Zebra-RFO
A Spectrum Repository for the Masses
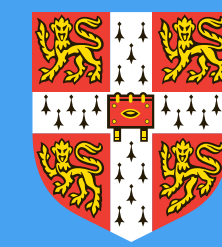
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Motivation

The convenience of wireless networks regarding mobility and ease of deployment has made them hugely popular. Globally, these networks convey data in the order of couple of exa-bytes per month and by 2019 this number is expected to grow by at least one order of magnitude. A consequence of this growth will be congested wireless spectrum creating the so-called spectrum crunch. In emerging countries, regulators use manual and static databases to keep track of incumbents and secondary users of the wireless spectrum, leading to inaccurate and cumbersome information about spectrum occupancy. Moreover, there is a potential conflict between intermittent legal users (e.g., UHF microphones), unaccounted legal users, and rogue users that make use of the spectrum with no control. There is a clear opportunity for regulators and local authorities to promote regional and distributed repositories for keeping track of the used and unused frequencies, enabling more efficient use of the spectrum within a regulatory framework [1].

Objective

We are developing an ecosystem of open and low-cost sensor devices and services to ascertain the current occupation of UHF and ISM band, allowing capturing and processing spectrum occupation in under-served areas. Our aim is to incentivize communities to be aware of the local occupation of the spectrum of interest. **Zebra-RFO** (Radio Frequency Observer) is a containerizable web service with collaboration capabilities akin to social networks, able to organize long measurement campaigns allowing the visualisation of spectrum occupation. **Zebra-RFO** also offers the possibility of recompose measurement campaigns in order to isolate different areas of interest (i.e., rural, urban, suburban), and also conveniently represent the rough occupation of large portions of the spectrum in UHF band and ISM band, both of high interest in the process of bringing the next billion people on-line.
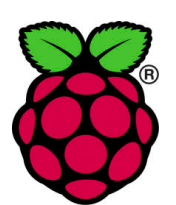
WhispPi

1. Why low-cost monitoring?

There is an organisational and potential social impact of a decentralised spectrum crowd-sourcing system and it is well known that spectrum analysers are expensive, difficult to transport, and they lack an appropriate interface to collect continuous spectrum activity. This situation motivated us to develop low-cost monitoring solutions. We have worked on assembling devices for the sub 1-GHz band such as **WhispPi** monitor using a Raspberry Pi to interface RFExplorer [2]. This solution cost below 400 US$. However, this and other similar solutions propose a heterogeneous vision of the spectrum usage due to the inherently different configurations.

2. How do communities assess the data?

Zebra-RFO is an open initiative to collect spectrum usage and a social platform to incentivize a crowd-sharing approach for collection. The system provides data organization and visualization capabilities that allow later post-processing.
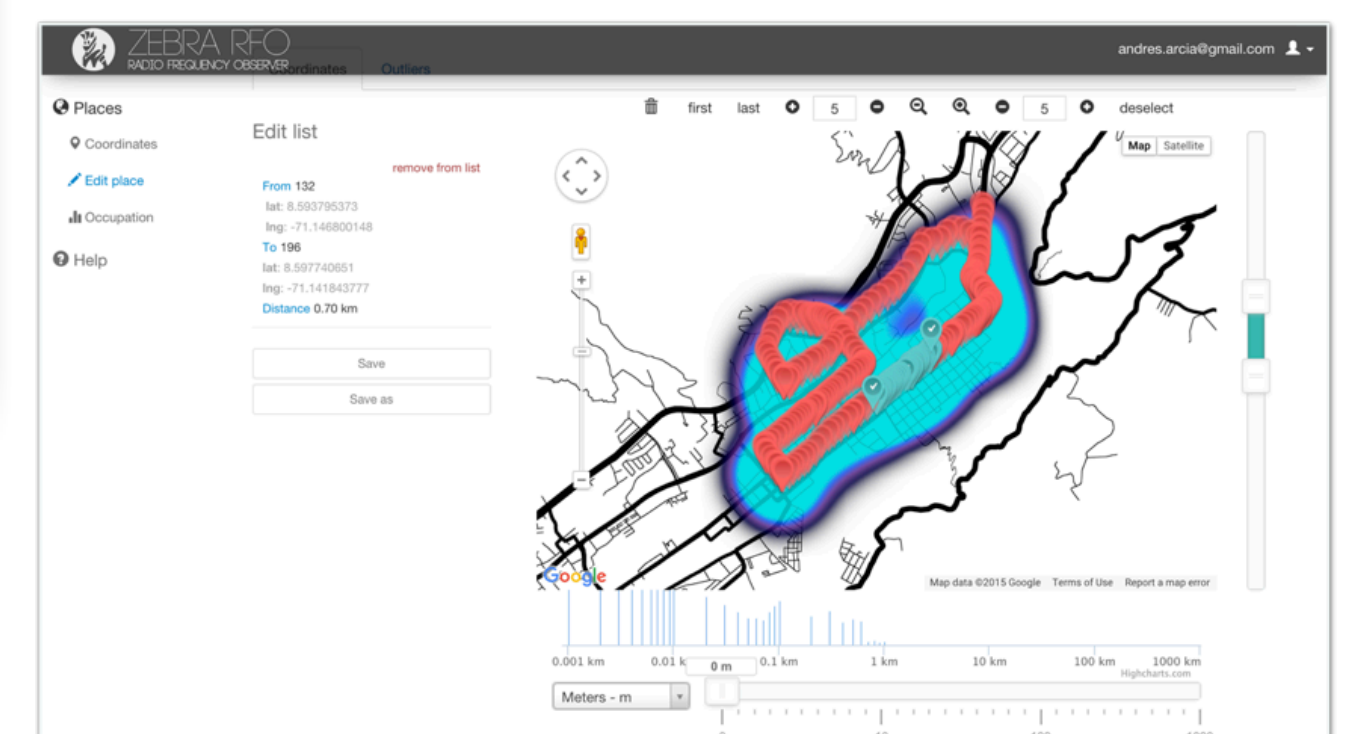
Zebra-RFO offers capabilities such as a convenient filtering of the geo-tagged journeys to get rid of potential biases introduced by the mobile collector speed as well as categorisation and isolation of specific portions of the data.
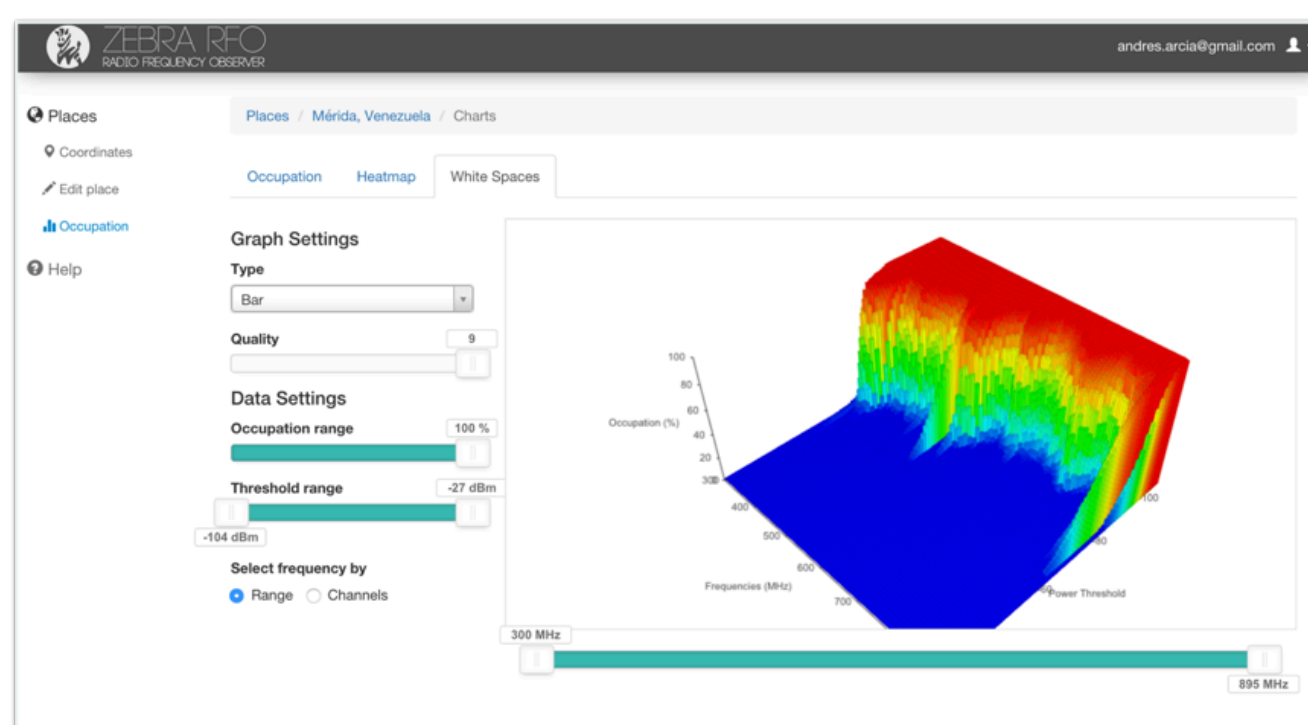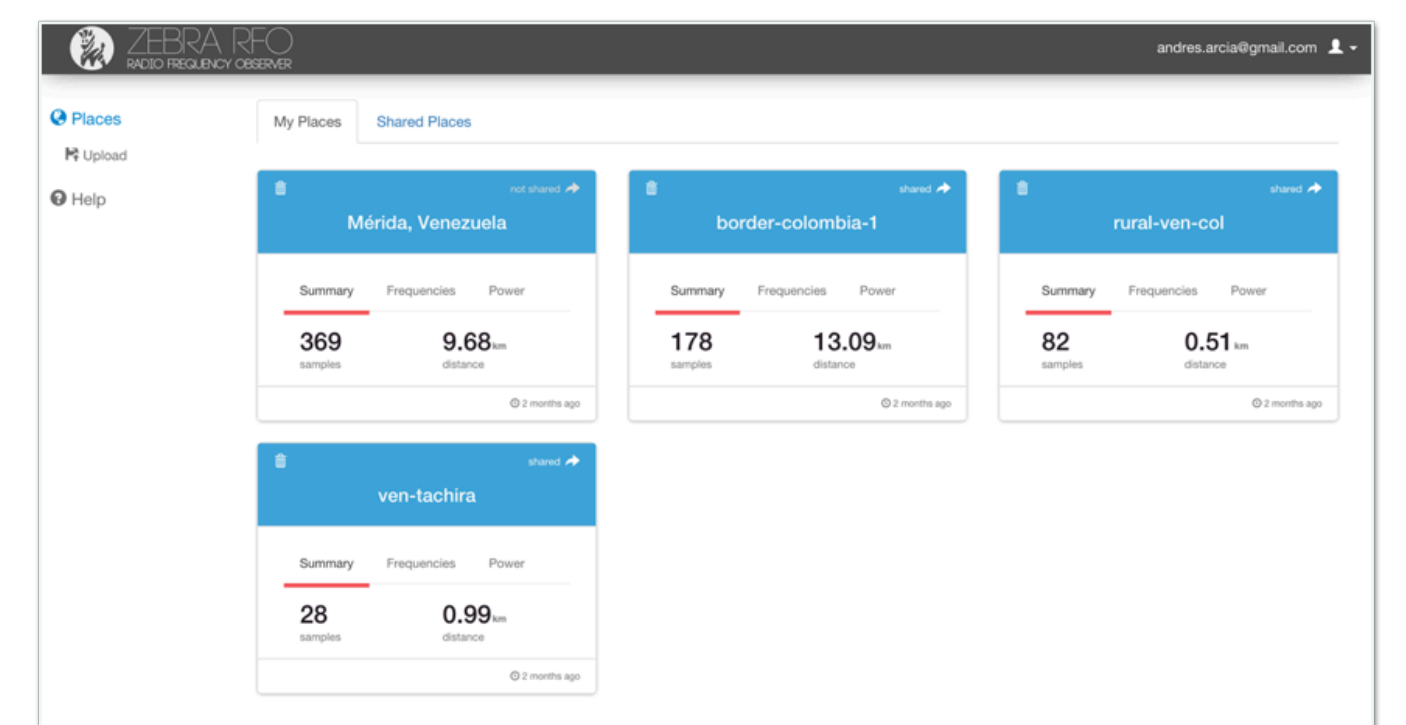
Analyse

Focus
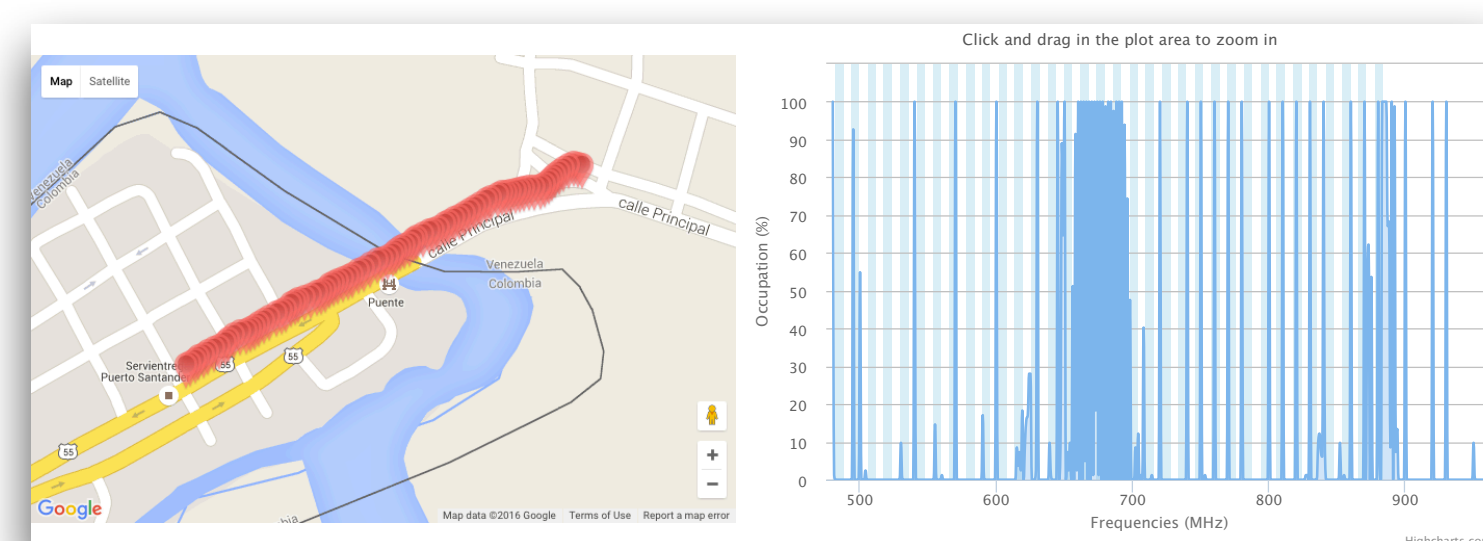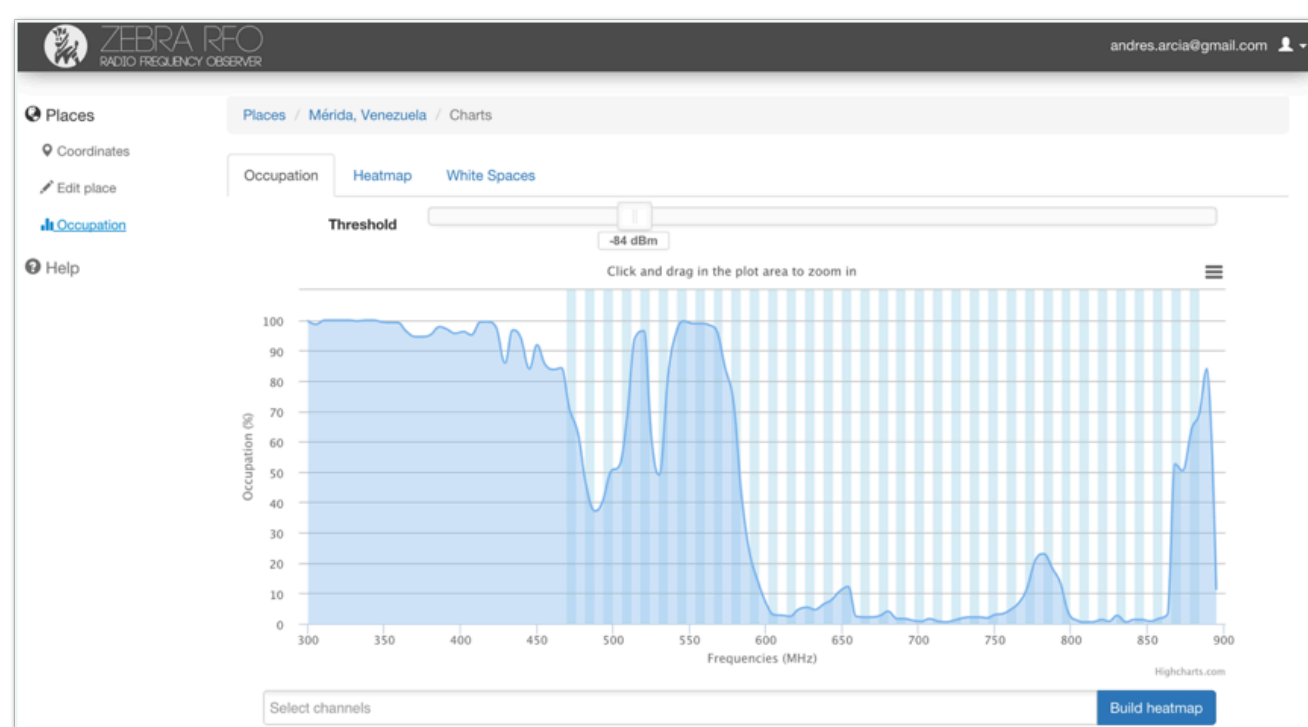
Recompose

Visualise

Share

http://zebra-rfo.org

[1] A. Arcia-Moret, M. Zennaro, F. Rondon, E. Pietrosemoli, D. Johnson. Open and Regionalised Spectrum Repositories for Emerging Countries. ACM SIGCOMM GAIA, 2016.
[2] A. Arcia-Moret, E. Pietrosemoli, and M. Zennaro, "WhispPi: White space monitoring with Raspberry Pi," in Global Information Infrastructure Symposium - GIIS 2013.