Collaborative System for the Analysis of Hearing Pollution in Urban Environments through IOT

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***Abstract:*** *In this article, we present the development of a prototype for a system that allows measuring the noise level in urban environments and monitoring it remotely through the Internet of things. A solution proposal is made based on the requirements and the technologies that facilitate them and possible practical applications are presented in the commercial world. Initially, anyone can enter a web application where they can analyze in 10 seconds the sound quality where it is located. This data is added to a global database and each user can view the measurements on a geolocation map. Subsequently, the data collected is used to analyze the auditory contamination by areas and offer this information to the community, to improve the indices and enhance the improvement of urban sound quality.*

# INTRODUCTION

During the digital era, technology has gone through different relevant stages. Initially, the Internet revolutionized the way of communication over long distances, and social networks introduced Web 2.0. In recent years, the large number of mobile terminals and the ease of acquiring them has given strength to a technological mega-trend: collaborative computing. Along with this trend, emerging technologies such as the Internet of Things, Artificial Intelligence and Big Data have gained importance, thanks to their ability to integrate terminals, technologies and platforms, offering intelligent analysis of large volumes of data. These large volumes of data are generated by millions of connected users who in turn benefit from the results of the analyzes performed on their data.

Today, both public attention and the interest of local governments are focused on working for a better quality of life for citizens. Part of this work is the analysis of air quality, which includes the levels of auditory contamination. In this proposal, a prototype is formulated for the collaborative measurement of the sound quality of the air. The Internet of things incorporates a whole system of detection processing transmission and data analysis focused on mobile devices and applications both small and large.

That is why, today it is one of the most used technological concepts when it comes to measuring and studying sensitive variables. It is used in a variety of applications, among which we find monitoring of variables such as climate, agriculture data, Smart Cities and more. In this case, we developed a system capable of measuring in a few seconds the auditory quality of the sound space using only a mobile device and a web infrastructure.

# PROBLEM STATEMENT AND ARCHITECTURE

Noise has become an increasingly large problem in the city of Bogotá, in our project we hope to contribute to improve this problem by offering the opportunity for people to upload natural audio samples from their area to the internet and through these samples we will analyze the noise in the area and according to standards of the WHO we will determine how healthy the noise indices are in the area, this will help to raise awareness among the population and help people who care about their hearing health to take measures such as Use plugs or avoid these places.

# JUSTIFY

In recent years Bogotá has had an exponential growth, although this brings some benefits, it also brings great inconveniences, one of them is noise. Unfortunately, noise pollution is one of the most difficult problems to control and to which it seems less important, so this project is expected to make use of noise to obtain some benefit.

Using sensors that capture noise in a specific area and send it to a database, we hope to process this information and have a reliable database with a negligible margin of error that can be sold to interested real estate agents, with the to raise the value of real estate. As we mentioned at the beginning, noise has become a problem in the city, so it is well known that many people would be willing to pay a little more in the value of their properties to maintain peace and tranquility in their homes.

# FUNCTIONING

For the current solution, we have taken an approach based on cloud processing web technologies. Initially, the user accesses the web page directly using their Internet browser. Subsequently, it uses a simple interface to record 10 seconds of audio, which they send to an information processing server, which extracts the fundamental frequencies from the sample and, together with the terminal location, saves this data in a source of information.

Subsequently, different reports can be viewed using the information provided by the users of the application. Being a web application, no additional installation is required to obtain the report, and that greatly facilitates its use in large numbers of users, in addition to incorporating support for both Android and iOS, Linux, Ubuntu, MacOS and virtually any operating system and device that supports HTML5 and has an internet connection.

A fast Fourier transform will be carried out to find the frequencies in which a greater amount of gain is found, and then save those records and display them in the form of a report and graph. We will use cloud processing tools, among which we can choose Microsoft Azure, Amazon Web Services and IBM Cloud.

# CONCLUSIONS

As a result, we obtained an IOT device that helps prevent long-term hearing problems, generating a history of the noisiest areas of the city and allowing people to act, such as using earplugs or avoiding these sites. Initially some components of the project such as websites were developed locally, so in future modifications it is expected to acquire a HOST to start the project publicly.

The creation of the project was an interesting challenge and working with people from different careers generated the perfect complement to deliver more complete and efficient solutions during the semester, it is great to see how little by little we are preparing for an increasingly competitive work world thanks to the tools acquired in this and other courses.

# REFERENCES

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# ANNEXES

Below is the code used, with its respective documentation: