



R&D project presentation (industrial PhD)

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« Electro Magnetic waves sonification to assist GSM research in a crisis resilience context »

Thesis supported by Astrium Services CTO lab (dedicated telecommunication solutions), ETIS (signal processing) and LIMSI (psychoacoustics).

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1. CONTEXT

Today, more than three quarters of the worldwide population possesses a cell phone (GSM). GSM devices are thus already used as localisation beacons for resilience after natural disasters. GSM based Localisation Services currently designed for professionals usually resort to *Geolocation* or *Direction Finding*. Current limitations of these systems are precision, ergonomics (not adapted to work conditions or specifications) and cellular network dependency.

2. THESIS CONTRIBUTIONS

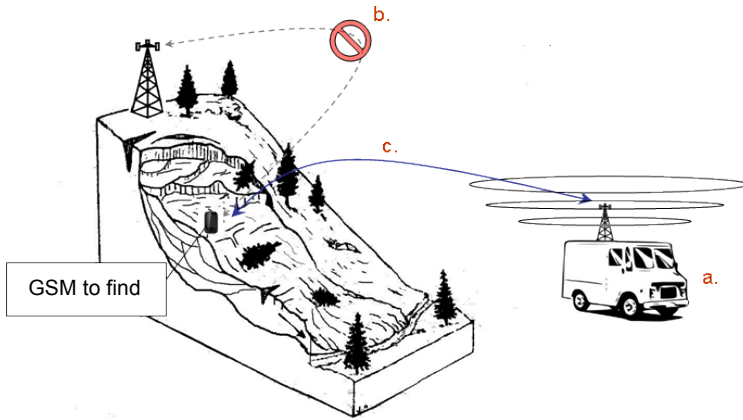
The project aims to design a GSM Direction Finding system, assuming that no GPS resources are available. Our researches are focused on features underdeveloped in actual systems: efficiency, robustness and ergonomics.

A prototype based on the envisioned concept shall allow a user to find every GSM beacon of a given area, without relying on the existing GSM network, in an intuitive fashion and without hampering him in his research activity.

The considered system is composed of 3 distinct features:

- GSM transmission parameters control in the research area,
- Measurement and processing of GSM (EM) signals to enable a progressive navigation towards the associated GSM sources,
- Acoustical restitution (sonification) of the directional information to the research agents.

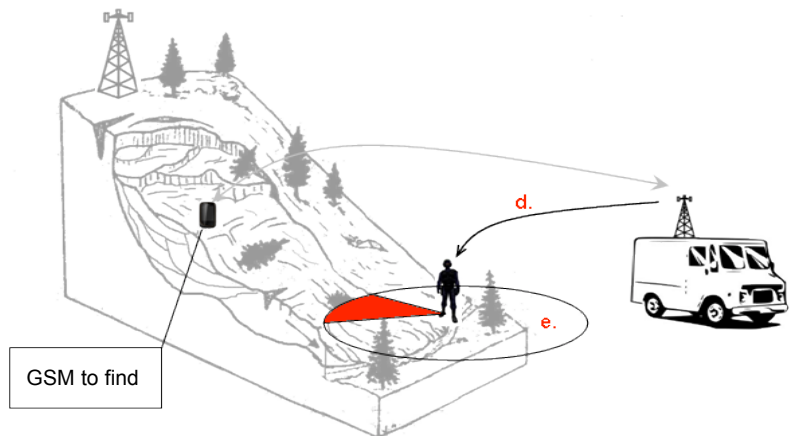
→ First, let's suppose we control the cell phones in the research area. (dedicated network)



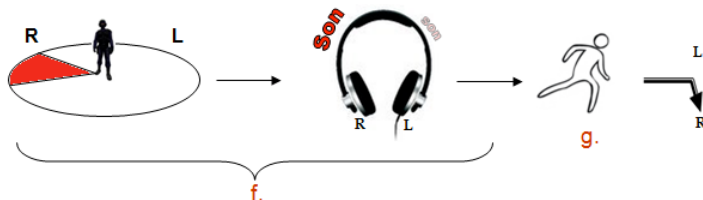
- a. Dedicated GSM network deployment.
- b. Hypothesis: no GSM coverage in the area (white zone).
- c. Connection to the dedicated network.

→ During a GSM transmission, each mobile is associated to a unique channel. Each mobile will thus be identified (through the dedicated network) and matched to "an agent": a device on the agent's back/head.

- d. Channel parameters sharing to allow the Direction Finder to isolate and listen to a single GSM phone in the research area.
- e. EM measurements on the GSM signal



→ EM measurements, processed or raw are thus transmitted to the agent through acoustic modalities (using mainly spatialization cues). In the end, he has to be able to find the direction towards the GSM phone.



- f. Ergonomic restitution of the orientation direction.
- g. Progression towards GSM source.