Towards a Virtual Portable Radio Platform for Audio Transmission

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Abstract. *Audio transmission in restricted area can bring different possibilities and be explored for education, arts and entertainment purposes. This paper presents an ongoing project that aims to develop an open-based technology device to broadcast audio to portable devices such as smart phones and tablets in a small range. Gambiarradio is the preliminary name coined to describe this project, which implements a dynamic local radio station to transmit audio for portable devices using wi-fi network. The goal of this project is to take advantage of low-cost equipment, based on free software philosophy and make it available to be used in education, promoting the inclusion of blind students and enabling live performances, for instance. The main features of the project, the first steps and the preliminary results are presented, as well as the prospective work.*

1. Introduction

New technologies are definitely transforming our lives and the way we interact with people in different environments. Specially in the last fifteen years, in terms of scientific research for the development of new technologies for musical expression [1] and artistic performance, researchers and musicians from all over the world have shared their knowledge and recent work on new performing interface design.

Inspired on that new possibilities, this project emerged from the scratch having in mind the challenge of creating a solution for a band to rehearsal at home without noise. One alternative was the idea of transmitting sound via FM radio waves instead of having loud speakers, with something similar to the idea of the ubiquitous music [Damian Keller 2014]. It was the birth of the project that would become a multimedia artistic performance entitled *Gambiarradio* (GR)[2], presented for the first time at *Escola Caseira de Invenções* (Home-made School for Invention), part of the educational project of the 9th edition of *Mercosul Biennial*[3], in 2013. In 2014, inside the prize winning *Projeto Casa Grande*[4], in partnership with the maker group *Matehackers Hackerspace* [5], we have established the GR, which got a new dimension with insertion of a tiny low-cost affordable computer, *Raspberry Pi*. Today new challenges arises as master degree project: turning GR into a multipurpose tool.

[1]http://www.nime.org/past-nimes/
[2]http://www.estevaodafontoura.com
[3]http://www.fundacaobienal.art.br/site/
[4]http://www.projetocasagrande.org/
[5]https://matehackers.org

This paper aims to present this ongoing project called *Gambiarradio*, describing its main characteristics, some architecture details and the next steps to be achieved for a full experiment and evaluation test with real users in a real context of use. This manuscript is organized with this introduction, one section where we describe the GR project, and a final section with the prospective work.

2. What is Gambiarradio?

GR was initially a set of different tools to transmit sound from an audio mixer via FM radio waves. The idea was to enable live performances that are audible only to the listeners. This is done by plugging only electric and electronic instruments into the audio mixer and spreading its signals wirelessly. The idea originated from a trio of amateur musicians who wanted to play music just for fun without worrying about if they were disturbing the neighbors.

After they started to use the FM transmitter they called the rehearsals / performances *Silent Gigs*. After performing the *Silent Gigs* for one year, they understood that it had the potential to be a platform for musicians to improvise in long jams without bothering anyone, giving the public the power to decide if they wanted to listen to the sound or not. In that way, they gave birth to GR: a democratic tool for live music performances. Therefore, what was first simply a home solution for the trio became a platform for long improvised gigs in which random musicians could play together and exchange instruments without knowing each other.

2.1. Preliminary architecture

The GR system is based on a portable free software/hardware philosophy. First versions were divided in too many parts, including external mixer and amplifier, so they weren't portable. The goal now is to achieve a modular and portable structure, with a base module composed by the battery and subsequent modules assembled by demand[6]. Figure 1 ilustrates an overall architecture of the system.

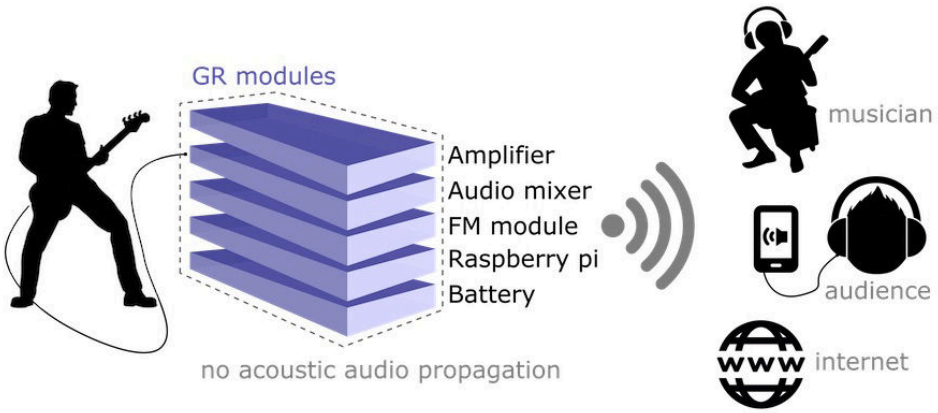

Figure 1. This figure shows the actual idea for the modular design of the next version of Gambiarradio, and how it works in a performance.

[6]This modular logic for the equipment was proposed by Joel Grigolo, from *Matehackers*, which keep being partner in this project

GR allows to use different configuration, adding extra modules for more complex tasks. Battery, Mixer and FM radio transmitter modules, for instance, will enable the use for a simple FM transmission. If internet transmission is necessary or desired adding *Raspberry Pi* module is mandatory. Other possibilities are explored further.

After the group be invited to present it as a performance at the 9th edition of the *Mercosul Biennial*, it was noticed that more potency for bigger places was needed. In 2014, during the realization of the *Projeto Casa Grande*, the group got help from *Matehackers*, which suggested the use of *Raspberry Pi*, in order to find a better solution to improve the system with more potency and better quality.

Raspberry Pi was then chosen because it matches with the project philosophy, and the group took advantage of *Matehackers* previous experience with it and from other projects such as *Easy As Pi*, where free workshops at public libraries were held to promote computational thinking and developing skills needed to work with technology, proving the educational vocation of *Raspberry Pi* [Wing and Meyers 2014].

2.2. The GR first appearance

In 2007 an one-day performance event called *Musicircus* created by John Cage took place into the *7th Mercosul Biennial*. First performed in November 1967 at the Stock Pavilion at the University of Illinois, the idea behind John Cage's *Musicircus* is "nothing more than an invitation to a number of musicians to perform simultaneaously anything in any way they desire" [Rønningsgrind 2012]. Another description can be found at the review "Musicircus Rocks Stock Pavilion" by Bruce Zumstein. The Daily Illini, Nov.18, 1967.

Then, in 2013, GR was used in a performance at the *Mercosul Biennial*, as part of the *Escola Caseira de Invenções* (Home-made School for Invention) program. The theme was to present workshops and experimental performances focused on educational relations between art, science and technology. In some way Musicircus can be considered an influence for GR: there wasn't even the embryonic idea of GR, which appeared in 2011. Therefore, watching *Musicircus*, the first possibility of thinking about participating in the *Mercosul Biennial*, the idea emerged and GR was born later on.

2.3. Potential applications of GR

With the possibility of thinking about GR as a tool also for educational purposes, it was decided to develop it into only one equipment: a multimedia portable radio platform. However, in this new version of GR, which is under development, some other possibilities can be also explored, such as: a) temporary local FM radio transmission (School radio), b) Simultaneous translation, c) audio description, and d) experimental music performances.

- **a) GR as temporary local radio transmission**. The idea is to make available several possibilities for students, such as a) a school radio during the breaks and lunch time to listen to music or send some announcements, b) live transmission of a new song that a group of students just created, playing live instruments as guitars and vocals, c) groups of students having their own temporary radio station for social or educational purposes, d) to make a pronouncement by the director to all the campus community.
- **b) GR as a simultaneous translation device**. Simultaneous translation is a very expansive service for a small public school to afford. The possibility of having its own system of transmission would encourage small school communities

to organize international events, as meetings, seminars or conferences and even web conferences. GR can be used in this context by taking advantage of a low-cost solution. With this equipment any school would self-organize a simultaneous translation just needing a language teacher capable to translate.

- **c) GR as audio description**. Considering the inclusion of people with disabilities, which is supported by the Brazilian Federal law (9394/96, Art. 4), every school in Brazil has the possibility and responsibility of receiving special students, such as blind or deaf. In this situation, GR can be used as a tool that promotes inclusion, enabling the teacher to show a video, for example, to his or her class and transmit via FM radio waves the correspondent audio description of that video only for the blind student who could use a smart phone as receiver.
- **d) GR as experimental music performances**. The Brazilian Government has recently approved educational law with the commitment to teach music as a subject of art classes. GR can be an useful tool to provide different approach in this matter. Silent electronic performances, as the original purpose of GR, with students playing instruments such as keyboards and MIDI controllers; explore the portable radio transmission property, making live music performances in movement, such as a guitar player walking through school corridors playing his guitar noiselessly, would be some ways of using GR at art classes.

3. Prospective work

This paper presented an ongoing work that aims to produce a portable free device to broadcast live audio, which can be used for several purposes. Since the development of the new modules can be achieved and tested, the project is still at the begin, looking at the very first steps. Some experiences will be considered with the previous versions of GR, when it was focused as a platform for improvisation in music jams and for artistic performances.

Next steps will include studying and implementing the new modules, printing a case for this device as make some preliminary experiments to validate the project. Considering it will be all based on free hardware and software licensed under a Creative Commons, a free device accordingly, it has a very big potential to contribute in several fields, making audio and music more accessible and achievable. At last, the authors want to produce the GR kit to put it available to anyone interested in make it, inside the *Do It Yourself* philosophy.

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