SONIFICATION OF UCSD ENERGY CAMPUS ENERGY CONSUMPTION

Auditory display to increase awareness of energy end-users

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Abstract

This student research project is about the sonification of UCSD's campus energy consumption. Our project involves collecting data from the campus energy database and then utilizing specific methods in java in order to analyze and interpret the data using sound; hence, "sonification". My portion of the project was to an analyze and retrieve energy consumption data off the MSCADA ION website, transferring it first to Microsoft Excel, and then preparing it for use with java and sql.

Introduction

Sonification is an engaging method that incorporates a new, novel way of reading and understanding data, as well as any repercussions of data. Rather than only relying on graphs, to keep track of energy using sound is an innovative technique, and auditory display may in fact prove to allow administrators to maintain a closer real-time watch on the sometimes byzantine patterns of energy consumption, therefore allowing them to apportion resources more efficiently. There are several already existing fields of application, for example in sonar and volcanic activity analysis. Sonification changes a user's perception of data. Producing sound to find out about properties of the environment occurs frequently in every day life.

We would like to use sonification in the context of the great and complex energy pathways that are present in the hierarchy of the many branching buildings extant on UCSD campus grounds. All of the different energy sources culminating into one overall process of energy consumption can be more easily clarified and understood through similarly branching and contrasting frequencies that sonification brings.

Acknowledgements

Process

The Sonification project's main purpose is campus sustainability. This entails investigating how the campus consumes energy and the relationship between production and consumption in order to optimize it. The campus stores its data in the mscada website, which displays the consumption of energy and control of facilities. My job was to get the data from the website into java. To do this, I saved a table of data displayed on the website, then edited the data in Excel and saved it as tab-separated text. From then on, I can parse the data in java, the specific database management language being SQL. After my portion is completed, the other members of my group can then proceed to link this read data to audio using the jsyn extension applet, thus giving birth to the data interpretation technique known as sonification. This project creates new paths and aspirations for data interpretation, and, regarding situations such as our campus energy level maintenance, is the most suitable for real time data comprehension.

TOTAL ENERGY CONSUMPTION
http://mscada01.ucsd.edu/ion/Historical/DateRange.asp?id=7d85c169-3b2c-44be-a4fa-9e4ad0c7a8d5&dgm=x-pml:/diagrams/ud/network.dgm&node=VIP.MSCADA01&isEventLog=&LogServerName=QUERYSERVER.MSCADA01&LogServerHandle=327952

SIO

Nierenberg Annex
http://mscada01.ucsd.edu/ion/realtime.asp?diagram name=OPEN TEMPLATE DIAGRAM&node name=SIO.Nierenberg Annex ES303&logserver name=QUERYSERVER.MSCADA01&logserver handle=327952

Hubbs Hall
http://mscada01.ucsd.edu/ion/Historical/DateRange.asp?id=e711dec3-0c3b-4763-a836-9429cd0e7024&dgm=x-pml:/diagrams/ud/custom diagrams/webreach/operations/hubbs hall usage.dgm&node=VIP.MSCADA01&isEventLog=&LogServerName=QUERYSERVER.MSCADA01&LogServerHandle=327952

E5102 Chiller 1

E5103 Chiller 2
http://mscada01.ucsd.edu/ion/Historical/DateRange.asp?id=5a61cc24-29f6-4c86-acdb-0bc9eb45e1a6&dgm=x-pml:/diagrams/ud/custom diagrams/webreach/operations/hubbs hall usage.dgm&node=VIP.MSCADA01&isEventLog=&LogServerName=QUERYSERVER.MSCADA01&LogServerHandle=327952 (for both chillers)

E5101 Main Meter
http://mscada01.ucsd.edu/ion/realtime.asp?diagram name=OPEN TEMPLATE DIAGRAM&node name=SIO.Hubbs Hall E5101&logserver name=QUERYSERVER.MSCADA01&logserver handle=327952

Scholander Hall

SIO Library

This is the data gathered from the MSCADA ION website, depicting all the various sources of energy consumption throughout UCSD's campus.

Tools and Implementation

For our project, we used the program Eclipse, which is a software development environment for java, as well as an extensible plug-in system. We included a java library, jsyn, that specifically allowed us to synthesize and create sounds in java. Next, we were to upload data from the UCSD energy consumption database, but as direct access was unavailable, we opted to instead manually collect the data from a MSCADA ION website that had the real-time and past energy usage of the campus listed out in separate branches and buildings. The graph and sound that convey the data are presented as a java applet, which is a frame of graphics or sound that can be displayed in a web browser. Our applets incorporate the sounds manipulated through jsyn as well as the graphics programmed in through java itself. An SQL database was installed and used as a stand-in for the unavailable campus database.
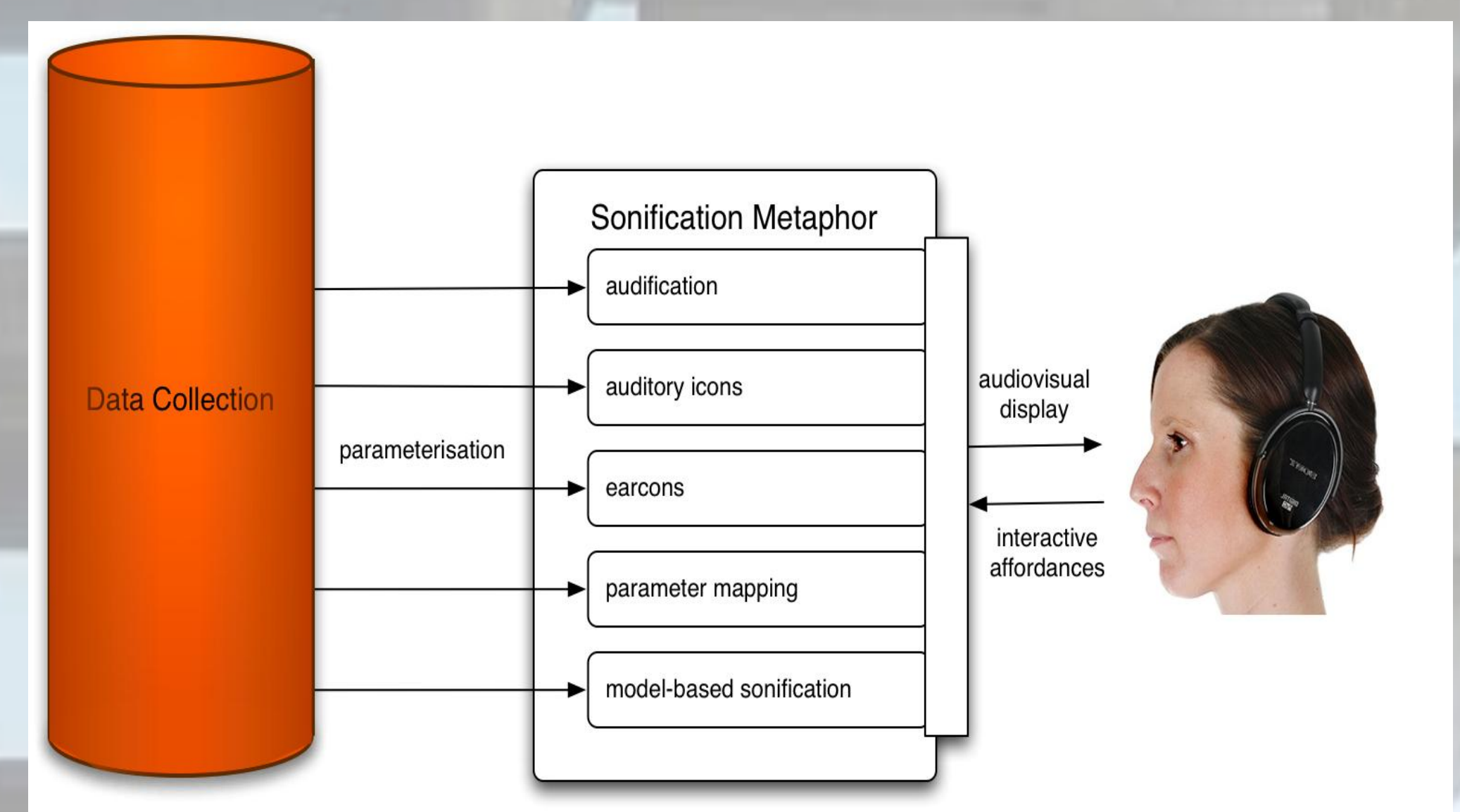
I am involved mainly in the "data collection" portion of the project. After obtaining the data, it can then be analyzed with Sonification.

```
1   package sonify.data;
2
3   import java.sql.Connection;
4   import java.sql.DriverManager;
5   import java.sql.ResultSet;
6   import java.sql.SQLException;
7   import java.sql.Statement;
8
9
10  public class sqlquery {
11      String databaseURL="";
12      public String database="sonify";
13      public String table ="buildings";
14
15      Connection databaseConnection;
16      Statement stmt = null;
17      ResultSet rs = null;
18
19      public void init()
20      {
21          databaseURL = "jdbc:mysql://host.sdsc.edu:3306/"+database;
22          try {
23              Class.forName("com.mysql.jdbc.Driver").newInstance();
24          }
25          catch (InstantiationException e1) {e1.printStackTrace();}
26          catch (IllegalAccessException e1) {e1.printStackTrace();}
27          catch (ClassNotFoundException e1) {e1.printStackTrace();}
28
29          try {
30              databaseConnection = DriverManager.getConnection(databaseURL,"sonify","sonify");
31          }
32          catch (SQLException e) {e.printStackTrace();}
33      }
34
35      public void query(String query)
36      {
37          try {
38              stmt = databaseConnection.createStatement();
39              rs = stmt.executeQuery(query);
40
41              while (rs.next()) System.out.println(rs.toString());
42          }
43          catch (SQLException e1) {e1.printStackTrace();}
44      }
45  }
```

After the data was saved in Excel, it was parsed in Java, using the database management language, SQL.

Summary

In conclusion, what our team can accomplish using sonification allows us to control and maintain large amounts of data, as sonification is a more viable way to organize and establish a hierarchy of information, the ranging levels of, in this case, energy consumption, all perceived through audio interpretation.