SenZations 2013

ARISTOTLE UNIVERSITY OF THESSALONIKI

8th Summer School on Applications of IoT and Wireless and Sensor Networks

Sensors talk and humans sense

Part III

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Palic, 6th September 2013

SEN2SOC experiment

inform

suggest

alert

engage

SEN2SOC

bridging SENsor measurements and SOCial networks interactions via natural language generation for supporting smart city services

interaction: sensor networks and humans

engagement of the Santander community

combination of sensor and social data into meaningful services

environmental sensor data processing/presentation in a simple way

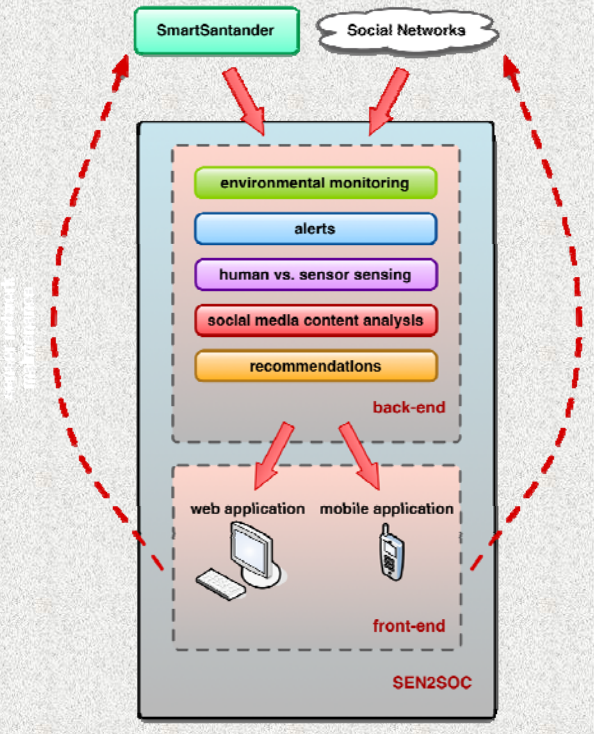
alerts about extreme environmental conditions

social media content analysis

detection of trending topics

"users as sensors": SEN2SOC app users can express how they sense the environment

sharing of environmental alerts in real-time on social networks



sensor-to-social interaction

objectives

refine and integrate sensor and social data

enhance sensor data analysis and monitoring

implement efficient data mining techniques on heterogeneous data (sensor measurements and social networking interactions)

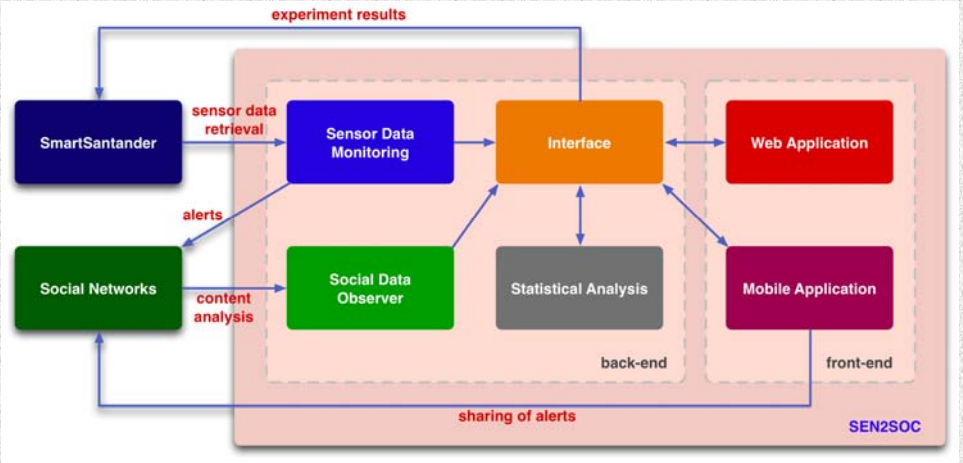
activate Santander citizens, visitors, and city authorities

offer route and place recommendations to Santander citizens/visitors (based on sensor measurements and social media information)

provide environmental monitoring tool to city authorities (real-time or past sensor data, statistical analysis results, alerts, etc.)

initiate a vibrant social network community of interest around SmartSantander sensor network

SEN2SOC architecture



sensor data monitoring

data retrieval

data cleansing

times series

virtual nodes

alerts

virtual nodes

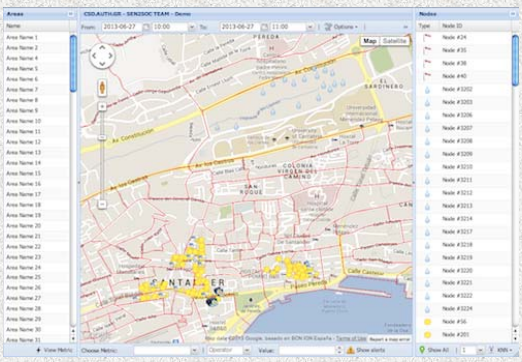
Santander shapefile

(Instituto Nacional de Estadistica - INE)

social data observer

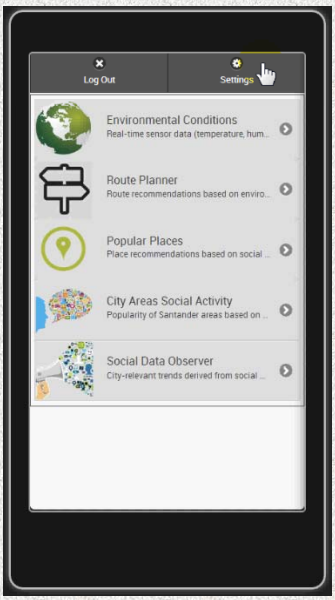
- geolocated data collection
- user-generated content mining
- Santander areas popularity based on user trails in social media
- content summarization (trend detection, clustering)
- identification of popular spots (recommendation)

web application & statistical analysis



- sensor data (graphs)
- virtual nodes (graphs)
- real-time / historic data
- alerts
- nearest sensors
- prediction (sensor / area)

mobile application



environmental conditions (real-time)

humans as sensors

route recommendations

social media content analysis

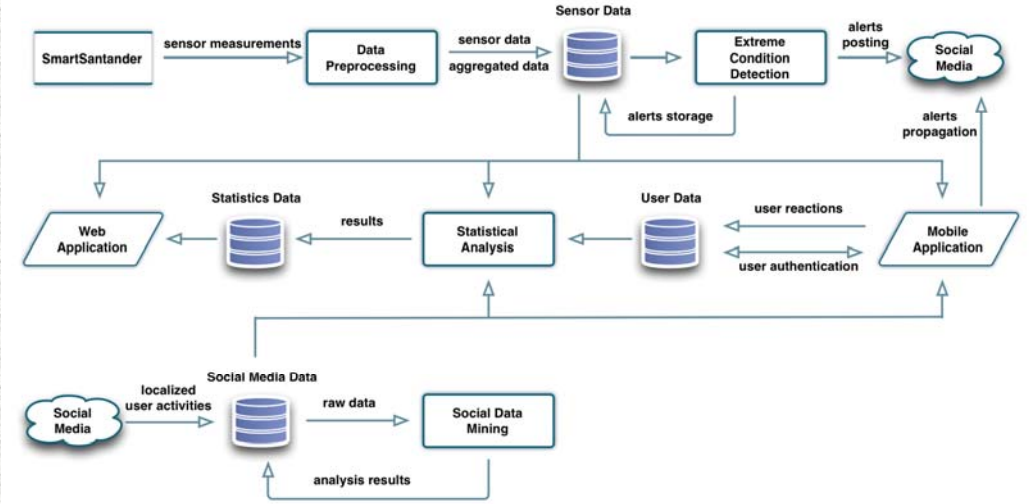
(place recommendations, trends, etc.)

interface

SEN2SOC data communication

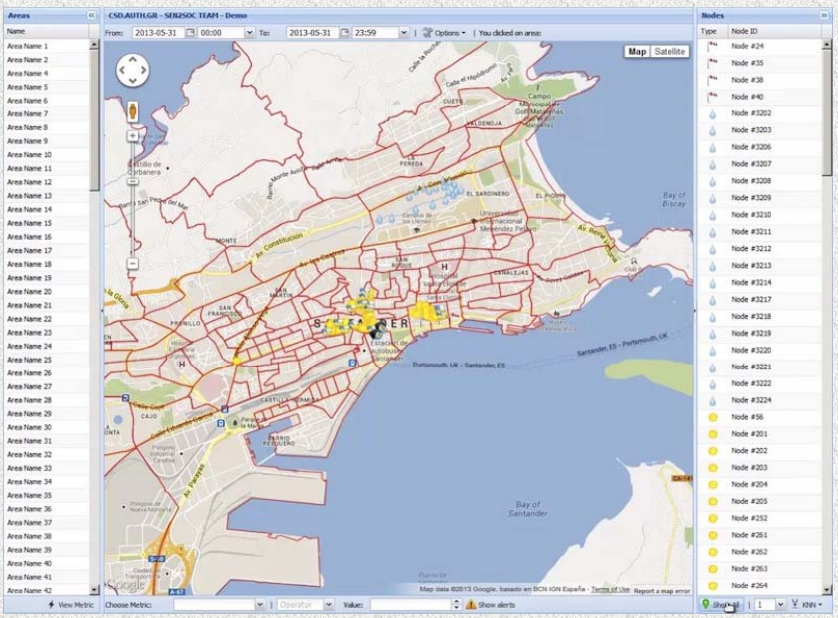
... the conductor

control flow diagram



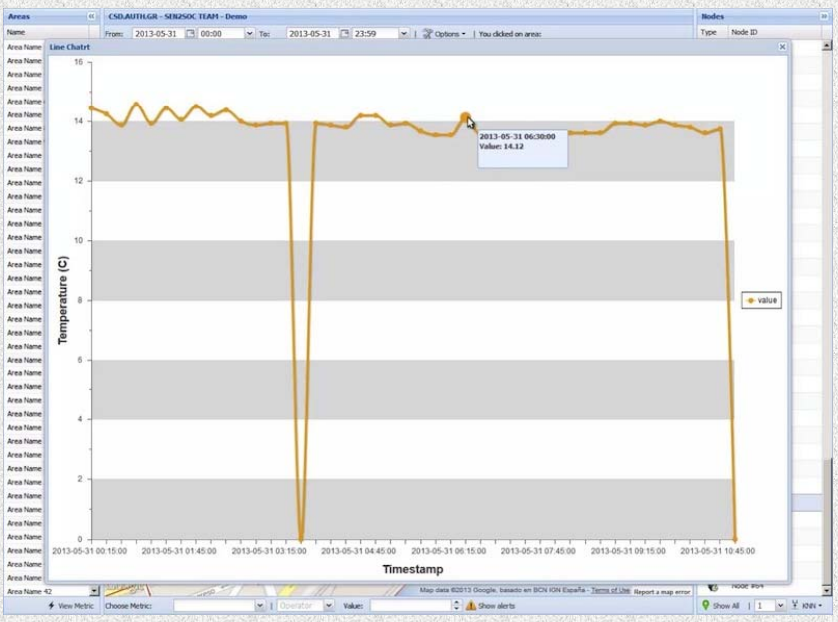
web app: list of areas and sensors

Santander geographic areas and SmartSantander sensor nodes



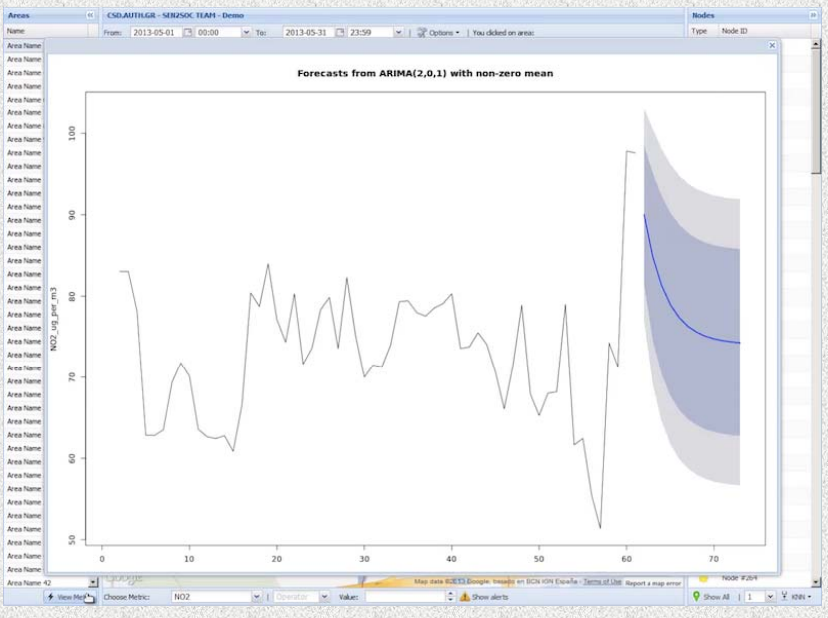
web app: sensor node values

graph for sensor measurements regarding the user-specified environmental parameter and time window



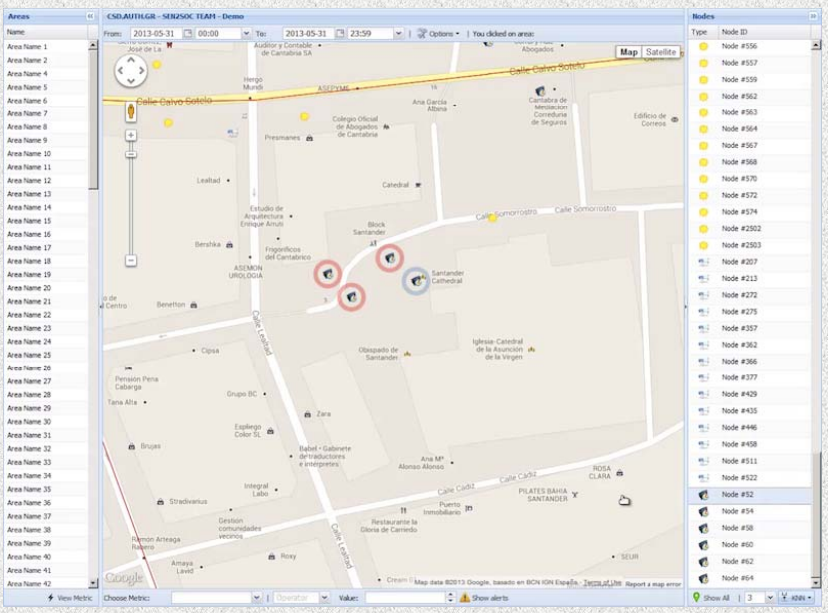
web app: prediction

prediction for the specified environmental parameter and desired time window (forecasted values in blue line)



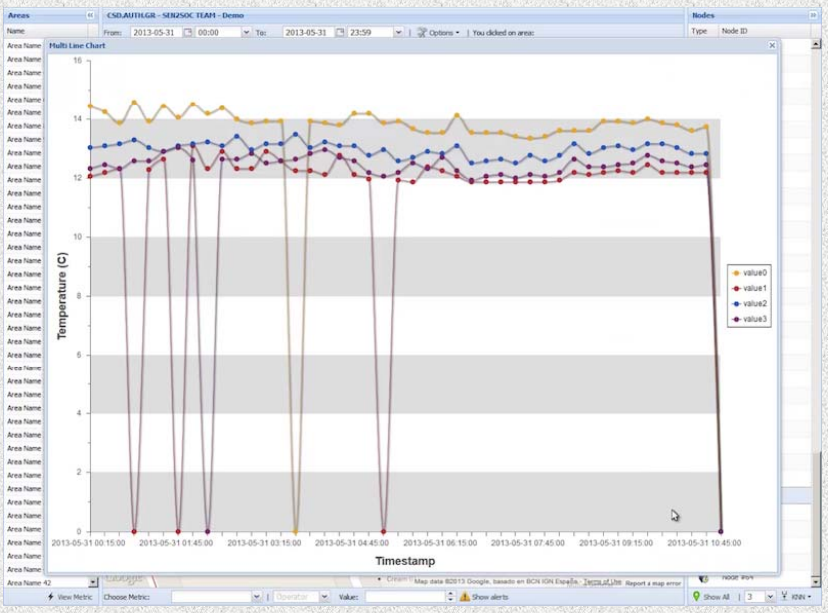
web app: K-nearest neighbors (KNN)

select some sensor node (in blue) on the map
and find its adjacent nodes (in red)



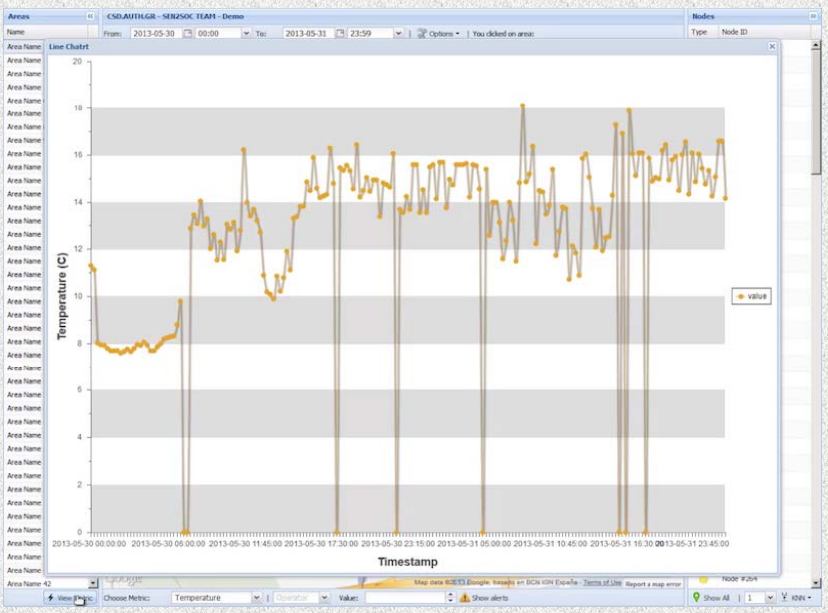
web app: K-nearest neighbors (KNN)

comparison charts



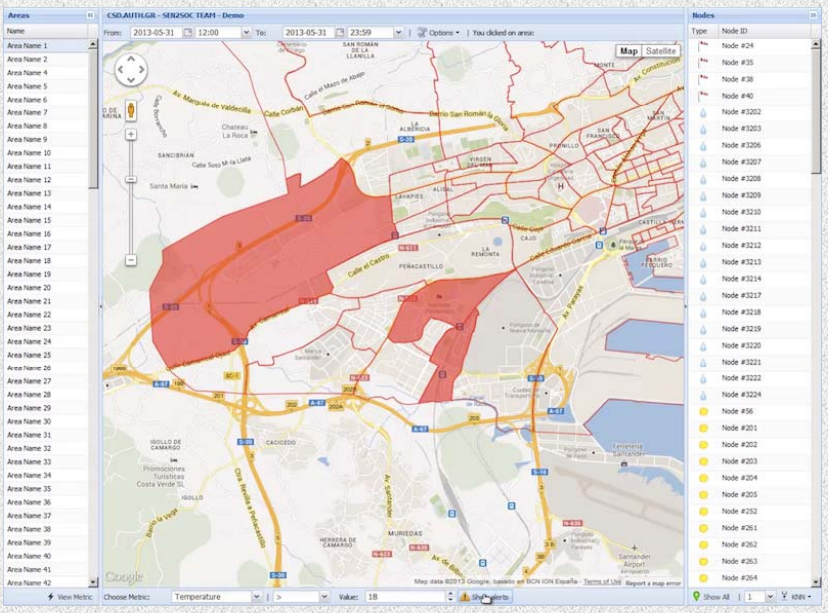
web app: virtual sensor values

aggregated values corresponding to geographic areas of Santander



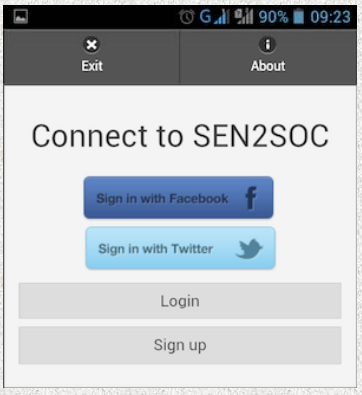
web app: alerts

alerts triggered by user-configurable parameters (areas filled up with red on the map)



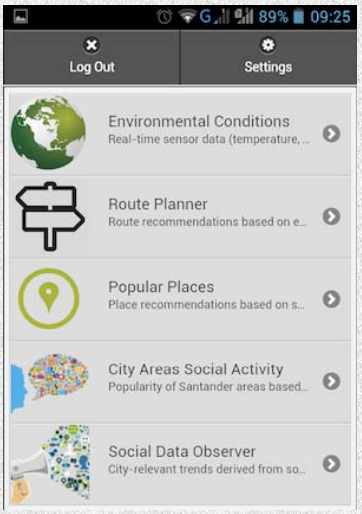
mobile app: authentication

users may register with the SEN2SOC platform or sign in with their Facebook or Twitter account



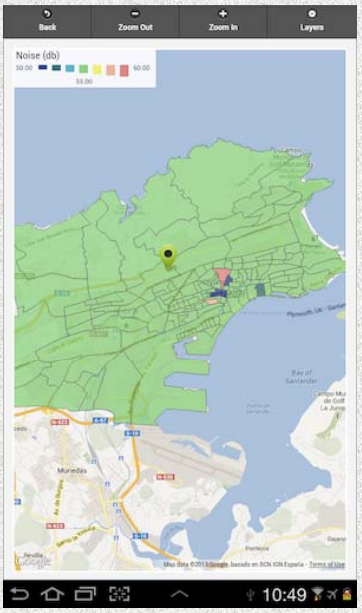
mobile app: services

main screen



mobile app: environmental conditions

real-time, aggregated sensor data (temperature, particles, NO2, relative humidity, noise, ozone, CO, and heat index)

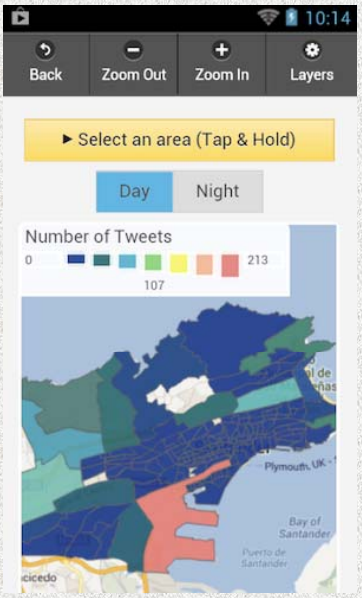


mobile app: route planner

route recommendations based on (favorable) environmental conditions

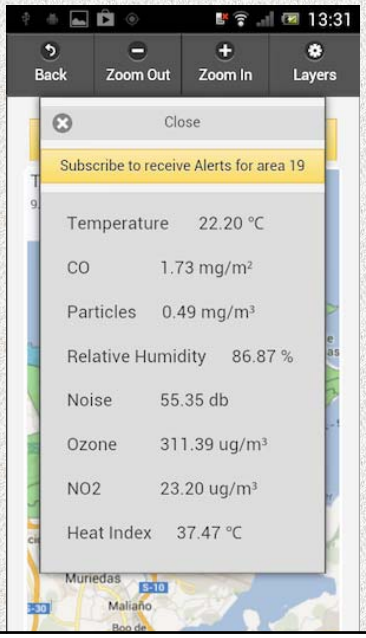
mobile app: city areas social activity

popularity of Santander areas based on social media: number of photographs (Flickr/Twitter) or number of tweets (Twitter)



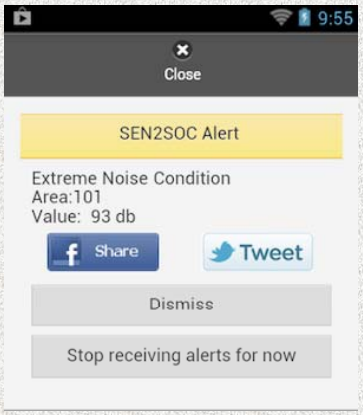
mobile app: user subscription to areas

subscribe to Santander areas in order to receive alerts about extreme environmental conditions



mobile app: alerts

alerts appear in real-time on the mobile screen; users are able to share alerts (Facebook/Twitter)



open data (1st method): sharing of alerts

SEN2SOC experiment data access method:

provides data regarding mobile users' sharing of alerts about extreme environmental conditions on social networks (Facebook/Twitter)

data is returned in JSON file format and can be accessed through the following URL:

http://sen2soc.afroditi.hellasgrid.gr/data/sharing/{start_date}/{end_date}

open data: sharing of alerts (JSON: 1 of 2)

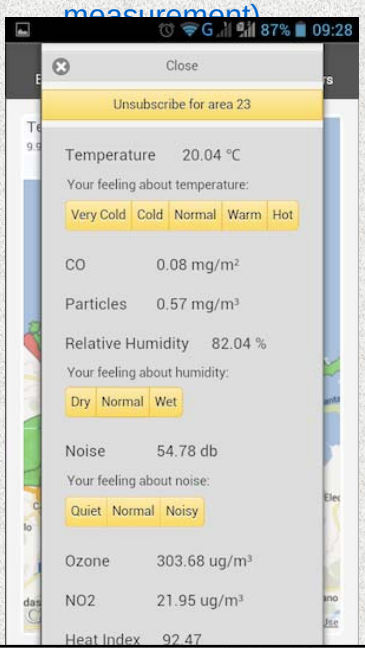

```
{
    "sharing": [
        {
            "measurement_info": [
                {
                    "measurement_date": "2013-07-16 15:31:01",
                    "area_id": 103,
                    "parameter_type": "heat_index",
                    "parameter_value": 42.5758,
                    "parameter_unit": "Celsius",
                    "accurate_measurement": true
                }
            ],
```


open data: sharing of alerts (JSON: 2 of 2)


```
"alert_sharing_info": [
                {
                    "alert_sharing_id": 708,
                    "alert_sharing_date": "2013-07-16 15:34:51",
                    "social_media": "Twitter",
                    "alert_message": "Extreme condition at area 103
  for heat index: 42.5758 Celsius."
                }
            ]
        }
    ]
}
```

mobile app: users as sensors

users can express their perception on the environmental conditions (user input based on qualitative scales of measurement)



open data (2nd method): users as sensors

SEN2SOC experiment data access method:

provides data regarding mobile users' feedback on how they "sense" the environment (users' perception on the present environmental conditions)

data is returned in JSON file format and can be accessed through the following URL:

http://sen2soc.afroditi.hellasgrid.gr/data/feedback/{start_date}/{end_date}

open data: users as sensors (JSON: 1 of 2)


```
{
    "feedback": [
        {
            "measurement_info": [
                {
                    "measurement_date": "2013-07-16 15:10:01",
                    "area_id": 23,
                    "parameter_type": "noise",
                    "parameter_value": 53.4306,
                    "parameter_unit": "dB",
                    "extreme_value": false,
                    "accurate_measurement": true
                }
            ],
```


open data: users as sensors (JSON: 2 of 2)


```
            "user_rating_info": [
                {
                    "user_rating_id": 238,
                    "user_rating_date": "2013-07-16 15:12:33",
                    "user_rating": 1
                }
            ]
        }
    ]
}
```

demonstration videos

- ✓social data observer
- ✓web application
- ✓mobile application

SmartSantander