Smart Sound Monitoring

TÉCNICO LISBOA

LEEC-IST
Course : PIC3

Group 3

Members(left to right):
- Pedro Martins
- Frederico Paula
- Afonso Cruz
- Nuno Jorge
- Carlos Reis
- Gonçalo Lázaro

Coordinator : Prof. Luís Caldas de Oliveira
T.A. : Rafael Cordeiro

Introduction of the Problem

When setting up an outdoor music venue(festivals, concerts…) sound technicians rely heavily on their ears and physical presence.

A team needs various technicians and much time in order to cover large areas and homogenous sound is hardly achieved.

A technician can only tune one location at a time (his physical location at the moment of operation) and must rely on others for holistic treatment of the venue.

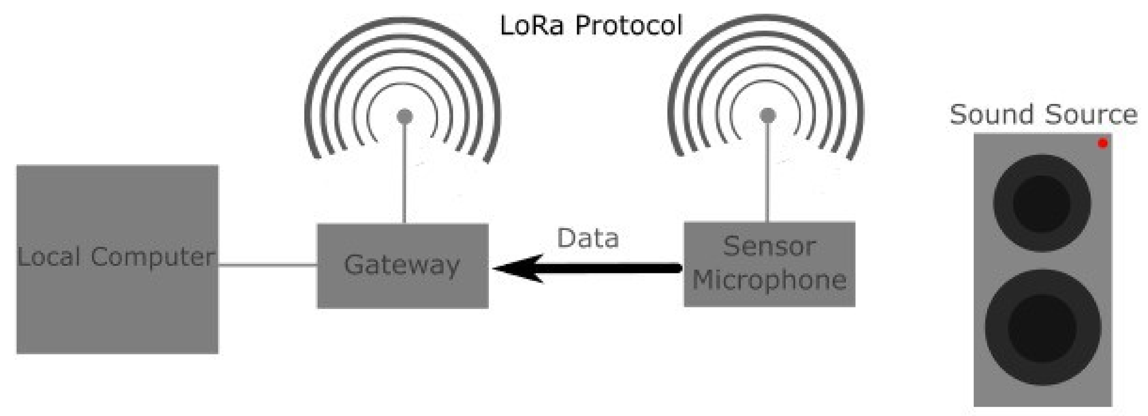
Our Solution

Through both accurate location and sound measurements our system can remotely provide information directly to technicians with no need to change their position.

A non-trained person can operate the device while the technician uses the data away from the site. Our solution breaks away from current analogue/cable based techniques.

Final prototype

Description of the Prototype



Prototype signal flow

The prototype consists of a computer software and two physical modules: The microphone sensor and the Gateway.

The portable sensor used is on-site by an operator that triggers the acquisition. Data is transmitted via LoRa protocol (over 10km of range) and received by the gateway connected to a USB port at the used computer.

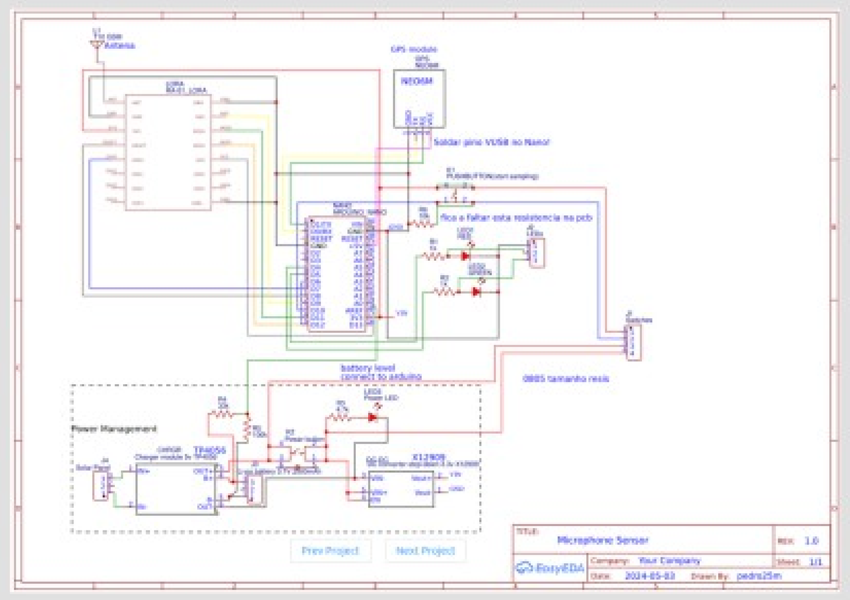
Microphone Sensor

Gateway

Electronics

Microphone Sensor was assembled with an Arduino Nano RP2040, a battery, a GPS Module and a LoRa transceiver. We decided to make a PCB for this module.

Gateway is composed by a WEMOS D1, and LoRa transceiver.



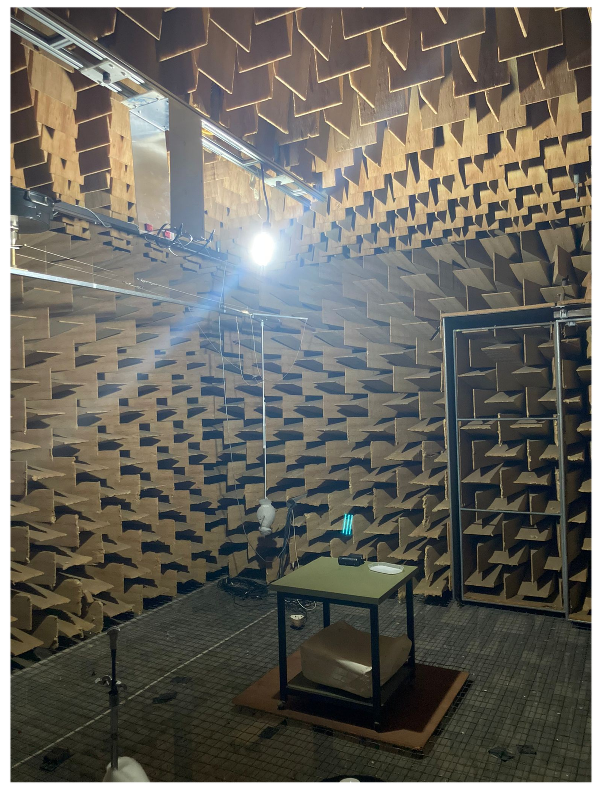
Microphone Sensor PCB schematic

Interface

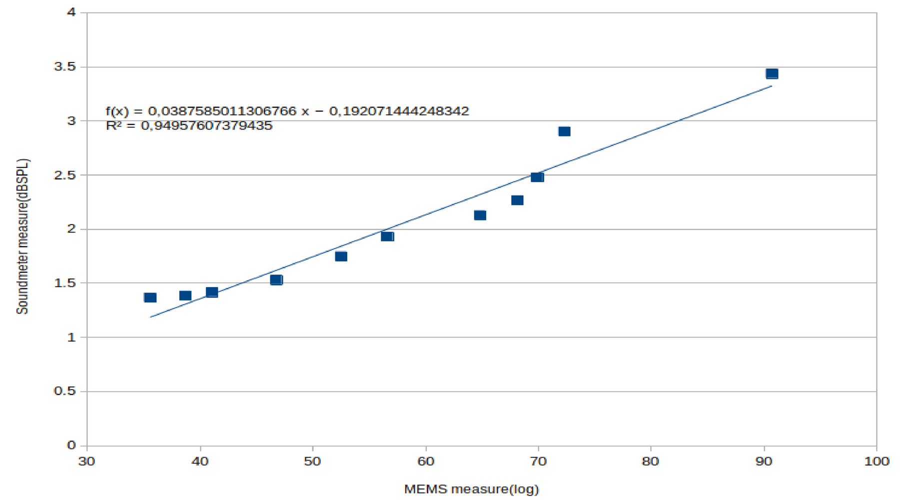
The interface receives the coordinates of the measuring point and a sound sample. From then on, an optimised FFT algorithm ensures fast and localised processing of the data. This prevents any unwanted recording from being transmited (data protection), ensuring our prototype focuses solely on sound quality.

The result is a point mark in the local map with a specific color associated with it's Sound Intensity [dBW]. The user can inspect the point's Spectal Density by clicking it. Our solution discriminates by frequency - not just intensity!

Calibration and Example



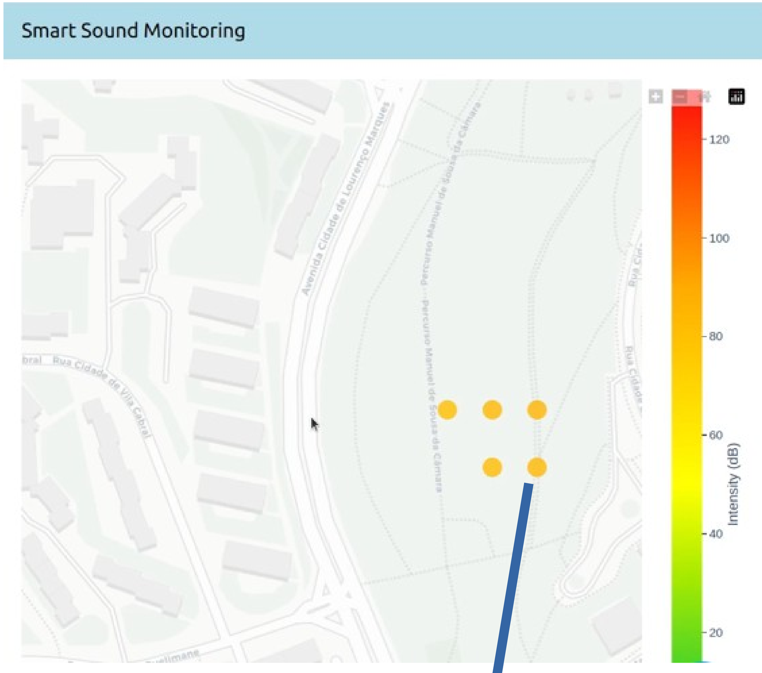
Calibrating our microphone at an anechoic chamber (noiseless), in the efforts to make our sound pressure level(SPL) readings as accurate as a market level device.



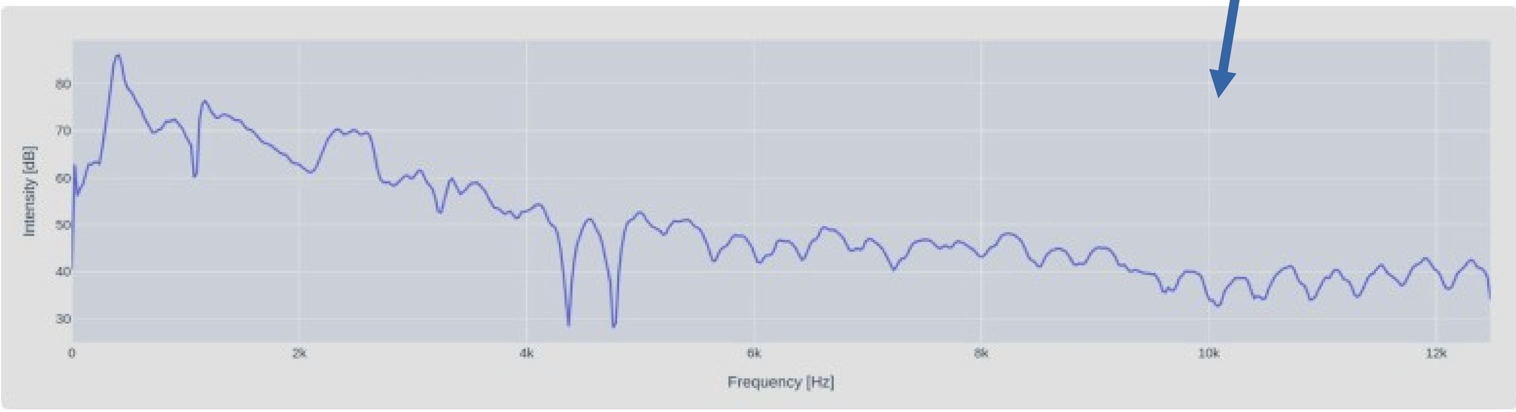
Calibration curve(microphone versus soundmeter)

We conducted a pratical experiment, in order to test the reliability of the prototype. The test location chosen was Vale do Silêncio. The five gathered points can be observed in the gps map of the interface.

Test Location: Vale do Silêncio, Lisboa, Portugal



Map of test location produced at the interface



Spectral Density of a point

By pressing one of these points, the user can inspect the respective Spectral Density of the sound sample. The tests were a success.

Follow the process

The website describes the prototype development and the arrival to the final idea.

Follow the hyperlink or the QR code:
https://web.tecnico.ulisboa.pt/~ist1102943/