about the importance of an alarm or the attention it required.Nowadays, when an alarm goes off at a new SCADA

Control Centre, an operator calls up a screen that shows the meticulous problem. The operator rapidly determines the importance of the alarm and simply makes an modification or, if necessary, dispatches the appropriate crew directly to fix the problem. SCADA now provides monitoring of the entire automation process, including the treatment facilitiesAt present, full control functions are being implemented in the SCADA automation system. SCADA systems allow equipment in many diverse locations to be monitored and controlled from a central location.

With the advances of electronic and software technologies, the supervisory control and data acquisition systems are widely used in industrial plant automation. It provides an efficient tool to monitor and control equipment in manufacturing processes on-line. The SCADA automation system always includes several functions, e.g., signal sensing,management, and networking control, human machine interface.

I. BLOCK DIAGRAM

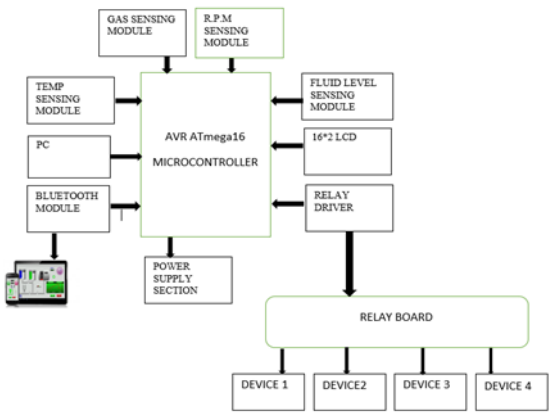

Figure 1.SCADA System

As shown in figure SCADA system consists of four sensors .The four sensors are associated with microcontroller.

Temperature sensor: Temperaturesensor used is thermistor.A thermistor is a type of resistor, with resistance varying according to its temperature. The word is a combination of thermaland resistor.Thermistorare classified into twotypes, positive temperature coefficient (PTC) thermistor and negative temperature coefficient (NTC) thermistor. NTC thermistor is used as sensor in which the resistance decreases with increasing temperature. In order to change voltage with varying temperature voltage divider junction is formed using resistance along with sensor.

Fluid level sensor: A potentiometer (colloquially known as a "pot") is a three-terminalresistor with a sliding contact that forms an adjustable voltage divider.[8] A plastic float and shaft is connected to angular pot which is used for detection of fluid level. Depending upon fluid level position of shaft moves and accordingly value of voltage fluctuates.

Gas detector sensor: LPG Gas Sensor - MQ-6 is used as gas detector sensor.This is a simple-to-use liquefied petroleum gas (LPG) sensor, suitable for sensing LPG (composed of mostly propane and butane) concentrations in the air. The MQ-6 can detect gas concentrations anywhere from 200 to 10000ppm.This sensor has a high sensitivity and fast response time. The sensor consists of two heating plates which engenders ions when gas is passed and generates voltage accordingly.

Speed sensor:DC Techogenerator speed sensors are housed in aluminum casings protected in accordance with Mil-C-5541 or Mil-A-8625. Alnico permanent magnets are used. Armature shafts are stainless steel, and rotate on fully-shielded stainless steel ball bearings.Along with variation in speed voltage changes at output side.

ADC0809: Output of all the senors is in analog form which rehabilitated to digital form using ADC0809 convertor.ADC0809 data acquisition component is a monolithic CMOS device with an 8-bit analog-to-digital converter, 8-channel multiplexer and microprocessor compatible control logic. The 8-bit A/D converter uses successive approximation as the conversion technique.

Microcontroller AT89S51: The AT89S51 is a low-power, high-performance CMOS 8-bit microcontroller with 4K bytes of in System Programmable Flash memory.AT89S51 is a powerful microcontroller which provides a highly-flexible and cost-effective solution to many embedded control applications. It is four port device. It works as an address data convertor.16x4 LCD display having 16 character and two rows is connected to port0.Port1 provides addresses and latch to ADC0808, 8-bit digital output of ADC0809 is given to port2 and to transfer acquired data to mobile HC05-Bluetooth module is used which is connected to port3. Relay drivers are used for adjusting the parameters of system to enhance performace of system.

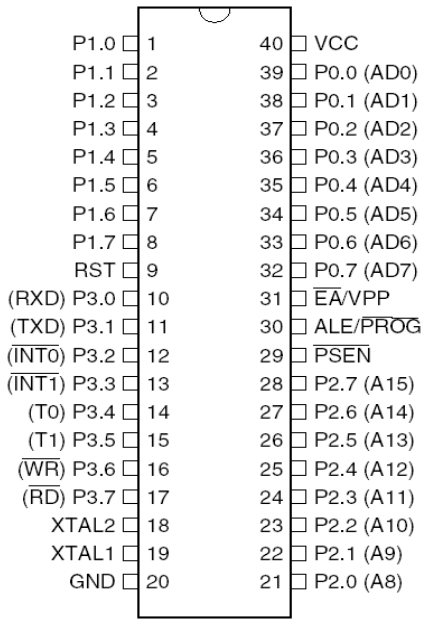

Figure 2. Pin Configuration

Features:

• 4K Bytes of In-System Programmable (ISP) Flash Memory

– Endurance: 10,000 Write/Erase Cycles

• 4.0V to 5.5V Operating Range

• Fully Static Operation: 0 Hz to 33 MHz

• Three-level Program Memory Lock

• 128 x 8-bit Internal RAM

• 32 Programmable I/O Lines

• Two 16-bit Timer/Counters

• Six Interrupt Sources

• Full Duplex UART Serial Channel

• Low-power Idle and Power-down Modes

• Interrupt Recovery from Power-down Mode

• Watchdog Timer

• Dual Data Pointer

• Power-off Flag

• Fast Programming Time

• Flexible ISP Programming (Byte and Page Mode)

• Green (Pb/Halide-free) Packaging Option

III. SCADA SOFTWARE

Server Side programming: The programming language used for the website designing is HTML (Hyper Text Markup Language) and PHP (HyperText Processor). PHP code is executed on the server itself. HTML and PHP both are open source programming languages which reduces system cost.

Tasks performed by PHP code are;

- Reads the "log.txt" file from the location.
- Extracts the last 5 characters from the file, which is nothing but the current status of the firm.
- The code analyses string & selects corresponding image to be displayed for various parameters.

GUI: Visual BASIC 6 software is used for developing GUI. GUI windows consist of two sections.

- System Status
- System Control

System Status performed following program

a. Reads data coming from RTU
b. The received array is decoded i.e. string parsing
c. Depending upon the characters received particular image is selected from database and values for different parameters are updated

System control is used to control output devices. In order to perform this four control buttons are provided. On click on the command buttons, characters are sent to microcontroller. The characters are sent serially to RTU.

B4A: Basics for android (B4A) software is used to develop any type of Android app.B4A software will develop platform to display data. Using this software display screen is generated. On display screen information about four sensors using .apk file extension will be demonstrated.

IV. NEED FOR SCADA SYSTEM

Reliability and strength: SCADA systems are used for mission critical industrial processes where reliability and performance are vital. In addition, specific development is performed within a well-established framework that enhances reliability and strength.

Maximize productivity: Maximizes productivity and ensures continuous production. SCADA's design is centred on multi-level redundancy to ensure constant communication and operation of system.

Improve product quality: Analyses and controls the quality of manufactured products using standard SCADA functionality. Advanced statistical alarms allow you to perform analytical calibration of process parameters. This prevents out-of-limit deviations before they occur.

Reduce operating and maintenance costs: Through the deployment of a centralized SCADA system you can significantly reduce operating and maintenance costs. This results in increased operator effectiveness

V. ISSUES OF SCADA

Cyber attack : Cyber attacks on SCADA system can take routes throughInternet connections, business or activity network connectionsand or connections to other networks, to the layer ofcontrol networksthen down the level of field devices. More purposely, the common attack vectors are

Backdoors and holes in network perimeter

- Vulnerabilities in common protocols
- Attacks on field devices through cyber means
- Database attacks
- Communications hijacking and Man-in-the-middle attacks

Unauthorized access: Attacker might gain unauthenticated remote access to devices and change their data. This can causedevices to fail at a very low threshold value or an alarmnot to go off when it should. Another possibility is that theattacker, after gaining unauthenticated access, could changethe operator display values so that when an alarm actuallygoes off, the human operator is unaware of it.[9] This coulddelay the human response to an emergency which mightadversely affect the safety of people in the vicinity of theplant.

VI. FUTURE SCOPE

The process could also be viewed in a graphical format with the help of advanced tool such as MATLAB and Lab view. This makes the process more convenient and reliable.[5] We can also increase the system performance by using highly accurate sensors. With the help of GSM and GPS module we can optimize the range of the system. For future development we can also interface zigbee for far distance. We can add more sensors such as fire sensor, proximity sensor and IR sensor and so on.

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