COMP 4905 Honours Project Report

Sirius Web Digital Audio Workplace

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Abstract

Coming from a musical background and interest, I've always wondered why digital audio workspace software's used in musical production is expensive and hard to use. I currently use Logic Pro X to produce hip hop beats for artists and I want to share my knowledge and make my own digital audio workspace called "Sirius" for beginners. As it was a huge learning curve for me to learn music, the sole purpose of this project is to help individuals who are interested in musical production use a simple and easy tool that allows them to make music. There are many digital audio workspace software's in the real world that are used for professional production like Ableton, FL Studio, Logic Pro X, and many more. The goal of this project is to implement a simple digital audio workspace web application for beginners to produce hip hop beats. This report will talk about the importance of the user interface, user experience, and the overall system design architecture of the digital audio workspace.

Acknowledgments

Firstly, I would like to thank Lou Nel for accepting the role to be my supervisor during these stressful times. COVID-19 took a huge toll on people's mental health and Lou acknowledged this and gave us more freedom in accomplishing our projects. The memories I will have for Carleton University is endless. From the first-year days of not knowing where your classes are, to the last year days of having Zoom classes. I will forever cherish these memories and be thankful for everything. During the pandemic I've learned that life is short, and I will never take it for granted. I am excited to start my new life during these stressful times and I will remain positive throughout. I am also excited to see what the future holds, and I am thankful for all the knowledge, networking, and experience I've gained academically at Carleton. Thank you, Carleton, thank you to the School of Computer Science staff and professors, and thank you to everyone.

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1. Introduction

1.1 Project Overview

Sirius web digital audio workspace is essentially a musical production tool that beginners can use to make hip hop beats. Over the semester, I've been researching the infrastructures of mainstream DAWs and what each individual software brings to the overall experience of usability. Hip hop production and music in general is a tough subject for some people and I wanted to make sure that the DAW I create removes this narrative.

1.2 Objectives

As there are many objectives I would like to get done for this project, I would like to state my main goals first. My first goal is to satisfy users with a user-friendly web application. The next goal I would like to aim for is for users to get a better understanding of how music is made. I would hope that my web application gives users a better understanding of music. Another goal I plan on achieving is satisfying users with the enjoyment and creativity of music. Thus, onto my objectives, these are the main features that will be implemented for this project: Allowing users to add and remove tracks, let users use existing MIDI drum patterns for tracks, let users create MIDI drum patterns, and let users play, pause, and stop tracks.

2. Background

This report includes the infrastructure and creation of the digital audio workspace. This includes the user interface, the user experience, and overall system design process of the project. Furthermore, this section gives you a better understanding of the topics that will be discussed later on.

2.1 User Interface

This section introduces the importance of user interfaces and the production.

2.2 User Experience

This section talks about the importance of user experience and includes participants.

2.3 System Design

This section dives deep into the infrastructure of the digital audio workplace using software engineering principles, architecture and processes. Furthermore, this section discusses the technical design process of the system using appropriate diagrams and tables.

3. User Interface

User interfaces are one of the most important design products of a web application. A clean and consistent looking user interface will attract users in being sold on your product. The main functionality of the user interface is to allow users to interact with your application [1].

A user interface design accomplishes the process of styling something in a specific way while maintaining strong functionality [2].

3.1 Design Approach

The web application is built on a one-page system meaning that all functionally that users want to communicate with, should be done on one page. This removes and avoids headaches for users trying to get familiar with the system.

The design is simplistic enough to not require a tutorial. It is a one-page application so it should be straight forward.

3.1.1 Design

Figure-1: *The DAW's UI.*

Looking at *Figure-1,* the simple UI of the project showcases all functionalities that can be processed.

Figure-2: *Top-left Menu for the DAW.*

Looking at *Figure-2,* the top-left side of the UI showcases a file hover down menu with an add and remove track feature to the right of it.

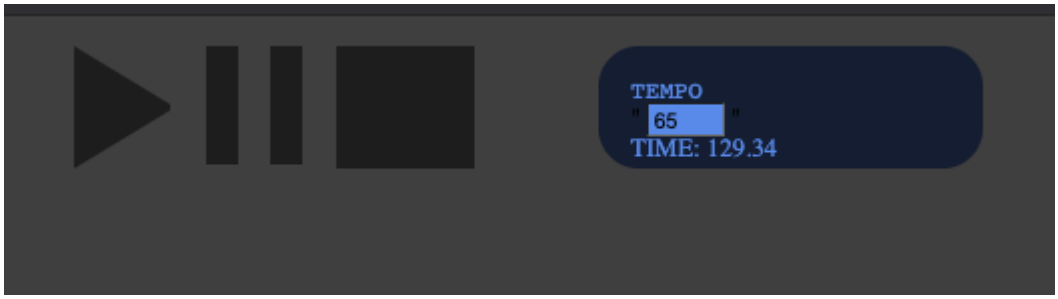

Figure-3: *Top-Middle portion of the DAW.*

Looking at *Figure-3,* the top-middle portion of the UI showcases a play, pause, and stop button. The play button allows the users to play their created beat. The pause button allows the user to pause their beat. And the stop button allows the user to stop playing their beat. Essentially the stop button will restart the time to the beginning of the track and any new pattern changes the user sets will be removed. To the right-side of the play, pause, and stop button, there is a BPM menu the users can adjust. The BPM is the tempo of the track and therefore users can increase it for a quicker tempo or decrease it for a slower tempo. Below the tempo is the track's time which is calculated in seconds.

Figure-4: *Tracks created with drum machines for the DAW.*

Looking at *Figure-4,* these are the appropriate tracks and instruments the project uses. Users can play around and make patterns with the pads that are displayed on the right side of the screen. Once a drum pad is selected, the pad will light up. This allows users to make their own drum patterns.

Figure-5: *Naming the Tracks.*

Looking at *Figure-5,* users can type into the tracks to identify which track represents which instrument. In this case, the closed hi-hats are in track 1, the claps are in track 2, the kicks are in track 3, and the 808 bass is in track 4.

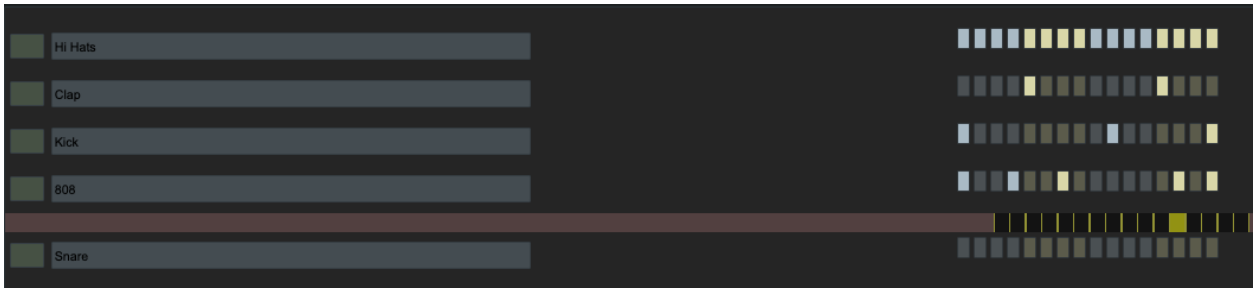

Figure-6: *Adding a Track.*

Looking at *Figure-6,* when the add track is clicked, a new track will be added in the DAW.

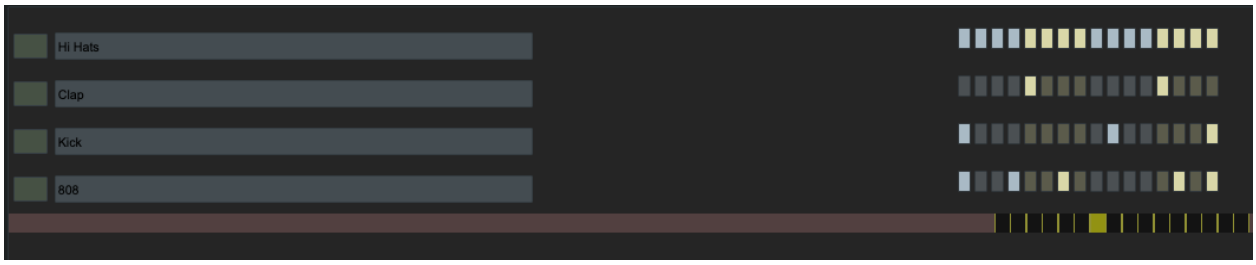

Figure-7: *Remove a Track.*

Looking at *Figure-7,* when the remove track is clicked, the new track will be deleted from the DAW.

Figure-8: *Metronomes for the DAW.*

Looking at *Figure-6,* these are the metronomes for the track. Both metronomes behave and function in similar ways although the first metronome is used for tracks drum patterns while the second metronome is the main metronome for the project. When the BPM changes, the metronome's tempo changes as well.

3.2 Conclusion

To conclude this section, user interfaces are one of the most important features of an application. The DAW is created on a one-page system meaning that all functionally that users want to communicate with, should be done on one page. Therefore, the design infrastructure of the DAW is simplistic enough to not require a tutorial.

4. User Experience

User experience design is the process termed by design teams to create products that provide not only a meaningful experience to users, but a relevant one [3].

As the user interface is the one of most important features a system can have, the UX must compliment the UI. In this section, I will be collecting data from three distinctly different users who will use the application to give feedback on how their experience was. All users have agreed for their data to be collected and their names will be kept anonymous.

4.1 User 1

User 1 is described as a middle aged non-technical individual who has no experience in musical production.

4.1.1 Walkthrough & Results

As described, user 1 is not familiar with technology nor music. This user's approach to the system is very simple. The user randomly selects pads on the track channels and then plays the play button. As the user slowly gets used to the program, they realize how all the track channels work. Therefore, the user then makes a beat in 65 BPM and states that they are satisfied with the results. The user then concludes saying that they are amazed on how easy it is to create music, and that they are looking forward to doing it again.

4.2 User 2

User 2 is described as a 4th year software engineering student at Carleton University who works at Shopify as a software engineer intern. This user has a musical background and knows how to play the piano. User 2 is also described to have a great technical background.

4.2.1 Walkthrough & Results

As stated, this user has a great technical and musical background. Knowing that, the user should not have any problems with getting familiar with the DAW. The user first changes the BPM to 55 and then constructs a beat to it. The user states that they are satisfied with the results and felt like they were using a drum machine plugin in FL Studio. They conclude saying that the user experience was great and recommends a “mute track” feature for the future.

4.3 User 3

User 3 is described as a master’s student at the University of Ottawa. This user has no musical background but is familiar with technology.

4.3.1 Walkthrough & Results

Having a minor familiarity with technology, the user easily loads up the DAW and is ready to produce. The user increases the BPM from 65 to 77 and then clicks play. After approximately 30 seconds, the user was able to distinguish which sound comes from each track. After that, the user then makes their own pattern on the drum machine pads. The

user states that they are having fun and that they would be looking forward to learning more about music. This user concludes by saying they've always wanted to produce music, but the software's are all expensive. This is true and is one of the main reasons why people are not interested in making music.

4.4 Conclusion

To conclude this section, all three participants came up with similar conclusions. All three were satisfied with the experience of being a creator and creating music. The positivity and creativity in music helps people overcome challenges in their life and I was hoping that my DAW can help do that. All three participants gave positive feedback and are interested in learning more about music. Music brings out the creativity of people and my participants definitely felt that. As Daniel Levitin states on page 108 in *This is your brain on music: The science of a human obsession*: "Our ability to make sense of music depends on experience, and neural structures that can learn and modify themselves with each new song we hear, and with each new listening to an old song." [4] (pp.108).

5. System Design

This section explores the proposed system, functional and non-functional requirements, and uses cases for the DAW.

5.1 Proposed System

This system will provide assistance to users who are interested in musical production, in specific, hip hop. It will allow users to create their own drum patterns with a sampled melody loop playing in the background.

5.2 Functional Requirements

F-01	Users must be able to access the DAW via Google Chrome.
F-02	Once launched, the user sees a hip-hop template already made.
F-03	Users can select the play button to hear the composed instruments.
F-04	Users can select the stop button to pause the composed instruments.
F-05	Users can change the BPM of the system.
F-06	Users can add tracks.
F-07	Users can remove added tracks.
F-08	Users can create their own drum patterns.

Table 1: *Functional Requirements for the system*

5.3 Non-Functional Requirements

NF-01	Useability: Clear, detailed instructions on installation and usage of system.
NF-02	Useability: Short code commands are provided for ease of functionality.
NF-03	Useability: User expertise does not matter. Tool is aimed for beginners.
NF-04	Reliability: System can handle exceptions with approach to using timers, fault prevention, and fault tolerance.
NF-05	Performance: Users should be able to use the system under a local host.
NF-06	Performance: System should support one concurrent user at a time.
NF-07	Supportability: The UI should work on any platform with little work in transferring code.
NF-08	Supportability: Mobile app can be developed.
NF-09	Implementation: The system should work on all operating systems.
NF-10	Implementation: The system should be written in NodeJS, HTML, and CSS.
NF-11	Operations: The system must be available on multiple operating systems.
NF-12	Packaging: The system must be available as a zip.
NF-13	Packaging: The system can be installed by users.
NF-14	Interface: All plugins are listed in the JSON file of the system.
NF-15	Interface: System is not consoled based.
NF-16	Legal: System complies with Not-for-profit act.
NF-17	Legal: System complies with the Canadian standards of care legal law

Table 2: *Non-Functional Requirements for the system*

5.4 Use Cases

5.4.1 High Level

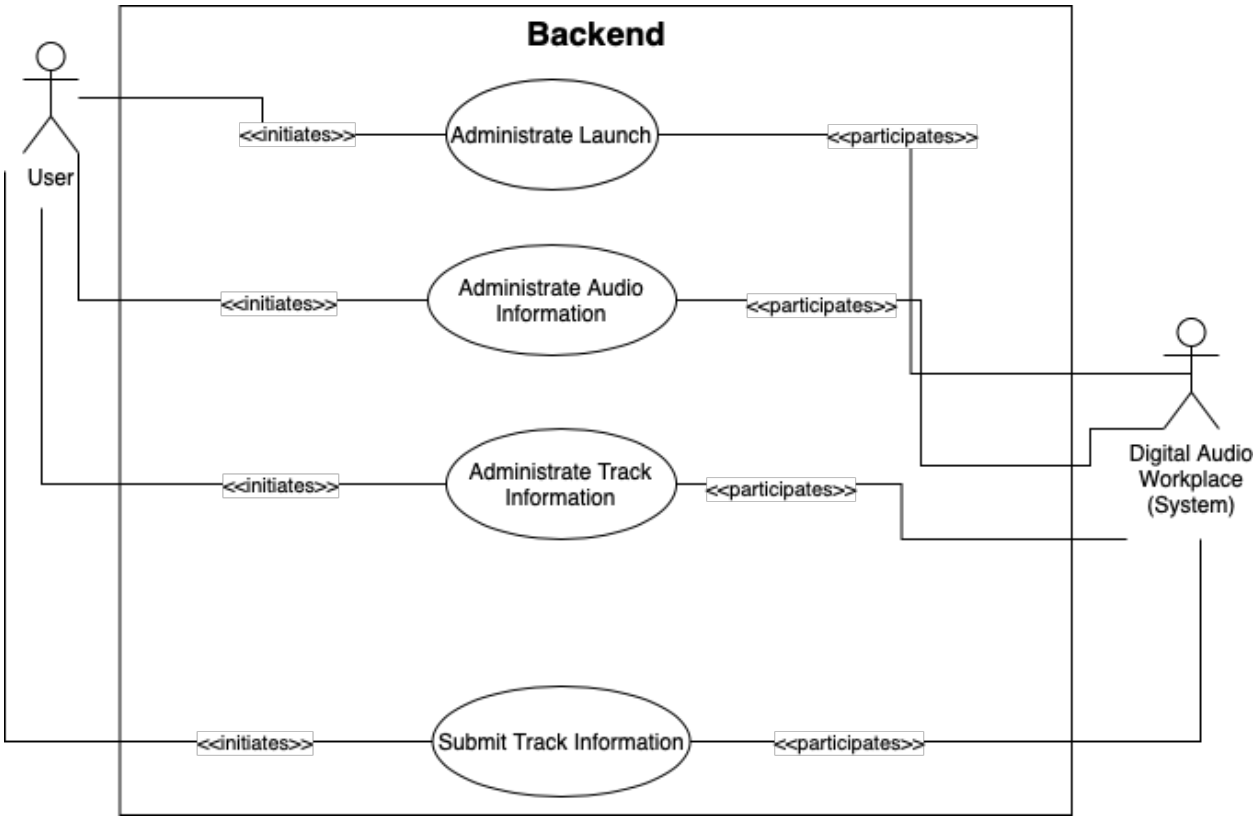

Figure-9: *High level use case of system.*

UC-01: **Administrate Launch**	Users will launch the system to a musical template.
UC-02: **Administrate Audio information**	Users can modify audio information.
UC-03: **Administrate Track information**	Users can edit track information.
UC-04: **Submit Track information**	Users can submit changes by clicking play.

Table 3: *High level use case table of the system.*

5.4.2 Detailed Level

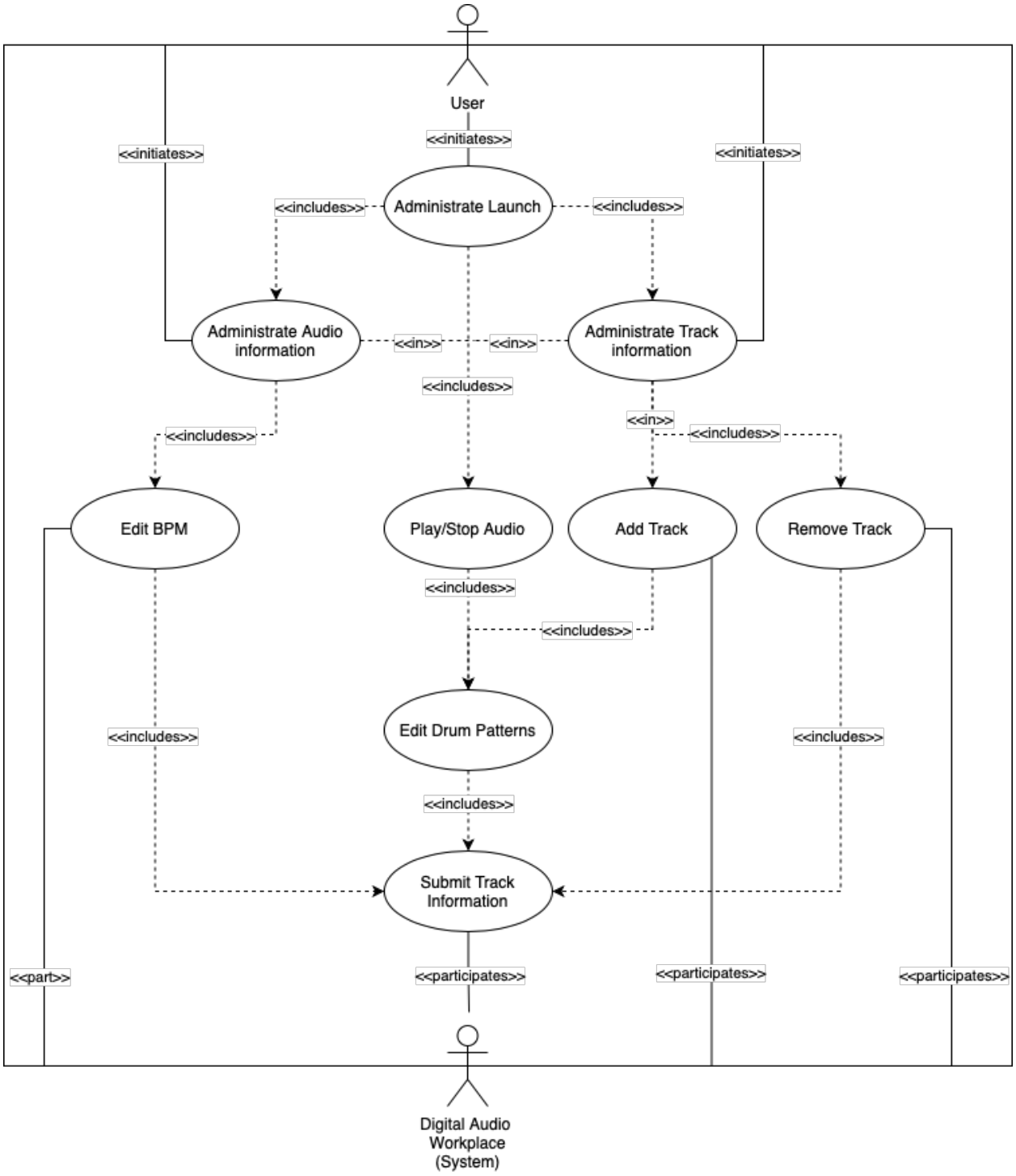

Figure-10: *Detailed level use case of the system.*

UC-05: **Play/stop Audio**	Users can play or stop audio.
UC-06: **Edit BPM**	Users can change the BPM of the project.
UC-07: **Add Track**	Users can add tracks to the workplace.
UC-08: **Remove Track**	Users can remove added tracks.
UC-09: **Edit Drum Patterns**	Users can modify drum patterns.

Table 4: *Detailed use case table of the system.*

6. Conclusion

In conclusion, Sirius web digital audio workspace is a musical production tool that beginners can use to make hip hop beats. Hip hop production and music in general is a tough subject for some people and I wanted to make sure that the DAW I create removes this narrative. This paper highlighted the specifics of the project and the use.

During the project I got a better understanding of how DAWs work and why they are complicated to use. Building a DAW and then having people use it gave me a better understanding on how people see DAWs. The goals that I stated in my objectives were accomplished and I am satisfied with how everything turned out.

For future references, I would like to mention and note some potential next steps for the project. New features like adding a mute button for each track, change the BPM of the sampled melody used, adding an equalizer to change up the highs and lows of audio frequencies, allow users to create their own melodies with a piano roll, and adding an audio compressor are all examples of what can be done next.

7. References

[1] Roman Berezhnoi From small landing pages to huge online stores. (2021, February 16). *What is User Interface Design (UI) and why is it important?* F5 Studio. https://f5-studio.com/articles/what-is-user-interface-design-and-why-is-it-important/.

[2] Fogel, B. (2020, October 18). *What is User Interface Design and Why UI is Important*. Operation Technology: Digital Marketing and Web Design Agency. https://www.operationtechnology.com/the-importance-of-user-interface-design/.

[3] *What is User Experience (UX) Design?* The Interaction Design Foundation. (n.d.). https://www.interaction-design.org/literature/topics/ux-design.

[4] Levitin, D. (2006). *This is your brain on music: The science of human obsession*. New York, N.Y.: Dutton.
pp. 108

8. Appendix-A Acronyms

BPM	*Beats Per Minute*
DAW	*Digital Audio Workplace*
in	*Includes*
part	*Participates*
UI	*User Interface*
UX	*User Experience*