Climate Monitoring Web Interface using Point Six® and 1-Wire® standard sensors

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Overview

Monitoring temperature and humidity in computer laboratories facilitates maintenance, and results in a longer life span of parts and devices. Light sensors can be used to keep track of laboratory usage and even reduce the electricity bill. The purpose of this project is to set up these sensors, create a user-friendly web based interface (applet) and a database that will hold previous data and provide query abilities to the applet.

Basic Inputs and Outputs:

Inputs:
- Light, temperature and humidity i.e. sensors readings
- Input from the user
  - Request history of a sensor
  - Update the readings

Outputs:
- Output displayed to the user from the interface
  - Current status of all sensors
  - History for selected sensor
- Data sent and saved in the database

Sensors, Adapter & I/O Cards used:

(Point Six, Inc manufactures all these devices)

- **D2Photo** Light Sensor
- **DS1820** Digital Thermometer
- **HMP-2001S** 0-100% Digital Relative Temperature and Humidity Sensor
- **HA5** RS232 to Isolated 1-Wire™ Host Adapter
- **T8A** 8 Channel 12 bit Analog 1-Wire™ CARD
- **T8D** 8 Channel Digital I/O 1-Wire™ CARD

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† An **Applet** is a Java program that runs within a web browser or on a computer within the Java runtime interpreter. An applet does not run on its own without running inside of something, a program which converts the Java program code into instructions for the computer.
Fig. 1. Complete system block diagram
**Hardware interface:**
The sensors will be distributed along two wires that go through different rooms of Jobst hall; these are connected to an adapter. The adapter connects to a computer by a serial (RS232) interface.

![Sensors Connectivity Diagram](image)

**Fig. 2. Sensors Connectivity Diagram**

The first subsystem of the project consists of three types of sensors:

- D2Photo light sensor
- HMP-2001S temperature and humidity sensor
- DS1820 digital thermometer

Information is sent to and from the sensors over two wires (signal and ground). These wires are connected to the HA5 (RS232 to isolated 1-wire host adapter). The sensors receive a signal from the adapter to start taking readings, once done they send the obtained values to the HA5.

![HA5 Adapter](image)

**Fig. 3. HA5 Adapter**

The second subsystem consists mainly of the HA5 adapter. The adapter queries the sensors, obtains the required data, and then sends it through a serial port to a computer. The HA5 is an addressed command/response device. To get a response, the user must send a command with the proper address command and checksum. The adapter will respond with data and checksum. All commands and responses end with a CR (hex 0D) character. The “address” is a single character “a” to “z” which is set by onboard switch positions A0-A4. The checksum is a modulo 256 sum of all the ASCII character values in the command or response but does not include the CR. For example, sending the command ‘aS,FF’ from the computer results in a search (S) for all connected sensors.

The HA5 must have the address switches set to a unique setting when it is sending the data out on the serial port.
The third subsystem is a computer that receives data from the adapter through the serial port (COM 1) and sends it to a database through a TCP/IP DSTP connection. The data space transfer protocol (DSTP) is used to index and retrieve data from a number of databases, files, and other data structures using a key that can find all the related data about a particular object across all of the data. DSTP is considered a tool for data mining.

Fig. 4. Sensor Query Daemon

Fig. 5. Sensor Query Daemon Flowchart
The fourth subsystem is the database. This is where the gathered data will be stored, allowing the user to access it any time he wants to. The database will be installed on the same computer as the web server. Due to cost, and copyrights issues the type of the database that is going to be used is still under research. The database connects to “our computer” and to the java applet through a TCP/IP DSTP connection. Thus the user will have access to statistical values gathered from previous times, and he’ll be able to check current values recorded by the sensors.

The java applet will be running from a web server. The user’s computer connects to the web server through a TCP/IP HTTP connection. The block ‘Files’ corresponds to all the data required to display our applet. The applet will query the sensors for readings. Data will be recorded in a database for later use. Many applications could be added to the applet making use of the records in the database. These have not been decided yet.
The applet will be running on the web server. The applet will also allow the user to access the database through a TCP/IP DSTP connection. The user will interact with the applet by means of a mouse or a keyboard.

**Fig. 8.** Graphical User Interface (GUI) Connectivity

**Fig. 9.** Applet Flowchart