

About SBHS

The single board heater system, abbreviated as **SBHS**, is a low cost, open source, lab-in-a-box setup. It consists of a heater assembly, a fan, a temperature sensor, an ATmega16 microcontroller and associated circuitry.

A stainless steel blade whose temperature has to be controlled serves as the plant. Nichrome helical coil kept at a small distance from the steel blade, acts as the heater element. AD590, a monolithic integrated circuit temperature transducer, is soldered beneath the steel plate.

A computer fan, a low cost and commercially off the shelf component, is used to cool the plate from below.



Technical Features

Microcontroller: ATmega 16

Temperature sensor: AD590

Indicators: 2X16 Characters LCD, LEDs and Buzzer

Driver: Power MOSFET IRTz8n

Communication: Wired RS232 serial/USB

Power: 12V, 2A

Software Interface

The software interface used to perform experiments on SBHS is Scilab. Scilab is an open source scientific software package for numerical computations. Scilab provides a powerful computing environment for engineering and scientific applications.

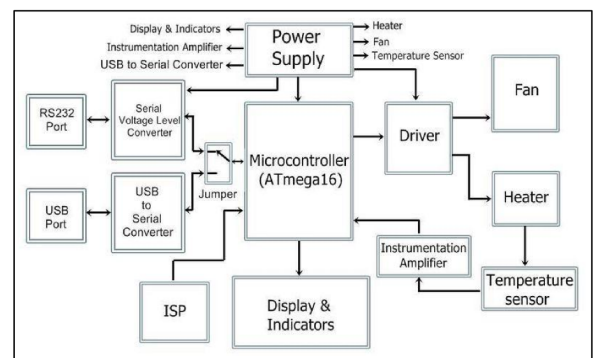
Lists of Experiments

- Step Test
- Ramp Test
- Sine Test
- PID
- PID-self tuning
- PID-self tuning
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- Internal Model Controller
- Model predictive controller
- PRBS testing

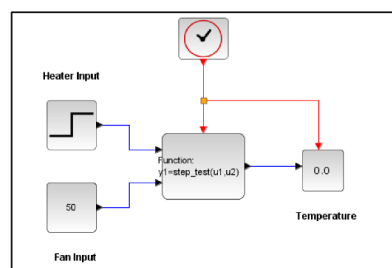
Salient Features

- The plant has a small time constant, less than a minute, that allows completion of an experiment in a short time
- Facilitates performance of a large number of experiments in a single laboratory session
- The speed of response not being too fast allows the measurements to be seen with naked eye, as it happens in industrial systems
- Demonstrates other measurement issues such as noise
- Can be easily connected to a computer via a Serial or USB port
- Board design is Open Source
- Available for purchase at nex-robotics.com

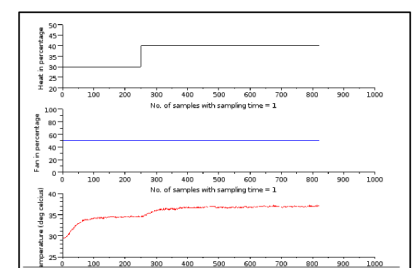
Block Diagram



Illustrations of Step Test experiment performed on SBHS using Scilab is shown below



Xcos interface for performing Step Test on SBHS. Xcos is an object simulator & is a part of Scilab software.



Output graph of Step Test experiment performed on SBHS

SBHS Virtual Lab

The concept of virtual Laboratory was introduced to extend the accessibility of labs beyond the regular lab hours to anyone who has access to a decent internet connection. The two main categories of any virtual lab are:

1. Simulation based Virtual Lab
2. Remote triggered Virtual Lab

The Simulation based virtual Lab allows users to perform online simulations which typically run on the server side. The remote triggered Virtual Lab enables users to actually use an existing experimental setup hosted at a remote location.

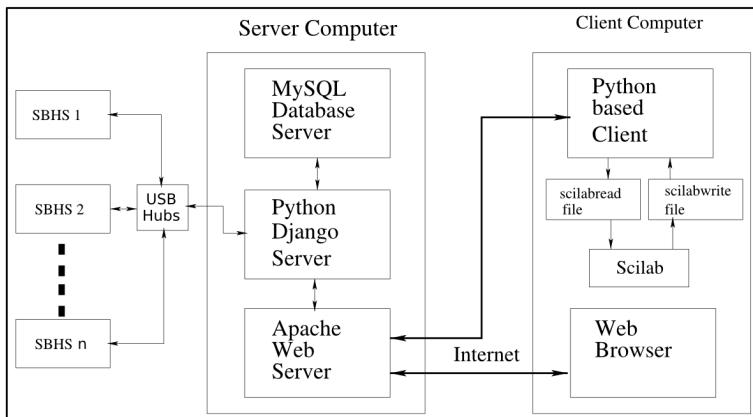
The SBHS Virtual Lab hosted at IIT Bombay is a remote triggered virtual laboratory.

Salient Features of SBHS Vlabs

- Available 24x7 and more than 30 SBHS hosted
- 24 one hour slots per day give you more than 720 hours of experimentation per day
- Provision of Video feed of the remote SBHS to user
- Computation happens on the student side
- Uses Python for network communication
- Uses Scilab to implement the experiment

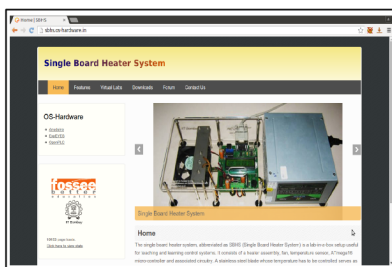


SBHS Vlabs current server architecture



SBHS Vlab Process

- Python, Scilab at student end
- Python, SBHS at remote site
- Student implements control algorithm of her choice in Scilab
- Python server communicates the data over internet
- Python at remote end changes the SBHS input output
- Scilab at student end successfully implements the control action



SBHS website (sbhs.os-hardware.in)



Illustration of Video feed

Documentation

A 300 page user manual is available for SBHS. It contains all details regarding SBHS and the local and remote access procedure. Total 9 chapters are dedicated for different experiments on SBHS. It is available on sbhs.os-hardware.in

Spoken tutorials on SBHS & Scilab are available on spoken-tutorial.org

Links

- **SBHS Vlabs website:** vlabs.iitb.ac.in/sbhs/
- **SBHS forum:** sbhs.os-hardware.in/forum
- **Email:** sbhs@os-hardware.in



<http://fossee.in>



IIT Bombay



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