Geolocation of Tools on Construction Sites and LoRa Performance

François Roland[1], Olivier Debauche[2], Enrico Filippi[3], Sébastien Bette[1]

[1] Electromagnetism & Telecom Department, University of Mons; [2] Computer Sciences Department, University of Mons; [3] FabLab Mons

Abstract

LoRaWAN is getting an increasing attention when there is need for low energy consumption and long range transmission.

Project 1 describes how LoRaWAN can be used to locate tools on large construction sites by adding mobile base stations and using smart software algorithms.

Project 2 describes collects experimental data so that factors influencing a LoRaWAN connection can be identified and prioritized.

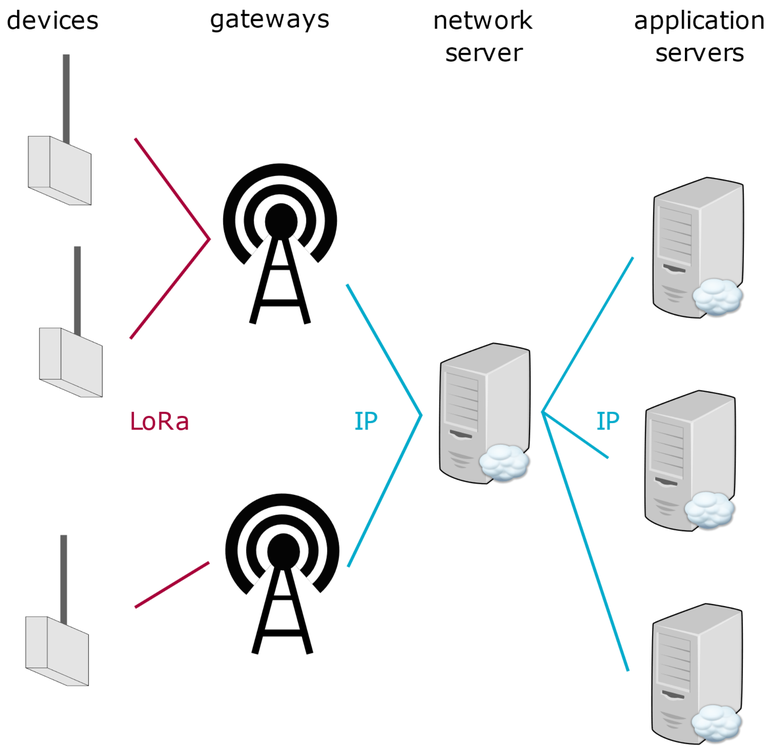

Figure 1: architecture of a LoRaWAN network

Project 1: Locating tools on construction sites

Challenge

One of our partners wants to locate tools (digger bucket, drills, jack hammers) on his construction sites by sticking some tags on them.

- Precision ~ 50 m
- Battery lifetime ~ 5 years
- Waterproof and rugged
- Largest dimension ~ 8 cm
- Cheap production cost

Solutions

- Sub-GHz radio frequencies are the best option to transmit over long ranges and in difficult environments.
- Extra mobile base stations deployed to improve the coverage and cut down transmission time.
- Specifically tuned PCB antennas allow shorter dimensions.

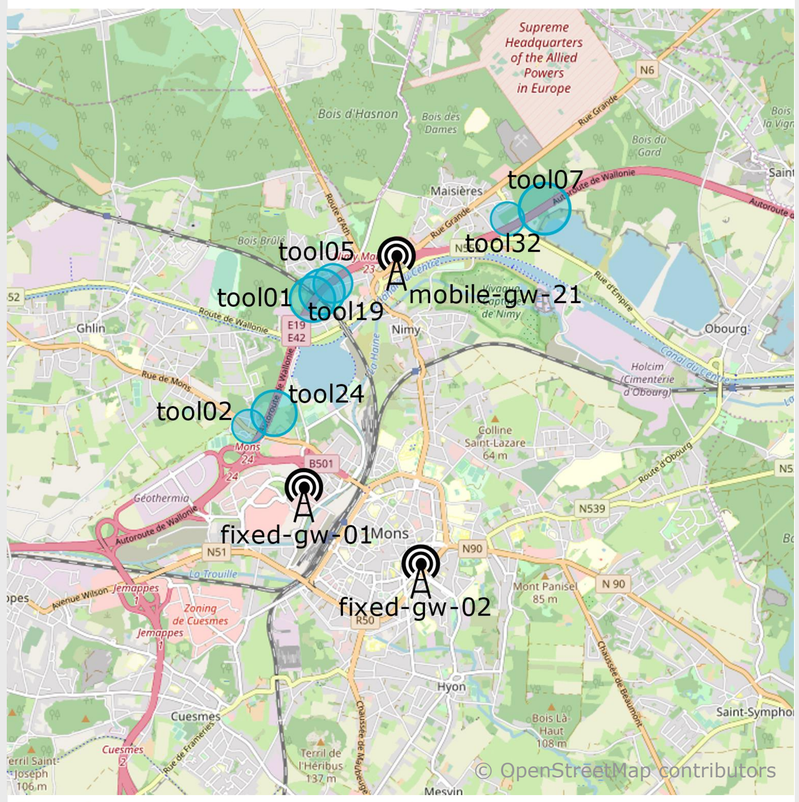

Figure 2: tools located on construction sites

- LoRa-based geolocation to reduce energy consumption (~ 500 0 accuracy).
- On-demand GPS geolocation to improve accuracy (~ 50m).
- Smart algorithm to tune the parameters which impact battery lifetime (number of wake-ups per day, transmission parameters and usage of the GPS).

Future work

As the partner runs many construction sites at the same time, the right number of mobile base stations has to be determined through simulations and experimentation.

The battery lifetime improvements also need to be estimated through experimentation.

Figure 3: current consumption profile of a GPS locator tag

Project 2: Identifying LoRa influencing factors

Context

LoRa is a technology commonly used for battery-operated sensors communicating over long distances. Multiple experiments have been carried on to estimate its performance. But they either use a limited number of devices and metrics [1-4] or simulation [5].

This experiment will collect extra data and identify correlations with the transmission quality metrics.

Method

In order to generate data, many devices will be disseminated across a city. Twenty devices will have a fixed location, five will be moving.

Data to be be collected:
- Transmission metrics communicated by base stations;
- GPS chip on mobile devices;
- Other web services (mainly meteorological observations)

Figure 4: mobile LoRaWAN device with its custom packaging.

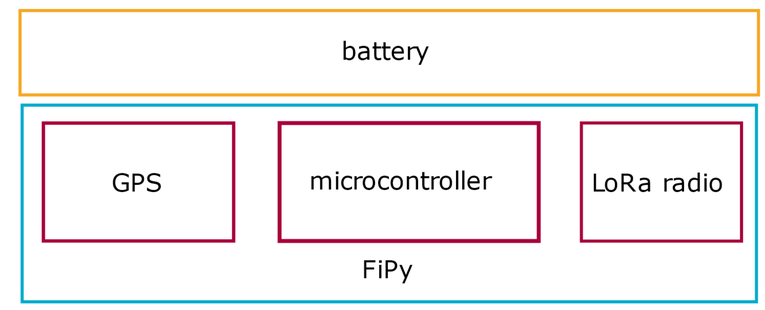

Figure 5: device block schema

Future work

- Deploy the sensors throughout the city.
- Locate the static devices precisely.
- Improve the packaging to be waterproof.
- Determine which data to transmit from the sensors, which data to collect from the network and how to store them in order to analyze them.
- Analyze the collected data in order to find correlations and create a statistical model.

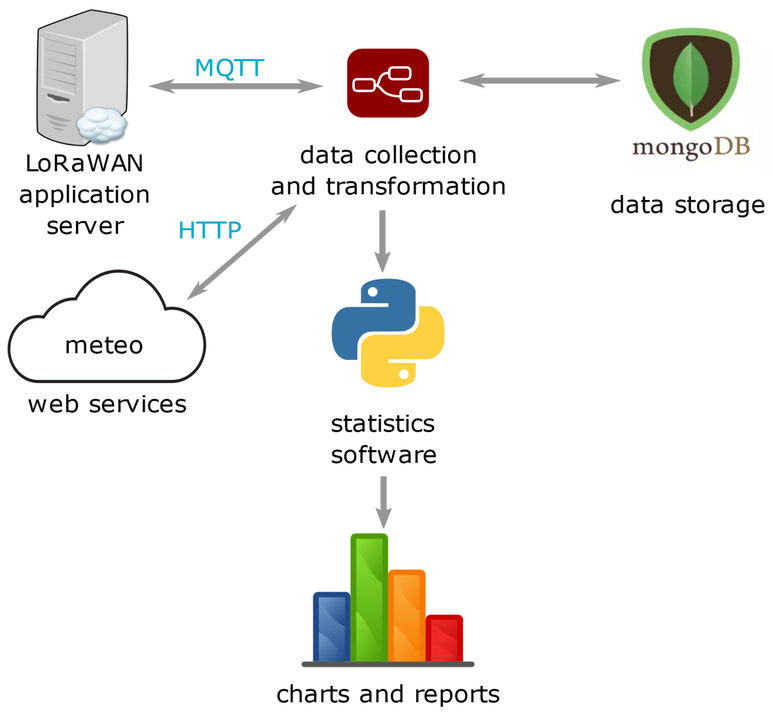

Figure 6: data collection architecture

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Acknowledgments

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University of Mons

francois.roland@umons.ac.be
+32 65 375059