

A BOTTOM UP SENSOR TESTBED



Universitat
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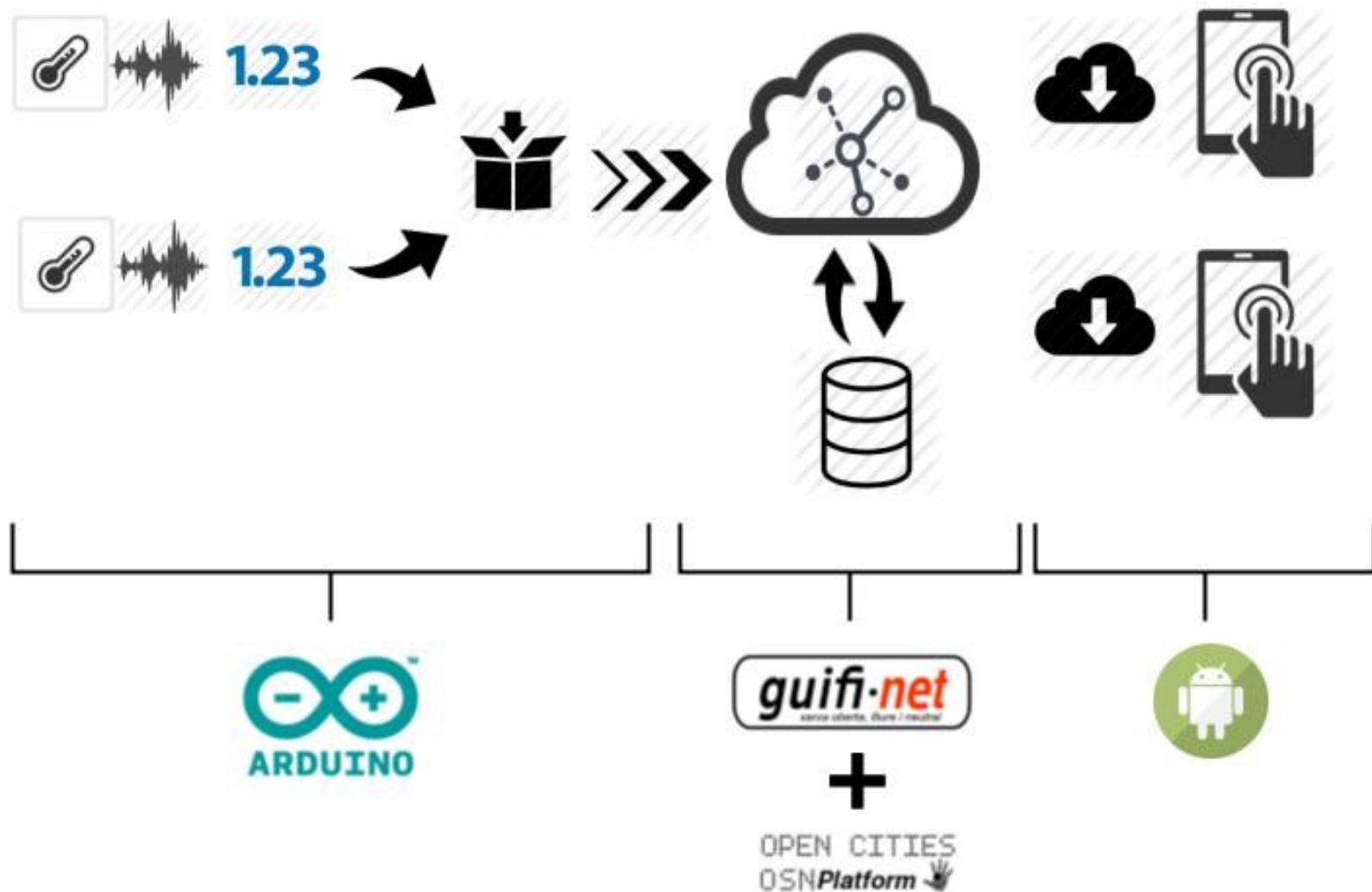
NeTS research group
Network Technologies and Strategies

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Year: 2014

Outline

- Introduction
- State of the art
- Technologies
- Testbed
- Conclusions
- Future Work

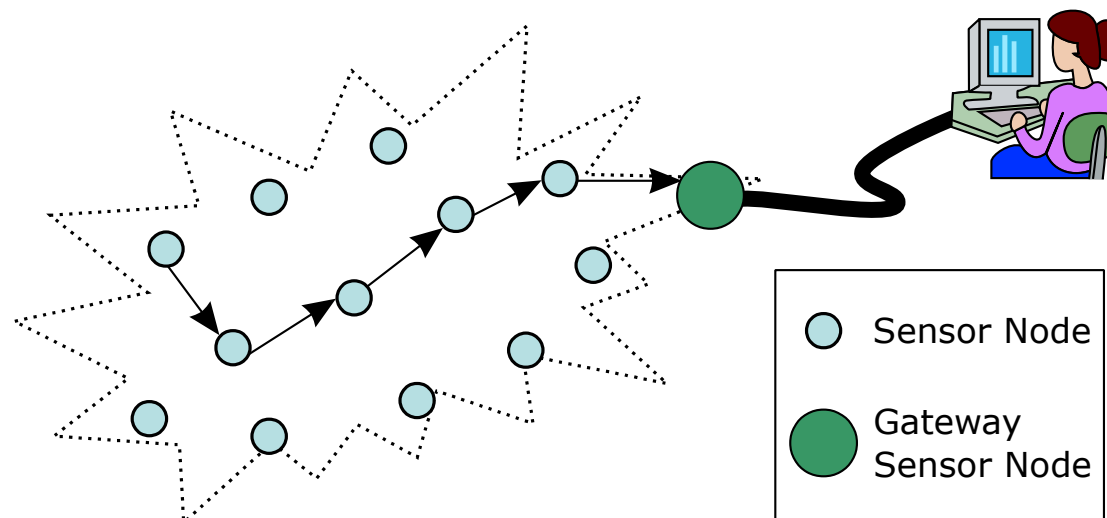
INTRODUCTION



INTRODUCTION

Wireless Sensor Networks

- A network composed of nodes.
- A node:
 - Is composed of a computer and sensors.
 - A node has equipped wireless technology to create ad-hoc networks.



INTRODUCTION

Bottom Up Broadband (BuB)

- BuB defines network design, deployment and operation initiatives driven by end user needs.
- These end users can be individuals, companies or institutions.
- In BuB, those that need the network are the ones that take the initiative and participate in the organization and funding of the project



<http://bubforeurope.net/>

State of the Art Smartcities

- A city capable of having real-time information.
- Amsterdam:
 - Flexible street lighting
 - Smart parking
- Santander:
 - Environmental monitoring
 - Traffic Intensity Monitoring



State of the Art Companies

- Smartcitizen is a platform that offers a sensor board based on Arduino to monitor the environment.
- Libelium is an Internet of things platform provider, which supplies an open source sensor platform for the Internet of things.



Libelium Smart Water

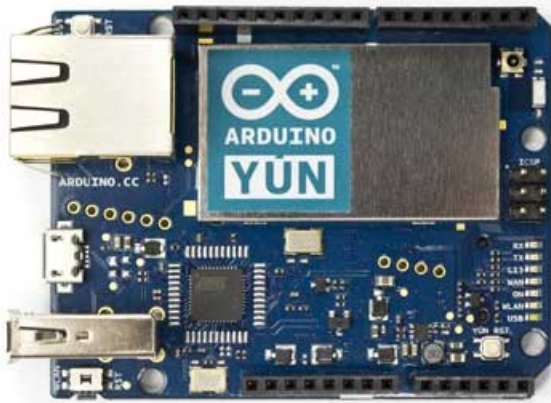
State of the Art

Open Data

- The term Open data pursues the fact that certain types of data should be available for anyone to use, without any control mechanism, e.g. copyright.
- Opencities, Xively and Sentilo are platform that allow the user to upload and download data.

State of the Art Sensor Boards

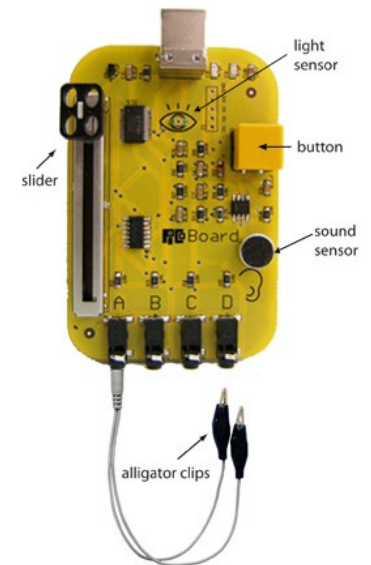
- Some options for the sensor node:



Arduino YUN



Raspberry Pi model B

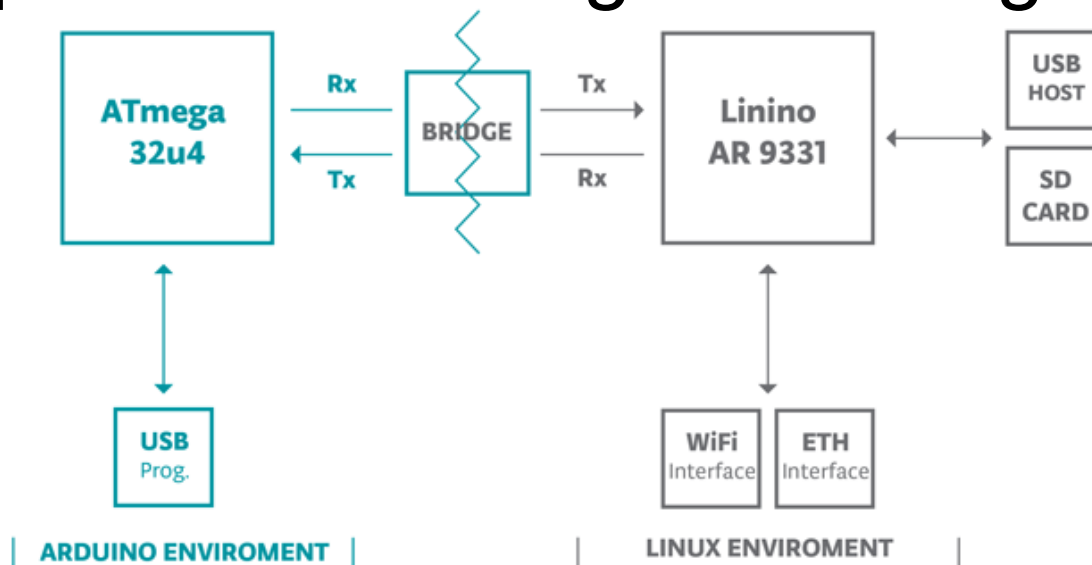


Picoboard

Technology

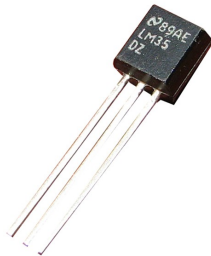
Arduino Yun

- Microcontroller board with one processor and one microcontroller.
- Has an Ethernet and WiFi module.
- Arduino sketches can communicate with the Linux processor through the Bridge library

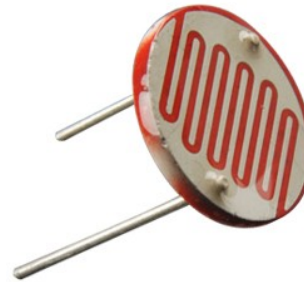


Technology Sensors

- The goal is to analyze the environment.
- These sensors measure the aspects that may be more useful for citizens:



Temperature



Light



Noise



Humidity



Air Quality

Technology

Upload Sensor Data

- Upload the data from the sensors to a platform so that everyone can access them.
- A GeoJSON message includes data from the 5 sensors.
- A Python script has been used to upload this message.

```
{
  "type": "FeatureCollection",
  "name": "dummy",
  "timeStamp": "2014-06-12T08:54:59.424Z",
  "features": [
    {
      "type": "Feature",
      "tags": [
        "red",
        "tall",
        "cheap",
        "upf"
      ],
      "geometry": {
        "type": "Point",
        "coordinates": [
          2.18946,
          41.403809
        ]
      }
    }
  ]
}
```

GeoJSON message

Technology

Community Network

- Is a network created and used by a community.
- Guifi is a network created by people interested in building an open, free and neutral network infrastructure.
- Guifi is the network where the Arduino nodes will be deployed.



Guifi Nodes

Technology

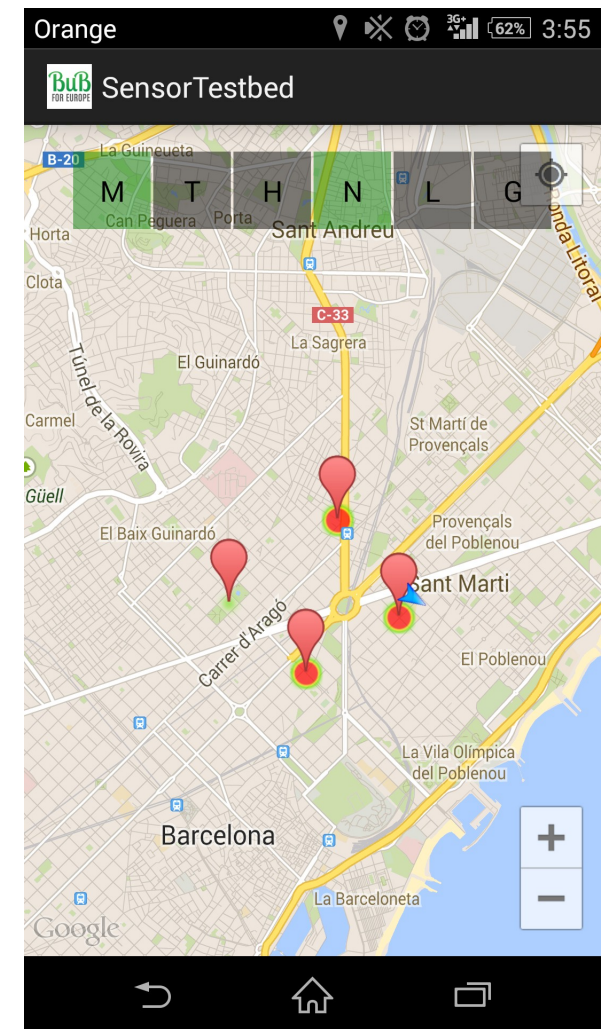
Storage Resource Broker

- The entity that stores the sensor data and is between the sensor network and the android App.
- Opencities is the opendata service that has been chosen:
 - The developers are at UPF, so the process of improving both projects (feedback, bug fixing, etc) can be fast and effective.
 - Easy API to upload and download the data.



Technology Visualization Platform

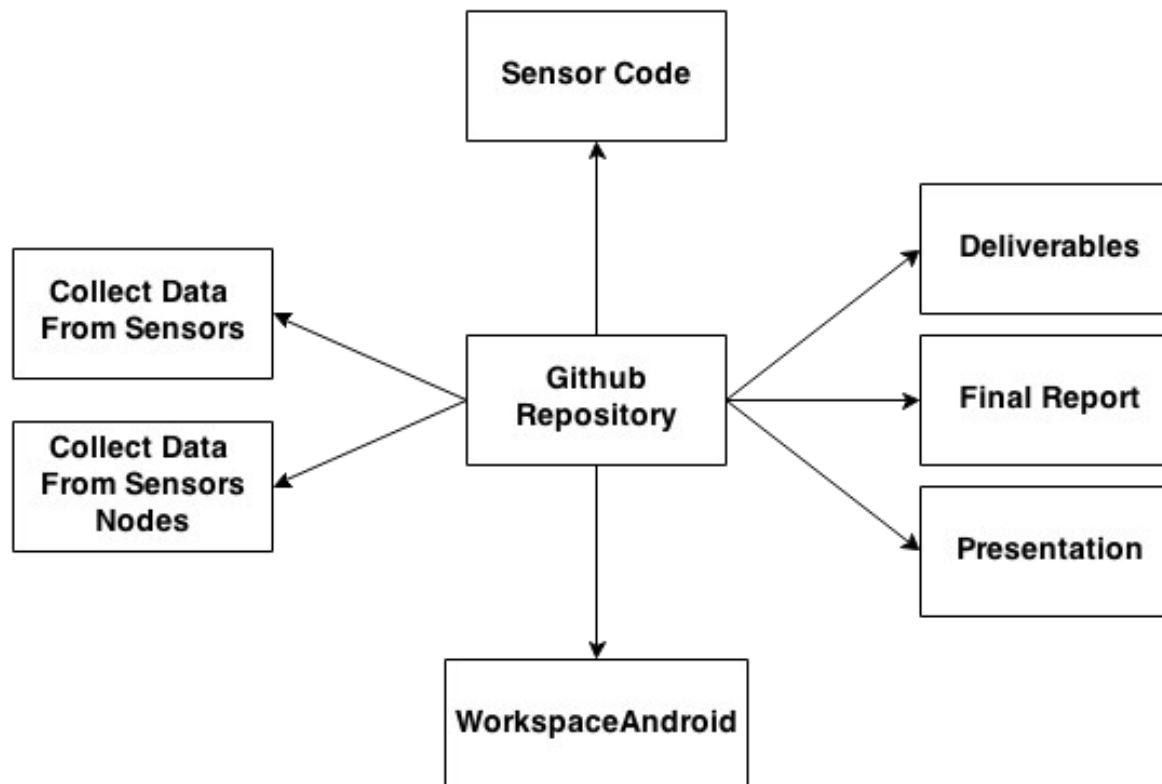
- A map is used to display the data.
- The goal is that a user checks it for a small period of time.
- The Android operating system has been chosen.



Android App

Repository

- All the code, report, figures, etc have been stored in a public repository.
- [Github.com/SergioAlmendros](https://github.com/SergioAlmendros)



Testbed

- A Testbed is a platform for experimentation of new technologies, scientific theories...
- For this project, three nodes had been deployed:

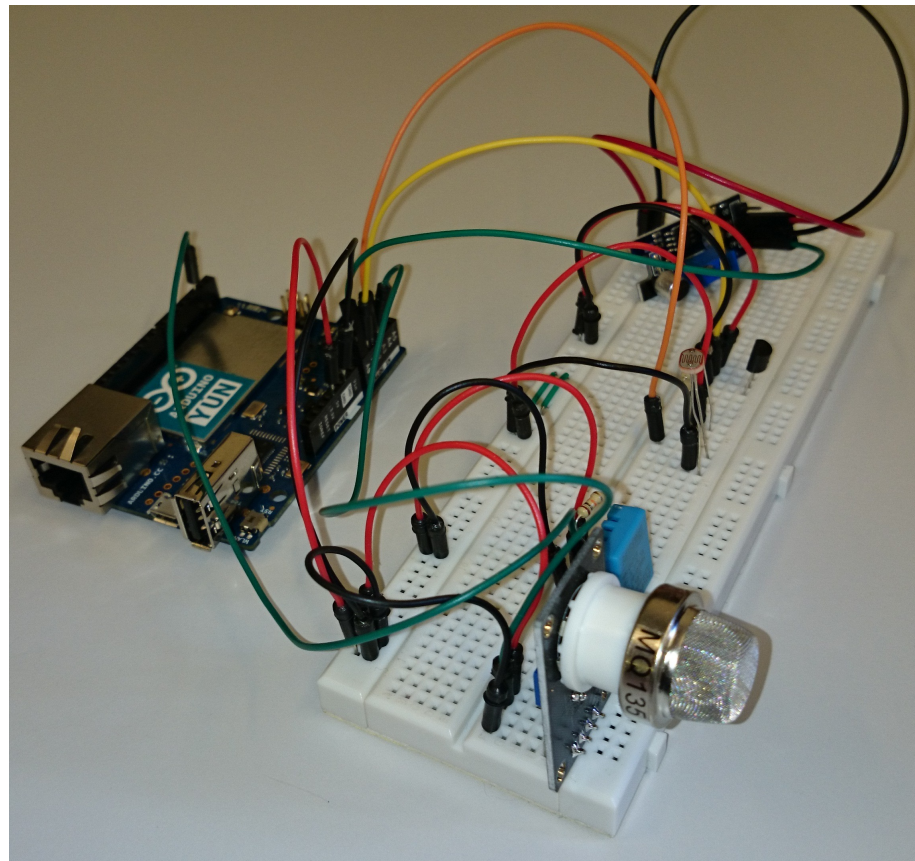


Testbed Nodes

Testbed

Sensor node Prototype

- It is composed of an Arduino YUN, and a breadboard with all the sensors.

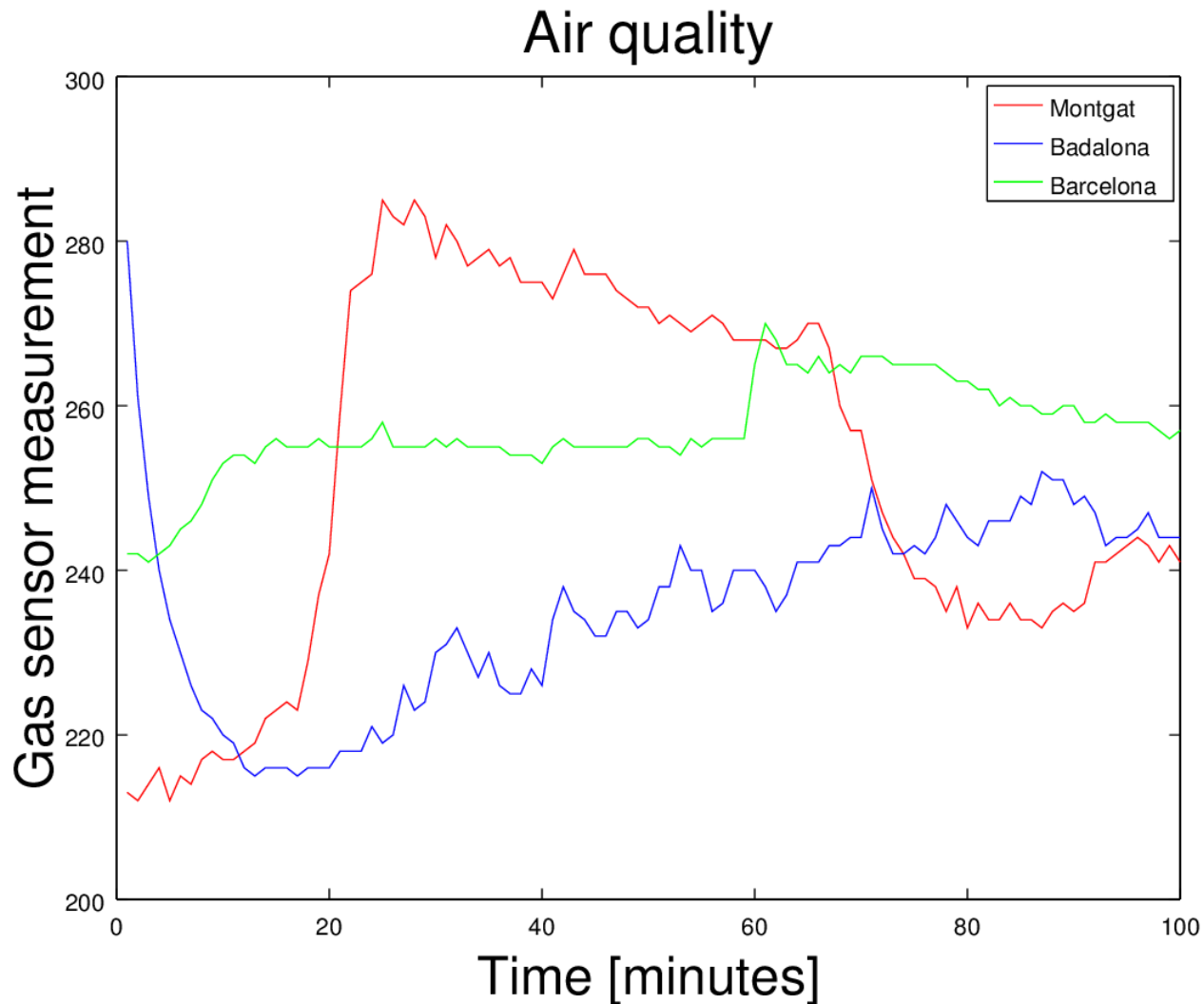


Node prototype

Testbed Results

- A Sensor Network has been deployed.
- The data has been stored as opendata.
- A mobile application shows the data.
- Some graphs show the collected data.

Testbed Results

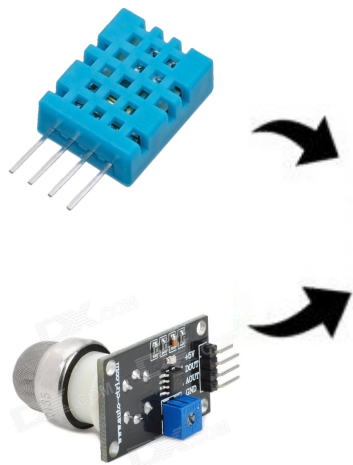
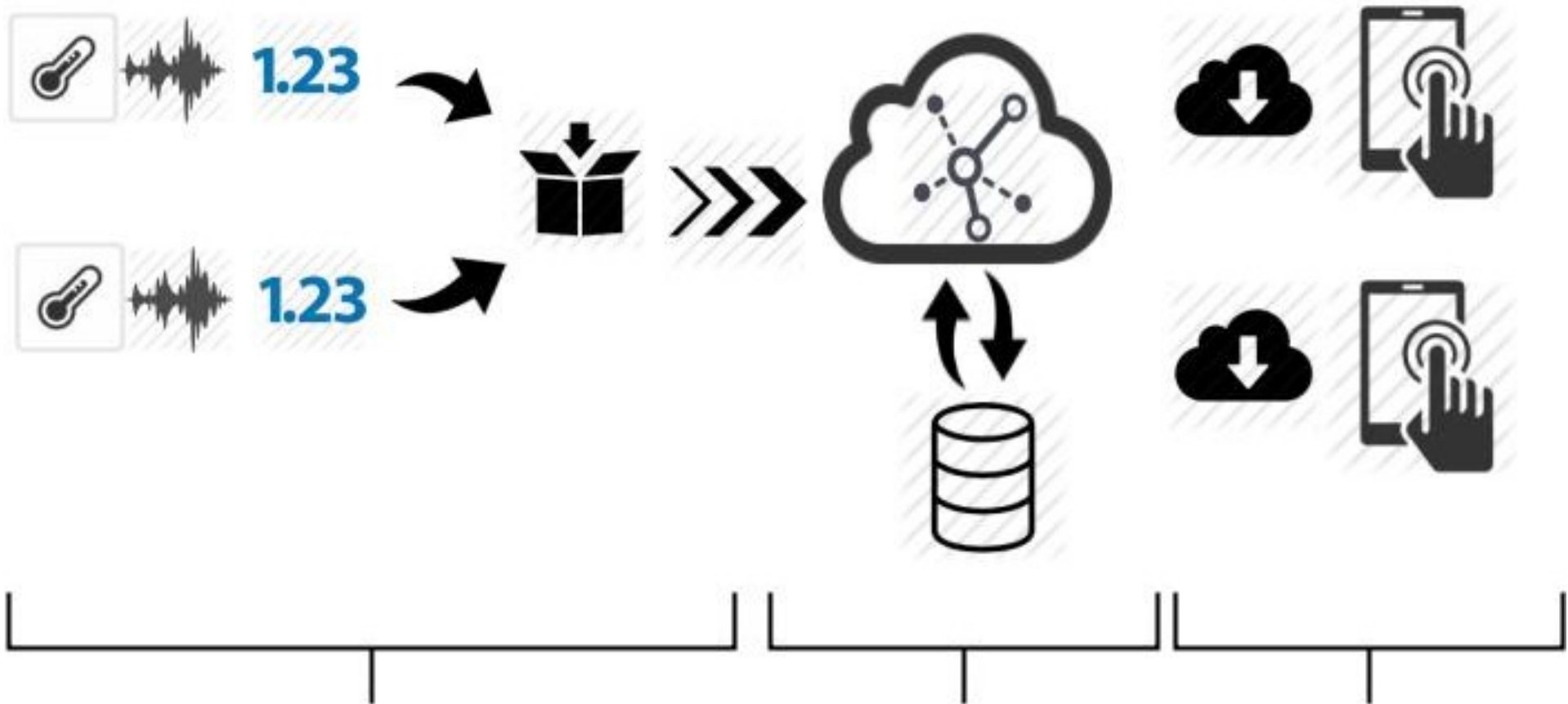


Conclusions

- The deployment of the sensor network has been successful.
- It has been shown that anyone can deploy their own network in an inexpensive way.
- A mobile application has been developed to serve as an example.
- The project satisfied the goals presented at the start.

Future Work

- Build a prototype.
- Make the Arduino Power over Ethernet.
- The mobile application showed some issues.
- Show how the data changes during a period of time.
- Disseminate the project.



OPEN CITIES
OSNPlatform

