

Summary

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Smart Guitar for beginners with emphasis in sensor development

Introduction

Learning something new is always a challenge with different degrees of difficulty for each person. However, bringing to the music niche, being more specific to musical instruments, the improvement of skills such as obtaining a musical note with precision can be somewhat difficult for beginners, since it is necessary a certain level of repetitions and also a training of the hearing itself, to facilitate the recognition of a note played correctly.

Therefore, it is with this objective that the following innovation plan proposes the development of a guitar sensor that aims to help beginners in this instrument to be able to play it more efficiently by issuing notes with precision.

This sensor shall send the user reports on its development through the internet, allowing it to see where its greatest difficulties are, which notes have been wrong most often, the difference in the sound of the notes wrongly played and the sound of the notes correctly played. All of this in real time, while practicing the instrument.

Objectives:

General Objectives:

- Research literature that supports the development of the project
- Investigate and analyze knowledge, methodologies and technologies appropriate for the development of sensors for musical instruments, emphasizing guitars.
- Through the knowledge acquired through research, model a possible way to execute the innovation plan.

A technical challenge that can be faced is related to the incorporation of this sensor in classically commercialized guitars, without changing its architecture much, so as not to transform them into artificial guitars, taking from the user the experiences found during the learning process, such as the process of being able to fix your fingers on the strings to achieve precision in the note, generating calluses, which seems bad, but that tells the story of the instrument's learning. Soon, achieving an integration of the sensor with a current architecture of classical guitars, made of wood for example, without changing its ergonomics and raw material, is an obstacle to be considered. As a result of this project, it's expected that all guitar students will be able to have a technologic help for practicing the instrument, but the sensor will not take away their expertise on playing the guitar.

Methodology:

This research follows the exploratory research method that, according to Gil (2002) and Braga (2007), aims to provide greater familiarity, gather data, information and standards about the proposed problem. As part of the construction of the theoretical foundation and contribution of necessary knowledge the research will be carried out in the scientific literature and CAPES journals, publications in relevant Congresses in the area and other materials.

For the development of the research, tools were used to support the management of activities:

- TRELLO: It is an application used for project management and task control. Available in <<https://trello.com/>>

Also, Some technologies are identified as promising for conducting the research when it comes to software development:

- Laravel php Framework: Framework chosen as the main tool for developing the software to perform the User and Smart guitar communication
- Visual Studio : Central environment and organizer of several elements to be used in the development;

Expected Results:

With this sensor, the expectation is to provide a technology help for all the enthusiasts in learning guitar, but without creating a dependency into playing what could be considered “artificial”, that in this case means that the students would not be able to play conventional guitars without any technology.

Therefore, All the users of this technology, shall be able to perfect their abilities, and then, become able to play a guitar, rather it has any technology implanted in it or not.

State of Art

With the arrival of the WIFI and the Internet of Things (IOT) technologies, a world of possibilities has been opened, creating lots of opportunities of making life easier for people in different areas, including the process of learning a new instrument. It's known that in many cases, the process of learning an instrument is considered a slow process, but with the support of the technologies already mentioned above, it is possible to streamline these processes. Choosing specifically the learning of guitar, there are already interesting alternatives to help with it, such as the Easy Guitar, which with the use of leds, indicates which notes should be played during the song. It uses a USB cable connected to the user's computer, who must go to the company's website, which links this device, then the user can view the available content and select a song. After finishing it, a report of its development in that song is made available. Another Example of a technology created in this niche, is the Jamstik Guitar Trainer, developed by jamstik, which is a brand of portable, app-connected (MIDI) guitars made by Zivix, which imitates the neck of a guitar, and aims to help in the learning of it. However, despite being interesting technologies they differ from the idea of the sensor previously presented, Since it is supposed to be coupler in a conventional guitar, preserving its natural learning process, but making it faster.

Researching in literature a concept until then unknown for me, I got introduced to the reading of an article named the “Internet of Things Applied to Robotic Musical Instruments”, such concept is called the Internet of Musical Things (IoMusT), which deals with the use of electronics such as sensors, actuators, etc., for musical purposes.

Some robotic prototypes are presented, such as a robotic violin made to interact with a platform, which aims to be used to control the robotic musical instruments mentioned in the article. The research process has been thought provoking, since IoMusT is an emerging research area and being able to imbue the networks of computational devices into physical objects. There are some technical challenges

that the designers of the IoMust area face, the issue with battery and energy consumption in the overall system for example, and the issue of miniaturizing computing units to support low-latency, sensing, actuating, and RF communication. Even with all issues that can be faced, this area brings many possibilities, such as allowing musicians to rehearse for an opera while they are in their homes, through mechanisms that allow them to control instruments by distance, making this practice a commonplace, for example. During the research, some groups that work with internet of musical things were being discovered, such as the Espirito Santo Nucleus of Musical Computing (NESCoM), which works with research in the area with the objective of developing new computational technologies and how they can apply them directly in music, as well as the Music Computing Laboratory (LCM / CME) of the Federal University of Rio Grande do Sul, among others. In short, all this research served to discover studies that already exist in this segment, and thus be able to bring knowledge to the proposed innovation plan, however the area in which the following innovation plan fits is also a new area, which is challenging, but it is a very interesting niche to develop projects.

Competitors, Intellectual Property and Freedom of Operation:

During the processes of researching which ones would be the major companies that have been working with IoMust area, I haven't find one yet that would be considered to be the greatest in the area, but I have searched for some smart instruments, especially guitars that have been having a better "debut in the market". The most famous brands are being listed in the next lines, as well as their producers.

- Jamstik Guitar Trainer
 - Made by Zivix, a company that creates innovative electronic instruments
 - Pros:
 - Real strings
 - iOS and web apps available
 - Completely wireless
 - Bluetooth and MIDI compatibility
 - Cons
 - Non-traditional design

- Runs on AA batteries
 - Left-hand version only available through Jamstik
- Artiphon INSTRUMENT 1
 - Made by Artiphon , an instrument designer .
 - Pros:
 - Pressure and tilt sensitivity
 - Can function as additional instruments
 - Built-in rechargeable battery
 - Cons:
 - Expensive
 - Not wireless
- Jammy G MIDI Guitar
 - Jammy Instruments U.S. Corp is a music tech company focused on designing innovative hardware and software solutions to make music practice and creation mobile and accessible
 - Pros:
 - Built-in tracks
 - Portability
 - Modular design
 - Cons
 - Expensive
 - Odd design
 - Requires Jammy app for tuning

Activities

1- Choice of theme for the innovation plan
2-Investigation of bibliographies related to the project for the internet of musical things.
3-Survey of groups that work with innovation in the musical area using IOMust.
4-Survey, investigation and study of languages and computational tools for the construction of interactive interfaces and understanding of the use of sensors in musical instruments, so that they can be integrated into the project.
5- Survey of basic requirements for creating a platform to assist users in the use of a smart guitar.

6-Development of a prototype of a graphical interface, which shall be in an experimental character for better visualization of the project.

7-Preparation of the final research report.

Schedule (**Mach/201**)

Activity	week 01	week 02	week 03	week 04	week 05	week 06	week 07
1	X						
2		X	X	X			
3			X		X		
4				X	X		
5							
6							
7			X	X	X		X
8							X
9							
10							
11							

Business Opportunities

Thanks to the IoMusT it is possible to reimagine certain musical activities such as live music performance or music learning, by leveraging a technological ecosystem that multiplies possibilities of interaction between different actors through dedicated Musical Things and services, as well as by augmenting the sonic content with other modalities. This has the potential to revolutionize the way music is composed, learned, experiences, as well as recorded.

(BARTHET,FISCHIONE,KELLER,TURCHET, 2018, p.62005)

Also the way that music is commercialized is going to be well affected, with the popularization of smart instruments of every kind.

This innovation plan has its focus on the development of smart guitars, and with the growth of its commercialization, the musical softwares market will tend to be impacted too, since there will be a need for an interface that shall communicate with the users .

Therefore, the IOMust area goes beyond what this innovation plan proposes, creating different scenarios for business. One exemple can be the way that concerts can become an immersive experience, (Barthet, Fischione, Keller, Turchet, 2018.) giving the public the choice to consume the concert through different interfaces, like the possibility to watch the concert through smart glasses or the pick up of an armband , which responds to the music through physical simulations .

In short. a new kind of business market can grow in the musical area, exploring the applications of IOMust and its impacts in people's lives.

Team Description

For the developing this project, it would be necessary a team with the respective roles:

- Product Manager: Responsible for making the point between the development, the User Experience and the Business, identifying, evaluating and validating the ideas that can mean new business opportunities or improvements for the products.
- IoT developer: Responsible for creating the software that allows products to function and connect to other devices.
- Industrial Engineer: Responsible for find ways to eliminate wastefulness in production processes and work with the sensors.

Estimated Budget

INNOVATION PLAN				
PROJECT	Smart Guitar			
# PROPOSAL	00001			
CATEGORY	ITEM	MAN HOUR VALUE	HOURS WORKED	MONTHLY WAGE
Human Resoues				
	Product Manager	213,38	40	R\$ 8.535,00
	IoT Developer	137,13	40	R\$ 5.485,00
	Industrial engineer	137,50	40	R\$ 5.500,00
Services	ITEM	VALUE	QUANTITY	ITEM COST
	Domain	20,00	1	R\$ 20,00
	Hosting	10,00	12	R\$ 120,00
Sensors				
	Tactile sensors	100,00	5	R\$ 500,00
	Sonorous sensors	100,00	5	R\$ 500,00
SUM				R\$ 20.660,00
EXTRA COSTS		VALUE	QUANTITY	R\$ 600,00
Third Party Services	Musical professionals	100,00	2	R\$ 200,00
Permanent equipment and materials				
	Tactile sensors; Sonorous sensors	200,00	2,00	R\$ 400,00
FINAL VALUE				R\$ 22.980,00

- The following items were added to table with the following purpose:
 - Permanent equipment and materials: Justified by the recurring need during the project
 - Third Party Services: Since the main domain is focused in the musical niche, consulting to professions that have a greater knowledge in this area is seen as required for the project's success.

Bibliographic references:

BRAGA, Katia Soares. **Aspectos relevantes para a seleção de metodologia adequada à pesquisa social em Ciência da Informação**. In: MUELLER, SUZANA P. M. Métodos para a pesquisa em Ciência da Informação. Brasília: Tesaurus, 2007. p. 17–38.

CAMPOREZ, Higor Araujo Fim et al. **Internet of Musical Things Aplicado a Instrumentos Musicais Robóticos**. Journal of Digital Media & Interaction, v. 3, n. 5, p. 89-101, 2020.

GIL, Antonio Carlos. **Como elaborar projetos de pesquisa**. São Paulo: Atlas, 2002.

Turchet, L., Fischione, C., Essl, G., Keller, D., & Barthet, M. **Internet of musical things: Vision and challenges**. IEEE Access, ,2018.