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# THE HI-AUDIO ONLINE PLATFORM FOR DISTRIBUTED MUSIC CROWDSOURCING DATABASE COLLECTION

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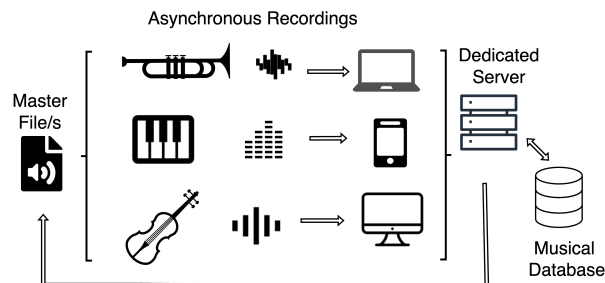
## ABSTRACT

We present in this paper the recent development of an online platform for musicians, researchers and an open community of enthusiasts of audio and music with a view to build a public database of music recordings from a wide variety of styles and different cultures. The data generated and collected will primarily be audio data, coming from various sources, including field recordings, existing datasets, and users' collaboration. The platform aims at gathering a distributed music crowdsourcing database collection where each music piece is built from asynchronous recordings of different tracks at remote sites. The complete tool and databases generated will be openly distributed for research purposes.

## 1. INTRODUCTION

Access to data, and in particular annotated data, is essential to learn the appropriate statistical models for the targeted applications. Many such datasets do exist for nearly all applications in Music Information Retrieval (MIR). They include for instance ENST-Drums [1], DALI [2], the Million song data set [3], Freesound [4], The Open Multitrack Testbed [5], MUSDB18 [6] or QUASI [7]. However, these datasets, while valuable, are either too small, lack annotation, are only weakly-annotated, or, in many cases, are only partially publicly available.

One of the major goals of the Hi-Audio online platform is to build a large, varied, multi-genre, multi-channel, multi-instrument publicly available music dataset for research that is suitable for a wide variety of MIR applications (such as music source separation, automatic track generation and mixing, cover version detection, music style transfer, ...). The Hi-Audio online platform permits to rely on a distributed and iterative music recording paradigm where the final music recordings will be semi-automatically mixed from individual tracks recorded at different remote individual sites by volunteer musicians. It is also important to note that it will be possible using the platform to straightforwardly extend an existing database with new tracks or recordings with a rapid impact on research in



**Figure 1.** Overall recording scheme. The recording is conducted in a distributed way in different locations and the information is stored and annotated in a dedicated server. A master file, extracted from an existing recording can serve as a main synchronizing track with a count-down at the beginning or with a metronome signal

MIR. The second major goal of the Hi-Audio platform is to provide musicians, researchers and an open community of enthusiasts of audio and music with a virtual meeting point to practice and record music jointly with others (in an asynchronous mode) as experienced by many ensembles during the Coronavirus crisis in creating music videos from individual tracks recorded at different remote individual sites [8–10]. We also believe that the platform could be of particular interest for further developing the concept of “music repurposing” as discussed in [11] where individual musicians/composer add their own recorded track to a given music excerpt that is then gradually enriched with each new contribution.

Although the market for Digital Audio Workstations (DAWs) and online platforms for music creation and collaboration offers a wide range of possibilities and a rich and varied selection, with a somewhat smaller number of open source alternatives [12], we believe that our proposal goes one step further. In fact, it will allow free access to content and code and provide a connection point such as the public API, becoming an entirely new open ecosystem, sharing the same social view as Freesound for audio clips [13]. The overall recording scheme is illustrated on Figure 1.

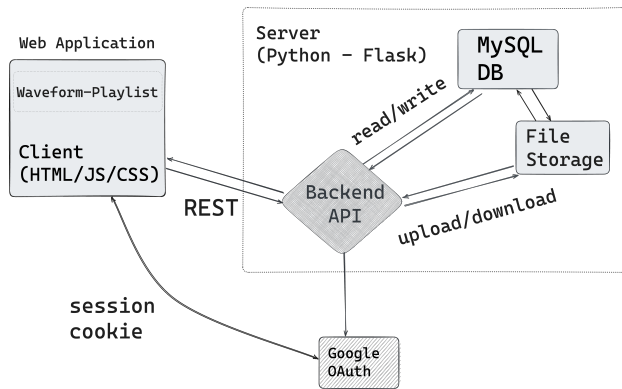
## 2. ARCHITECTURE

To allow centralization of access to resources, a client-server architecture has been designed. The client and the server technologies are depicted on Figure 2.



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**Figure 2.** The diagram shows the different blocks and parts involved in the system interaction. The web application developed using JavaScript, HTML and CSS communicates with a dedicated server for data management and also with Google OAuth service to generate new user accounts and valid sessions within the platform. The back-end is used as an endpoint to store and retrieve information and files from the database.

## 2.1 Client

The client, an online web application, allows musicians to record and upload music files and collaborate with others along the internet by creating collections and compositions. The application, developed using standard web technologies such as Javascript, HTML and CSS, provides a friendly user interface, compatible with major modern browsers. It consists of a multitrack editor with basic capacities similar to traditional DAWs. Although there are many web services regarding music production workstations (e.g. Ampedstudio, Bandlab, Soundtrap [14]), most of the existing software is proprietary and its usage is limited. We then chose to rely on open source [15], to contribute and promote collaboration following the FAIR principles<sup>1</sup> of open science. Several existing open source libraries for audio interaction were considered. For instance, Gridsound<sup>2</sup> was pre-selected but finally not retained especially due its intricate user interface to display compositions. Instead, we finally chose a simple library called waveform-playlist<sup>3</sup> [16, 17] which has the main features required for the audio functionalities (recording, playing, uploading and displaying tracks). We have tailored it to improve server communication and to allow users' interconnection.

## 2.2 Server

The aforementioned cloud solutions available in the market are not compatible with the idea of providing an online system to researchers to develop bespoke tools and transparent access to the information [18]. This motivated us to create our own server instance and an endpoint to facilitate an API that will be publicly available for anyone

willing to contribute, making the server module a key and differentiating component of our proposal. The aim of the developed ecosystem focuses on data collection applied to music creation, as in Beat Byte Bot [19]. The server side is built using the Python programming language and it is based on Flask<sup>4</sup>, a web application framework written in Python. The back-end provides a RESTful API that allows any client to connect to the server infrastructure and retrieve or exchange information via JSON data format, which is one of the most common formats for data exchange [20]. Regarding authentication and registration of users within the system, OAuth 2.0 flow is used through Google OAuth 2.0 and the requests are authorized in the API by a cookie session stored in the browser. The access to the information is also controlled by different roles and levels of privacy and users can decide which information they want to share and with which audience (from a single invited collaborator to everyone).

## 3. DISCUSSION AND FUTURE WORK

The Hi-Audio platform is still in an early stage of development and only part of the envisaged features will be demonstrated at the late breaking demo session. If the current platform is functional, important developments are still needed in particular regarding the user interface or the control of the recording latency, for example by replacing the MediaRecorder<sup>5</sup> API with more efficient approaches like WebAssembly or AudioWorklet. The integration of classic DAWs features such as editing, sound effect and the integration of automatic annotation tools will be a major asset for building MIR research databases and is clearly on the development roadmap. Our main interest in this demo will be to gather first feedback from the MIR community and to identify potential collaborators for the platform development as amateur users, beta-testers or co-developers.

The platform will be temporally accessible using a dedicated login account during the conference at <https://hiaudio.fr>

## 4. CONCLUSION

In this paper we have presented the Hi-Audio Music Platform, our future open source online tool for researchers and performers in the music field. We explained the main goal of the developed platform which is to collect a large number of compositions in a multi track structure and distribute both the code and the data produced in a public way to share it with the audio and MIR community. We provided some details about the client-server architecture and technology stack chosen. We then discussed some of the immediate future work related to the web application that we plan to start intensively testing in the coming months.

<sup>1</sup> <https://www.go-fair.org/fair-principles/>

<sup>2</sup> <https://github.com/gridsound/daw>

<sup>3</sup> <https://github.com/naomiaro/waveform-playlist>

<sup>4</sup> <https://flask.palletsprojects.com/en/2.3.x/>

<sup>5</sup> <https://developer.mozilla.org/en-US/docs/Web/API/MediaRecorder>

## 5. ACKNOWLEDGEMENT

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