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Online Communication of Critical Parameters in Powerplant Using ZIGBEE

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ABSTRACT: *The application of wireless sensor network (WSN) for online monitoring of power plant using zigbee is composed of number of sensor nodes with networking capability deployed for an ad-hoc or continuous monitoring purpose. The use of zigbee based wireless system for monitoring powerplants reduces labour cost, facilities setup cost, in addition to providing flexibility in terms of distance or location. Although monitoring using RF Technologies has good antipiracy ability, large network capacity, high reliability, sensitivity and it is not much economical to implement..In this paper, the conventional wired LAN in power plants is replaced by wireless using zigbee unlike RF.To design and develop a system for communicating the field measurements on real time basis to a Centralized server using wireless communication.Therefore the developed platform is cost effective and easy customization.*

Keywords: *wireless sensor network, Zigbee technology*

I. INTRODUCTION

After considering the critical situation of the wired LAN based network. For that, it is important to have such a monitoring system with characteristics of autonomous, lower cost,reliable and flexible. The use of automation in monitoring task will reduce the reliance on man power at the monitoring site thus reducing the cost.

This paper focuses on the use of multiple sensors as a device to check the level of parameters as analternative method of monitoring the condition of the critical parameters. Several sensors that are able to continuously read some parameters that indicate the parameter such as temperature,pressure etc will be used to monitor the overall level. As the monitoring is intended to be carried out in a remote area with limited access, signal or data from the sensor unit will then be transmitted wirelessly to the base monitoringstation.

A currently becoming popular and widely used technology based on wireless sensor network is extensively used in this project as it is able to provide flexibility, low cost implementation and reliability. Ahigh power transmission with a relatively low power consumption Zigbee based wireless sensor network technology is applied in this work. Zigbee is acommunication standard for use in the wireless sensor network defined by the Zigbee Alliance [1] that adoptingthe IEEE 802.15.4 standard for its reliablecommunication. It is chosen due to its features that fulfil the requirement for a low cost, easy to use, minimal power consumption and reliable data communication between sensor nodes.

The development of graphical user interface (GUI) for the monitoring purposes at the base monitoring station is another main component in the project. The GUI should be able to display the parameters being monitored continuouslyin real time. Severalmeasurement and performance analysis to evaluate the reliability, feasibility and effectiveness of the proposedmonitoring system are also presented.

II. HARDWARE DESIGN

2.1 Sensor Unit

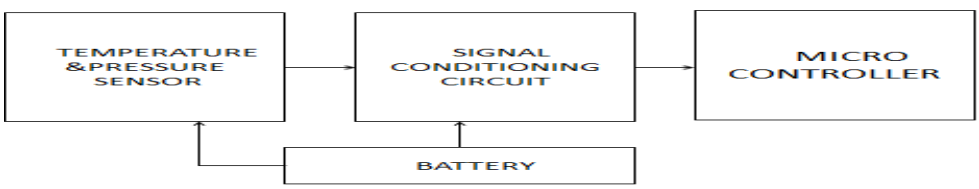


Fig1. Block Diagram Of Sensor Unit

A sensor unit is basically consists of several sensors used to detect the predetermined parameters that indicates the sensed value of temperature and pressure. In this work, two types of sensor temperature sensor and pressure sensor are used. All the sensors use battery for its operation. The information being sensed by the sensors are then converted into electrical signal and go through the signal conditioning circuit that functions to make sure the voltage or current produced by the sensorsis proportional to the actual values of parameters being sensed. Then it is passed to a microcontroller ormicroprocessor that processes it to the value understandable by human.

2.2 Wireless Sensor Node

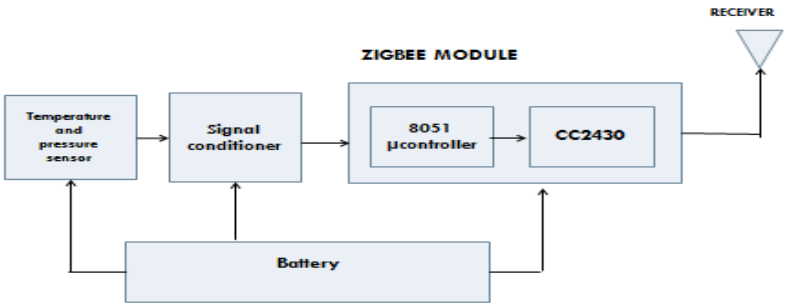


Fig2.Block Diagram of wireless sensornode

The wireless sensor node in this work is consist ofsensor unit as mentioned in section A; a microcontroller or microprocessor with a task of signal digitizing, data transmission, networking management etc; and radio frequency transceiver for communications at the physical layer. All of them share a single battery as a power source. The Fig. 2 shows the block diagram of the wireless sensor node.

The main microcontroller in the module isreprogrammable whether to function as an end device,router or coordinator nodes. As an end device sensornode, it can only communicate with the router orcoordinator to pass the data from the sensor. An enddevice can only communicate indirectly with the otherend device through the router or coordinator. The sensor node defined as a router is responsible for routing data from other routers or end device to the coordinator or to other routers closer to the coordinator. The router can also be a data input device like the end device but in actual application it is generally used to extended the coverage distance of the monitoring system.There can be only one coordinator for the monitoring system.Thecoordinator responsible for setting the channel for the network to use, assigning network address to routers and end devices and keeping the routing tables for thenetwork that are necessary to route data from one enddevice to another in the same Zigbee network.

2.3 Base Monitoring Station

The base station consists of a same Zigbee module programmed as a coordinator that receives the data sent from the sensor nodes (end devices and routers) wirelessly. As the coordinator needs to continuously receiving data from the end devices, it is normally mains powered. Data received from the end device nodes is sent to the computer using the RS 232 protocol and data received is displayed using the built GUI on the base monitoring station.

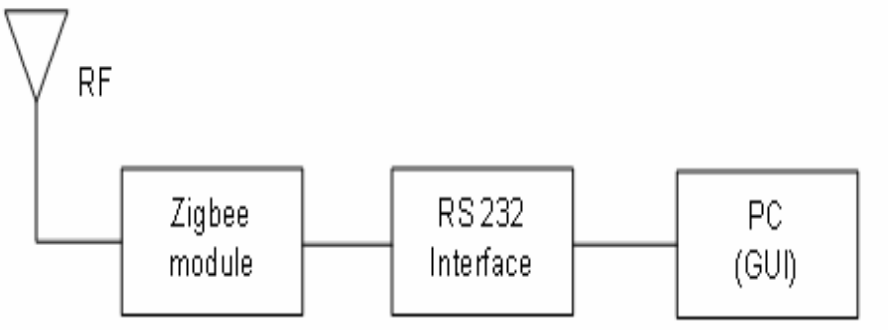


Fig3.Components of Basestation

2.4 ZIGBEE NETWORK DEVICES

Coordinator:

The role of the Coordinator is mainly related to starting up and configuring the network. Once that is accomplished, the Coordinator behaves like a Router node (or may even go away). It can also be used, to assist in setting up security and application-level bindings in the network .

Router:

A Router performs functions for (i)allowing other devices to join the network (ii) multihop routing (iii) assisting in communication for its child battery-powered end devices.

End Devices:

An end-device has no specific responsibility for maintaining the network infrastructure,so it can sleep and wake up as it chooses. Thus it can be a battery-powered node.

2.5 HARDWARE DESCRIPTION

The ZigBee Development Kit includes following hardware modules such as,Z RF Module, Z Debugger andZ Battery Board. The **Zigbee RF Module** is consisting of CC2431 (SoC) processor and its corresponding RF circuitry to transmit the data Over The Air (OTA) at ISM band for low power wireless network.

The **Zigbee Debugger** is designed with 8051F320 processor for downloading the code to the SoC present in the Z RF Module and it can also be used as dongle for TI's Packet sniffer, Location Engine, Daintree Networks SNA software.

The **Zigbee Battery Board** provides the battery power to Z RF Module and makes it to work as a standalone system with many user interfaces such light sensor, potentiometer, LEDs, micro switches, and RS232 Interface.

2.6 COMPARING ZIGBEE WITH OTHER TECHNOLOGIES:

Market Name	ZigBee™	---	Wi-Fi™	Bluetooth™
Standard	802.15.4	GSM/GPRS CDMA/1xRTT	802.11b	802.15.1
Application Focus	Monitoring & Control	Wide Area Voice & Data	Web, Email, Video	Cable Replacement
System Resources	4KB - 32KB	16MB+	1MB+	250KB+
Battery Life (days)	100 - 1,000+	1-7	.5 - 5	1 - 7
Network Size	Unlimited (2^{64})	1	32	7
Bandwidth (KB/s)	20 - 250	64 - 128+	11,000+	720
Transmission Range (meters)	1 - 100+	1,000+	1 - 100	1 - 10+
Success Metrics	Reliability, Power, Cost	Reach, Quality	Speed, Flexibility	Cost, Convenience

Fig4.Comparing with Other Technologies

III. PROPOSED SYSTEM

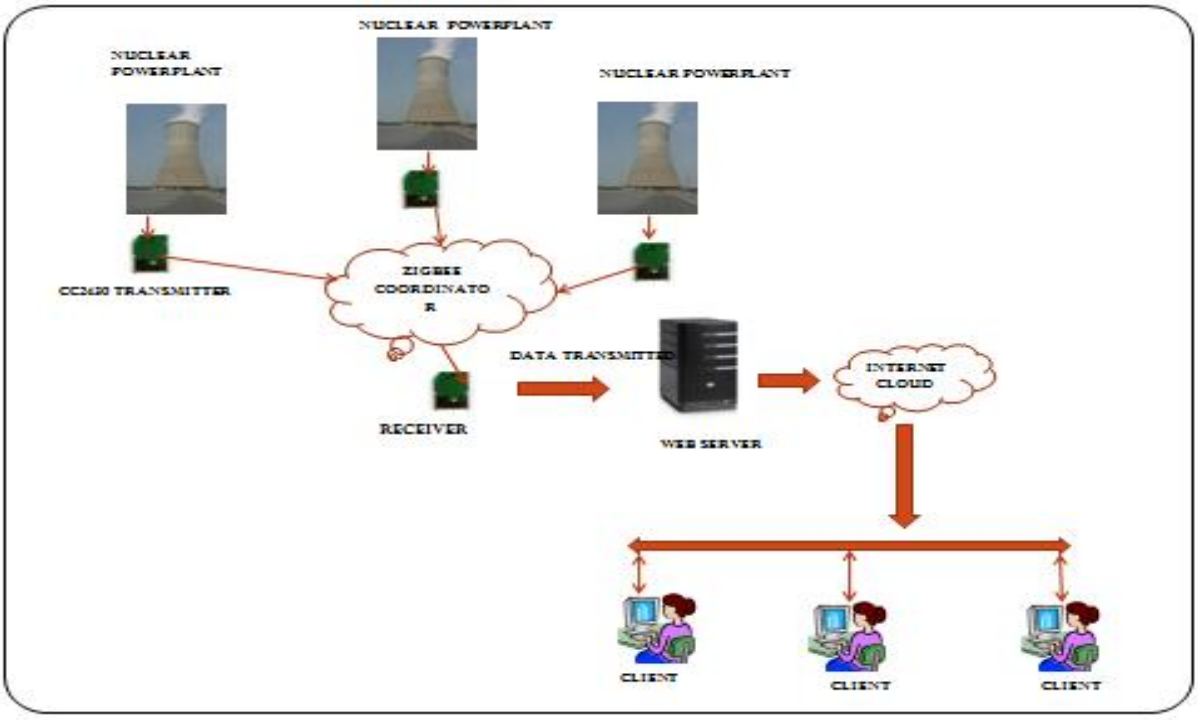
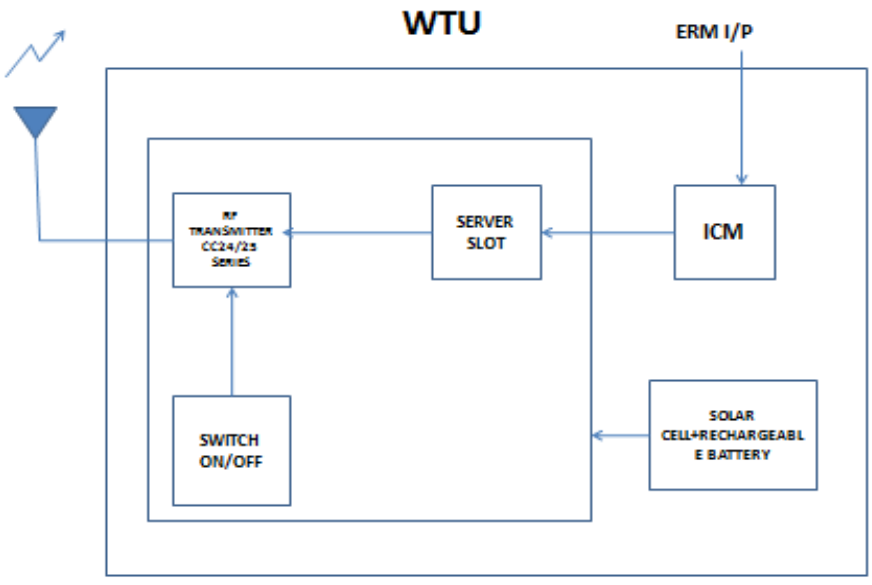
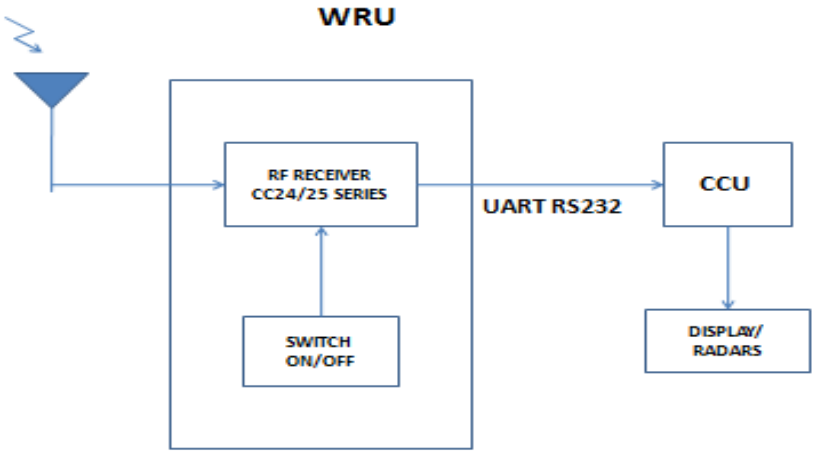


Fig5. Block Diagram of Proposed System

In Proposed system,we are going to store the value of critical parameters in a powerplant in a centralised webserver.Then by means of login authentication method,the respective higher official in the powerplant can view the value of parameters being monitored in real time from any remote location by username and password loin method developed using Java Servlet Platform.By incorporating such method,there will be reduction in manpower, since in the present method there is a need for a labour to take readings from a PC kept in a base station located at a particular distance from the plant area.Hence in the proposed we are going to impose a system based on wireless LAN network which may overcome the difficulties of wired network that may have high cost of cable installation and problems in distance coverage.

3.1 SOLAR POWER WIRELESS TRANSMITTING SYSTEM:





In wireless transmitter and receiver unit,zigbee module is operated by solar cell and rechargeable battery by which we can consume more power when compared to a normal AA+ battery.Zigbee module operated with a solar batttery is one of the most efficient way of conserving power such that it can be possible to transmit and receive data with long transmission range with out any power dissipation.

IV. OUTPUT RESULTS

4.1 MONITORING SECTION:

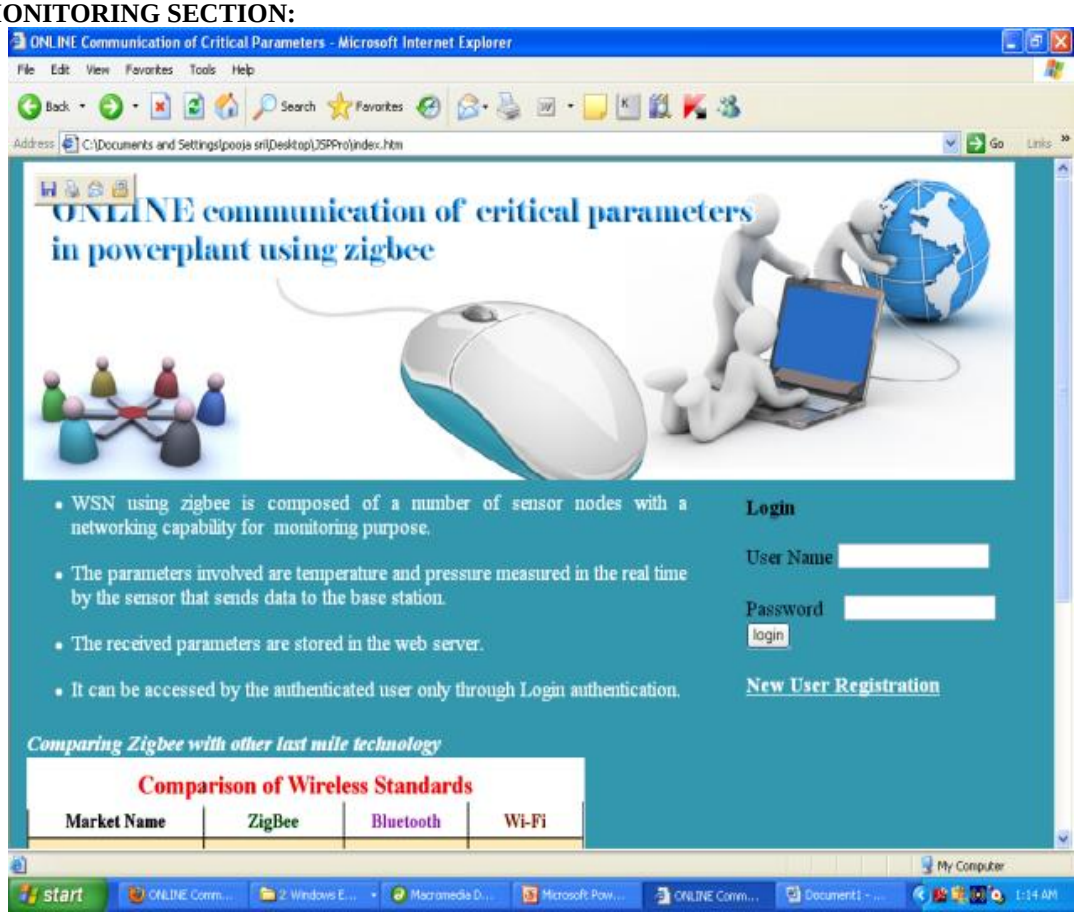


Fig6.Home page

Initially the value of critical parameters stored in the web server is accessed by means of client as shown in the homepage.

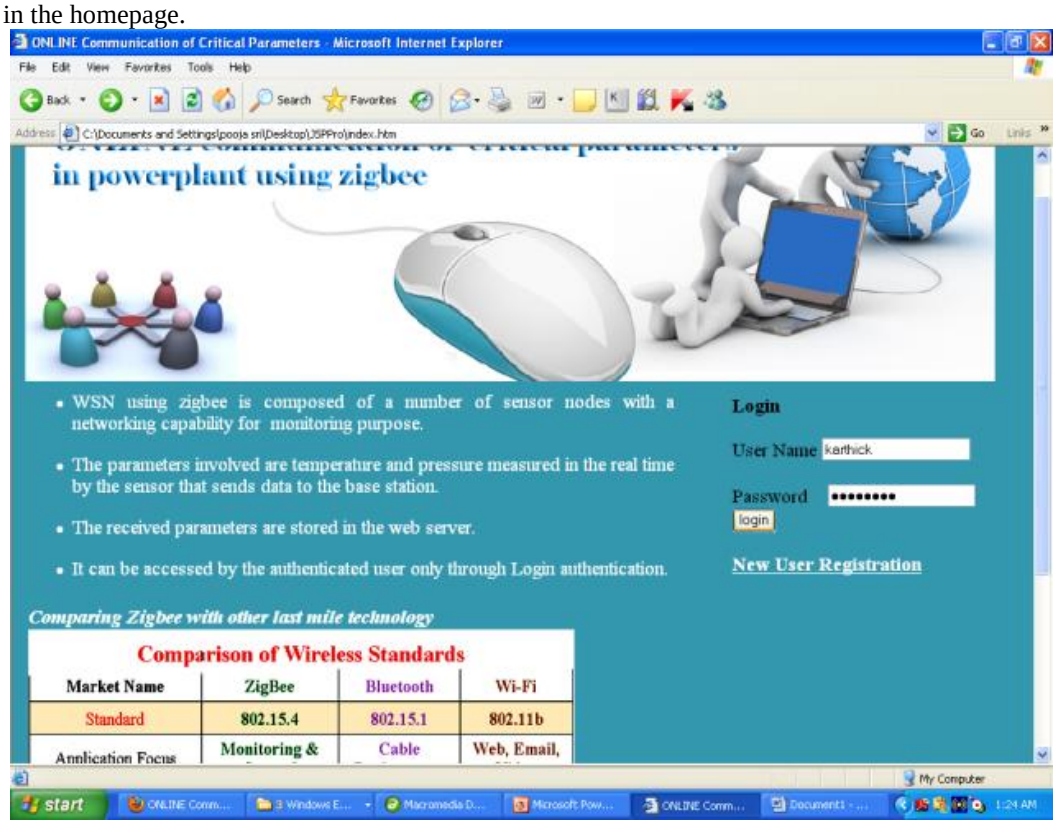


Fig6. User login

In username password login method only authenticated users with valid username and password are allowed to access the values of parameters stored in the web server.

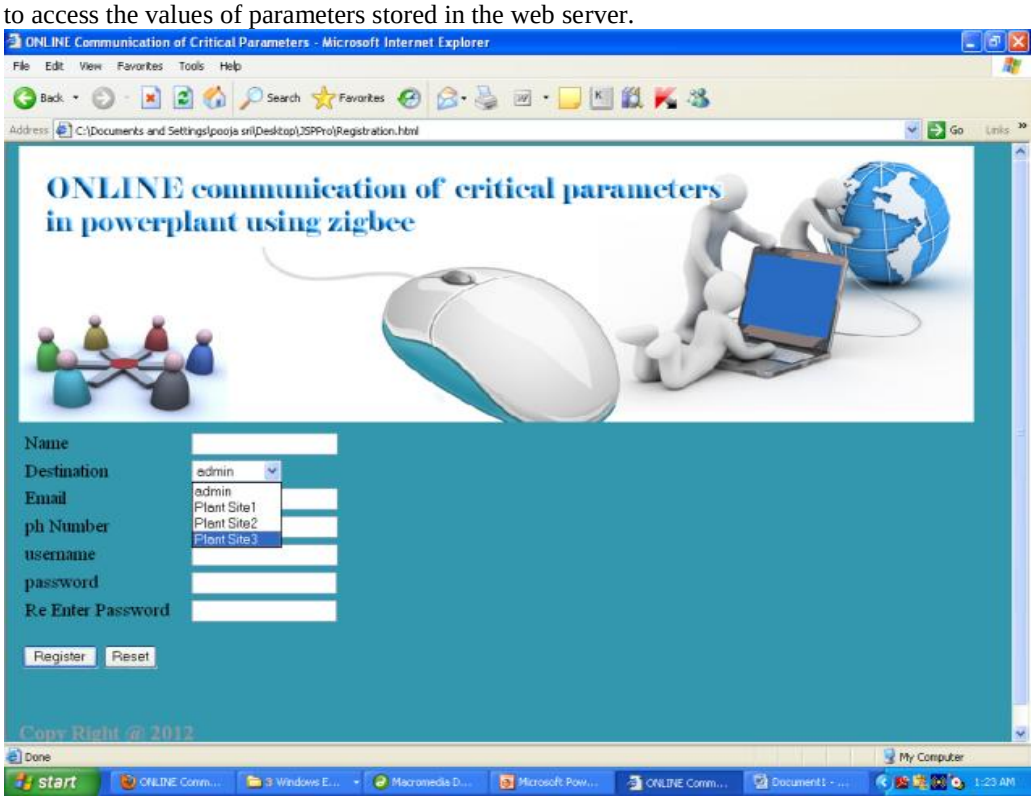


Fig7.monitoring of parameters in various section

After login session, the required parameters are displayed.By entering the particular site location, the corresponding values stored in the respective plantsite Will be displayed on the client system.

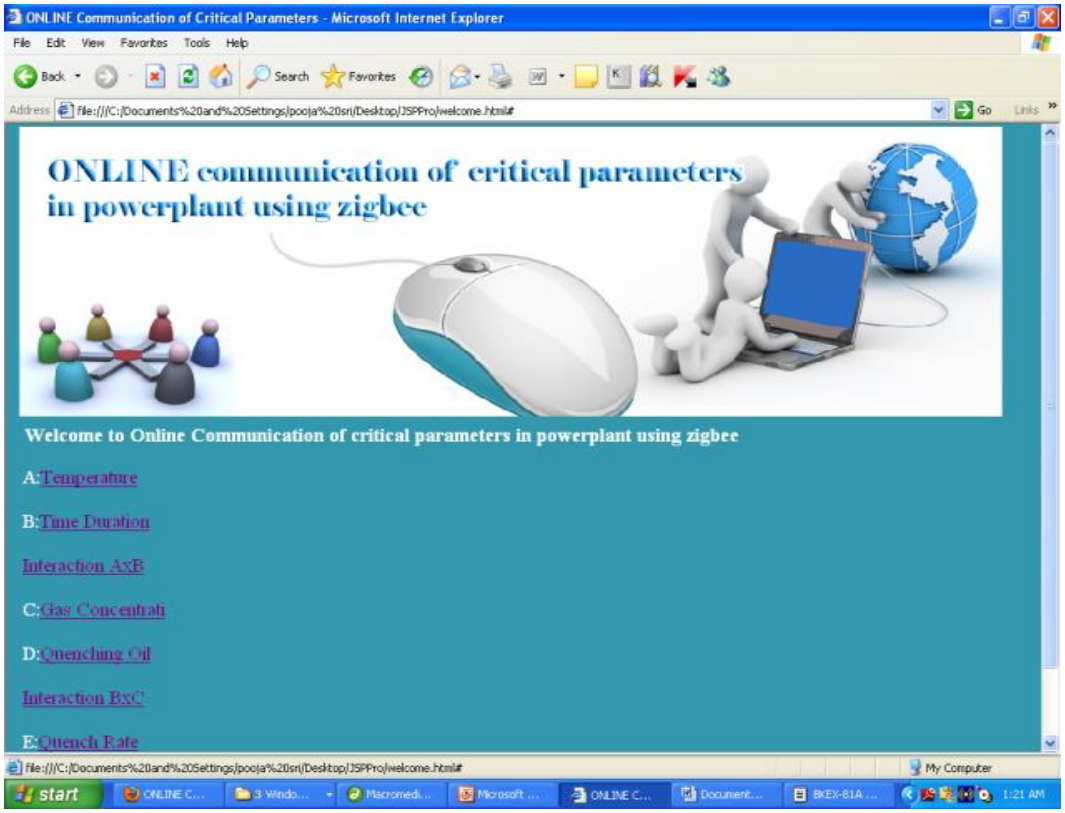


Fig8.After login

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