Chapter 1

Using Single Board Heater System, Virtually!

1.1 Introduction to Virtual Labs at IIT Bombay

The concept of virtual laboratory is a brilliant step towards strengthening the education system of an university/college, a metropolitan area or even an entire nation. The idea is to use the ICT i.e. Information and Communications Technology, mainly the Internet for imparting education or exchange of educational information. Virtual Laboratory mainly focuses on providing the laboratory facility, virtually. Various experimental set-ups are hooked up to the internet and made available to use for the external world. Hence, anybody can connect to that equipment over the internet and carry out various experiments pertaining to it. The beauty of this idea is that a college who cannot afford to have some experimental equipments can still provide laboratory support to their students through virtual lab, and all that will cost it is a fair Internet connection! Moreover, the laboratory work does not ends with the college hours, one can always use the virtual lab at any time and at any place assuming the availability of an internet connection.

A virtual laboratory for SBHS is launched at IIT Bombay. Here is the url to access it: **http://www.co-learn.in/web_sbhs/**. A set of 7 SBHS are made available to use over the internet 24× 7. These individual kits are made available to the users on hourly basis. We have a slot booking mechanism to achieve this. Since there are 7 SBHS connected with an hours

slot for 24 hrs a day, we have 168 one hour slots a day. This means that 168 individual users can access the SBHS in a day for an hour. This also means that up to 1176 users can use the SBHS for an hour in a week and 5208 in a month! A web page is hosted which is the first interface to the user. The user registers/logs in himself/herself here. The user is also supposed to book a slot for accessing the SBHS. A database server maintains a record of the data generated through the web interface. A java application server is hosted on the server side and it helps in connecting the user with the corresponding SBHS placed remotely. The client is also suppose to run a java client on his computer. A free and open source scientific computing Software, Scilab, is used by the user for implementing the experiment on SBHS, in terms of simple Scilab coding.

1.2 Component Details of the Virtual lab

In this section we will see the details of the building blocks of virtual lab. Figure 1.1 shows the block diagram for the same. A virtual lab is similar to a remote lab where in communication takes place between two computers over the internet. The server computer consists of a web server, a data base server and a java application sever. The client computer should contain a web browser, Scilab Software and a java client. A web server is hosted using apache software. The web pages are written in php language and are hosted on this server. Some of these php pages are necessarily linked to a data base server. The Database Server is hosted using mysql. It keeps a record of the information generated during a person registers and books a slot. The java server communicates with the SBHS connected to the computer on a USB port. It also accesses the data base and communicates with the java client.

On the client side, the web browser is any internet browser available. The user visits the specified web page, logs in/ registers and book/view/delete a slot(s) using the web brwser available to him. The java client is a simple java application provided by us. The user keys in the information provided on the web page pertaining to the booked slot in to this java client. The interface also provides an option to view a live streaming of the display of the SBHS to which he has connected to. This facility is however limitied to one SBHS for now and an elegent method is currently under development to accomodate all of the SBHS. The Scilab software must be installed by the client on his computer. Here, he will write the experiment he wants to conduct on the

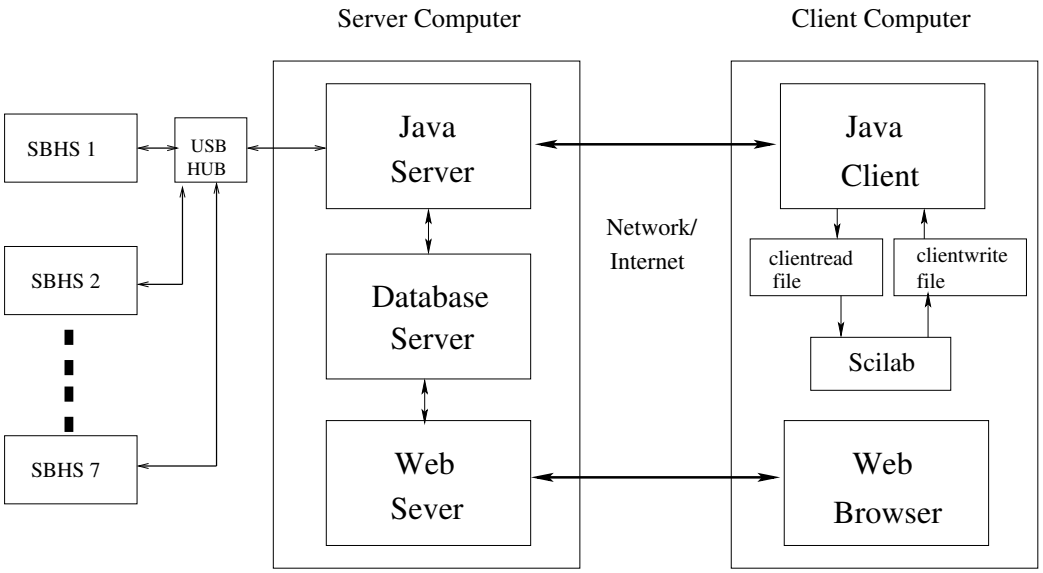

Figure 1.1: Block diagram of the Virtual lab setup

SBHS in simple scilab language. A primary scilab code will be provided and the process of modification of the code will be explained. Here is a step by step explaination of the working of Virtual Lab for SBHS assuming the necessary files and softwares are available on the users computer.

1. The user goes to the specified url and if he is a first time visitor, he registers himself and follows the information provided there, else he directly logs in.

2. After logging in, the user will book a slot. This activity will provide him with some information.

3. The user will start the java client and put the information provided and click login and start button.

4. The java client will communicate with the Java server and will ask to authenticate the user if he is authorised to access the particular SBHS at the booked time, else the user will not be connected to the SBHS.

5. After getting the confirmation from the java client, the user will execute the scilab code. The scilab code will output the value of heat and fan by writting it in to a file "clientwrite.sce"

6. The java client will read from this file and communicate these values to the java server and the java server will in turn input these values to the respective SBHS.

7. The SBHS will output the value of temperature to the java server and java server now communicates this value to the java client.

8. Java client will write this value in to file "clientread.sce". Scilab now reads the value of temperature of the board from this file and will output the new value of heat and fan in to the "clientwrite.sce" file. This process will continue untill the experiment is stopped.

9. A log of the experimental data with time stamp is maintained on the server side and is available to download using the "Download Button" in the client java application.

10. The slot is actually made to last for 55 minutes. The last 5 minutes of the slot are used to reset the SBHS so that the next user will get the SBHS at a normal operating condition. The client java closes automatically as soon as 55 minutes are over.