An Architecture for Sensing Environment with Vehicular Networks

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1) OBJECTIVES: Our main goal is define and evaluate an architecture to sensing environment data using vehicular networks, for this goal is need to work in differents aspects like:

- Analyze data capture process.
- Model environment data.
- Analyze/Define an architecture.
- Deploy a central sensor node.
- Analyze data trasmission process.

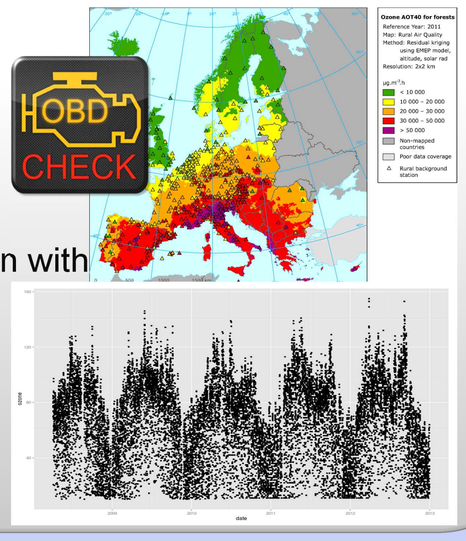
a) Analyze data capture process/Data model

The process for capture data have diferents data sources for analyze:

- OBDII
- GPS
- Environment sensors (Ozone)
- Etc.

Moreover, to analyze space/time variation with differents statistics tools:

- Linear Regression
- Krigging Model



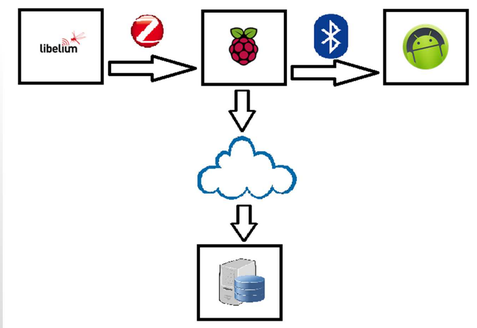
b) Analyze/Define an architecture

In this work is need an architecture to manage:

- Sensor.- measurement of data
- Collector/Edge.- collect/pre-process data from differents sources
- Transmisor.- send data to server
- Server/Cloud.- save and process data

Also, as part to work

- Develop a environment sensor node
- Implements a prototype of system



c) Analyze data transmission process

In the transmission process is need to analyze best option in differents parts:

- Sensor-to-edge
- Edge-to-cloud
- Cloud-to-sensor

In terms of power consumption, messages size, price, etc.

Otherwise, to analyze messages format:

- XML
- SensorML
- Etc.

Resources

For this work need:

- Sensors:
  - Waspmote Smart Environment
  - Environment Sensors
- Embedded Components
  - Raspberry-Pi
  - Beagle-Bone
  - Arduino
- Network components
  - ZigBee modules
  - Bluetooth modules
  - WIFI modules
- Smartphone/Tablet Android
- Bluetooth OBDII Interface

3) Advances

At the moment we have:

Bluetooth OBDII protocol analysis:

- Develop of VEWE (Vehicle ECU Wireless Emulator).
- Comparition OBDII signals with real vehicles.

Ozone sensor reading:

- Measurement data.
  - Low-Pass Phase Filter
- Calibrate values (Linear Regression) with historical data.
  - Value = -9.9 + 2.67 * Reading

Model environment data:

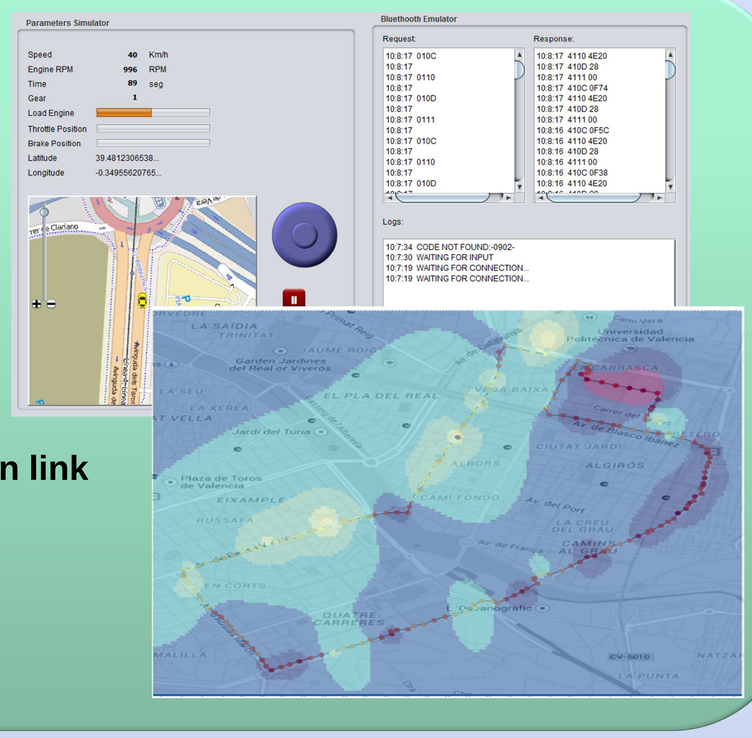
- Adjust time variation.
- Krigging model.

Architecture

- Define Edge/Cloud architecture.
- Define network links.

4) Next Steps

- **Analyze format message**
- **Analyze transmission links costs**
- **Define algorithm to choose transmission link**
- **Define hardware elements**
- **Implement a prototype**



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5) CONCLUSIONS: In this research we will define an architecture that allows us sensing environment data using vehicles in movement to reduce number of sensors and thus reduce costs. Furthermore we will try to reduce to minimal number of sensors using kriging models to predict some values in places.
Our architecture will define all elements and links required and will analyze the best options for implement this type of solution.

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