

Berklee College of Music

# **Remote Recording in 2020: Turning Remote Record-Making into an Immersive Experience**

Submitted in Partial Fulfilment of the Degree of  
Master of Music in Music Production, Technology, and Innovation  
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July 2021

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## **Abstract**

This project aims to explore and develop a methodology to effectively work on remote recording sessions. This is especially relevant in current times when we as a society are dealing with the limitations of the COVID-19 pandemic. Consequently, typical methods for making music in a studio are not entirely viable. In order to test the suggested methodology, a collection of singles is being produced in collaboration with a group of artists that are responsible for writing all of the music. The selected songs will then enter the phase of production, recording, mixing and mastering. The final masters will be collected and included. The project aims to shed light and reflect on key problems around "remote-record making", as well and provide solutions and ways on how these difficulties can be addressed. Furthermore, my work can hopefully serve as a basis for future projects regarding this theme.

Keywords: remote recording, music production

## **1. Introduction**

The initial idea for this project was conceived in the beginning of the first COVID-19 lockdown in Portugal, in February 2020. Studios and businesses were forced to close their doors, which made recording projects no longer viable. And as we go through this world-changing pandemic new solutions have to be found in order to accommodate for the newfound restrictions.

With quality recording equipment prices going down in addition to general widespread faster internet connections, remote collaborating is a viable solution. Not only in response to the pandemic, but as an adaptation of the recording industry to modern times.

Although remote recording projects are not new, they are far from being usual. Music-Making is a business focused around people and the inability to have in-person interaction definitely impacts negatively the overall experience for all parties involved.

This project does not aim to redefine the way music is made in a studio environment, but rather reflect on the technologies available and how the latter can be used to improve overall studio experiences. In addition, allowing producers and recording engineers to broaden their clientele by working remote, with minimal compromise on the artist's involvement.

## 2. Review of the State of the Art

Remote recording and online collaborative projects are not something new. However, remote collaborations were for a long time expensive and hard to implement, requiring reliable systems running on ISDN<sup>1</sup> technology on both ends. With recording equipment becoming better and cheaper, together with overall widespread of faster internet connections, that is no longer the case. As we see a reduction in recording budgets<sup>2</sup> this type of approach becomes more relevant each day, allowing access to a larger number of creative minds that would not be accessible in a typical “in-person” session.<sup>3</sup>

There are 3 main approaches to this type of project: Real-time, Offline, File-Sharing.

- Real-time: Real-time collaboration usually involves some sort of software allowing collaborators to interact with each other in real-time. Whether it be linking their DAW's, or just providing a way of everyone being able to see and hear what is happening in the session. The project session is hosted locally, on one of the machines, and participating machines are linked through the network. Technologies like Audiomovers allow for low latency, and fairly high fidelity lossless audio streaming (dependent on the internet speeds of users)<sup>4</sup>. Zoom, as an example for a simplified video conferencing software, allows for HD video and audio, as well as tools like screen sharing that can prove useful in this type

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<sup>1</sup> Integrated Services Digital Network (ISDN) is a protocol for “simultaneous digital transmission of voice, video, data and other network services over the digitalised circuits of the public switched phone network.”; Decina, M., and E. Scace. “CCITT Recommendations on the ISDN: A Review.” *IEEE Journal on Selected Areas in Communications* 4, no. 3 (1986): 320–25. <https://doi.org/10.1109/jsac.1986.1146333>.

<sup>2</sup> Kirby, Philip Ronald. “The Evolution and Decline of the Traditional Recording Studio.” University of Liverpool, September 2015. <https://livrepository.liverpool.ac.uk/3000867/>.

<sup>3</sup> Pejrolo, Andrea. “Remote Collaboration: Long Distance Recording Projects.” *Sound On Sound*, March 2014.

<sup>4</sup> “Real Time High Resolution Remote Audio Collaboration With Anyone In The World.” Accessed November 10, 2020. <https://Audiomovers.Com/Wp/>.

of scenario.<sup>5</sup> In this context, due to the syncing limitations implied by available network capabilities, this type of collaboration would usually be limited to two collaborators/"collaborating systems".

- Offline: Software like OhmStudio<sup>6</sup>, allows people to collaborate on a project without needing to be present at the same time. The "master session" would usually be hosted on a cloud server, but be updated locally on every machine quite frequently, simulating real-time workflow. While the benefits of this method are apparent, there are also limitations. Integration with popular professional DAWs is somewhat limited, working best with dedicated software. Other examples of this method are Avid's ProTools Cloud Collaboration<sup>7</sup> and Splice Studio<sup>8</sup>.

More recently, there has also been a rise in companies and plugins trying to solve this problem with DAW integration. MixedInKey's Satellite plugins<sup>9</sup>, and SessionWire<sup>10</sup> are prime examples of this, both companies' plugins aim to provide a way to link collaborators DAW's (even if they're different) without needing to download any files from external websites. The Project itself is "hosted" inside their plugin continuously syncing between the clients.

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<sup>5</sup> "Video Conferencing, Web Conferencing, Webinars, Screen Sharing." Zoom Video. Accessed November 10, 2020. <https://zoom.us/meetings>.

<sup>6</sup> Ohm Studio. Accessed November 10, 2020. <https://www.ohmstudio.com/collaboration>.

<sup>7</sup> "Cloud Collaboration - Pro Tools." Producing Software for Music - Cloud Collaboration - Pro Tools. Accessed December 07, 2020. <https://www.avid.com/pro-tools/cloud-collaboration>.

<sup>8</sup> "Splice Studio." Studio – Help Center. Accessed December 07, 2020. <https://support.splice.com/hc/en-us/categories/360000112328-Studio>.

<sup>9</sup> "Satellite Sessions Plugin - Music Collaboration Inside Your DAW." Satellite. April 13, 2021. Accessed June 03, 2021. <https://mixedinkey.com/satellite/>.

<sup>10</sup> Sessionwire Platform. Accessed June 03, 2021. <https://community.sessionwire.com/landing>.

- File-Sharing: The simpler of the three, relies on cloud-based services like Dropbox<sup>11</sup>, Google Drive<sup>12</sup>, or even generic email. There is not usually a direct connection with DAW software, instead, the collaborators exchange files by uploading and downloading files to external cloud-based storage. Consequently, the process of adding these files to a project is entirely manual. Filepass is a service which in addition to providing large file cloud server hosting (with never-expiring links), offers among other things the possibility of easily adding time-stamped comments, which could prove useful in this scenario.<sup>13</sup>

There are several “services” specialising in this type of work. It was able to notice two different approaches.

- “Partial” Production/ Single-Service based: Services like OnlineSessions and Airgigs, provide the client with a list of session musicians and engineers from their roster. The client is able to pick and choose which musicians they would want to work on their song. Post-production services are also offered. These platforms end up functioning more like a management service, connecting industry professionals with potential clients.<sup>14 15</sup>
- Full Production: Services like The Online Recording Studio and StudioPros stand out by assigning the client with a dedicated producer who will oversee the entire process of making the song. While StudioPros ends up working on a “hybrid” system where they do

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<sup>11</sup> "Dropbox." Accessed December 07, 2020. [https://www.dropbox.com/?\\_hp=c](https://www.dropbox.com/?_hp=c).

<sup>12</sup> "Cloud Storage for Work and Home." Google Drive. Accessed December 07, 2020. [https://www.google.com/intl/en\\_in/drive/](https://www.google.com/intl/en_in/drive/).

<sup>13</sup> "Filepass." Accessed November 10, 2020. <https://filepass.com/>.

<sup>14</sup> "Online Recording Services." Onlinesessions, April 24, 2020. <https://www.onlinesessions.com/>.

<sup>15</sup> "Online Recording, Mixing & Mastering Gigs." Accessed November 11, 2020. <https://www.airgigs.com/home>.

provide the client with a producer. However, sessions musicians and post-production engineers are “outsourced” from their roster and the producer play a more management role. The Online Recording Studio possesses a roster of different producers who are assigned to clients based on their style/genre. The producer then works with sessions musicians from their own network of contacts and are present in every recording session as well as being in charge of the post-production.

For both of these models, in case the client wants to participate musically in the song, he is in charge of providing the recorded tracks with their instrument. Both cases in the “Full Production” model also offer guidance in self-recording.<sup>16 17</sup>

For this Culminating Experience project, it is intended to further expand on these models. While relying heavily on the “real-time” method for collaborating online, it is intended to take what’s best from the others. The ability for the artist to not partake in every session and still have access to every file recorded in a simple way.

That being said, this project intends to find a way to make online collaborations more immersive and seamless, providing the artist with the feeling of “being in the room”, and participating live in the entire process through the technologies mentioned above. Through multi-camera setups and microphones spread throughout the studio’s different rooms, the artist will be able to see and hear what’s happening. Furthermore also having the ability to interact directly with everyone present. Communication with the producer/engineer in the control room can be made through the studio monitors, and with the musicians in the live room as well through the talkback system.

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<sup>16</sup> The Online Recording Studio. “How It Works: Online Music Production + Recording.” Accessed November 11, 2020. <https://www.onlinerecordingstudio.com/how-it-works>.

<sup>17</sup> Music Production, Mixing and Mastering, Custom Studio Tracks and Vocalist services. Accessed November 11, 2020. <https://studiopros.com/services.php>.



Furthermore, it is intended, by the methods just previously mentioned, to improve upon what other services offer, by not only providing the artist with a producer who will personally oversee and manage every stage of the recording process, in this case — the author; but at the same time, make sure the artist plays an active role, providing the previously described immersive experience in this fully remote environment.

### 3. Description

For the purpose of this reflection paper the words artist and client will refer to the same entity and therefore be used interchangeably.

This project started off by selecting a number of artists with whom to work with, and collaborate on producing a track. The artists were selected based on the author's personal music taste, their availability and commitment and, what recording equipment they had access to — since ultimately every artist would have to record something “on their own”.

The artists were found on several music forums (ex. Reddit<sup>18</sup>), and platforms like Youtube<sup>19</sup>, and then reached out to.

The following seven artist and respective songs were selected (displayed by alphabetical order):

- Cameron Sage - Newfound Criminal (USA)
- David English - Mole Traps (Zimbabwe)
- Ellie Finnerty - Six Pound Forty (United Kingdom)
- Maple Ward - Home Of Our Own (United Kingdom)
- Shayan Chakraborty - Little Joy (India)
- Sienna C. Wright - This Body Is Mine (United Kingdom)
- Tomás Pintos - The Wave Returns To The Ocean (Uruguay)

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<sup>18</sup> "The Front Page of the Internet." Reddit. Accessed June 03, 2021. <https://www.reddit.com/>.

<sup>19</sup> YouTube. Accessed June 03, 2021. <https://www.youtube.com/>.

The technological part of this project was developed in tandem with the production of the songs, allowing iterations of the former and consequential improvements of the remote workflow.

The envisioned workflow has two main aspects to consider:

- Video
- Audio

## **Video**

The first aspect to consider was how to transmit a video feed, and at the same time ensure a system that would allow 2-Way communication. For this, there were experiments made using open source video conferencing APIs<sup>20</sup>, and attempts at integrating them into a website. However it proved to be a bigger project than pictured, and outside the scope of this thesis. Ultimately, it was decided to use Zoom to provide the video conferencing, due to its recent widespread success, and affordability.

It was decided to utilise a multi-camera setup ensuring wider “visual coverage” of the studio — Control Room, Live Room, etc; and posteriorly develop a way for the artist to control which “view” they would be looking at — adding to the “immersive-ness” of the project.

In order to transmit these several “views” into zoom there are different options; for example:

1. Log in to Zoom, using a different client per camera.
2. Combining the different cameras and, streaming it to Zoom.

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<sup>20</sup> “An API is defined as a specification of possible interactions with a software component. API is the acronym for Application Programming Interface, which is a software intermediary that allows two applications to interact with each other.”; "Application Programming Interface." HubSpire. March 21, 2021. Accessed June 03, 2021. <https://www.hubspire.com/resources/general/application-programming-interface/>.

The first option, while apparently easier to conceive, presents several different problems. Firstly, the necessity for a different system (or computer) per camera. And while Zoom can run on Linux<sup>21</sup>, which would allow the use a single-board computer, like the RaspberryPI<sup>22</sup> (instead of a “full-blown computer) this would turn the whole project less affordable. Furthermore, having several machines connected to the video conferencing software presents a problem with internet bandwidth<sup>23</sup>, leading to slower video streaming and a less desirable experience.

By combining the different cameras into one “camera” and streaming it to Zoom, makes it possible to circumvent the bandwidth problem. The approach taken was to use OBS<sup>24</sup> as a software video mixer<sup>25</sup>, and then utilising the Virtual Camera function to stream it to zoom. This approach, beside being more affordable, has the advantage of the flexibility of using a digital video mixer — ex. infinite amount of “scenes” (independent presets for ways to combine video sources), additional options for combining video sources, video processing, etc.

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<sup>21</sup> “Linux is an operating system.”; “What Is Linux?” Linux.com. Accessed June 03, 2021. <https://www.linux.com/what-is-linux/>.

<sup>22</sup> Raspberry Pi. "Teach, Learn, and Make with Raspberry Pi." Raspberry Pi. Accessed June 03, 2021. <https://www.raspberrypi.org/>.

<sup>23</sup> “The maximum amount of data transmitted over an internet connection in a given amount of time.”; "What Is Bandwidth - Definition, Meaning & Explanation." Verizon Fios. Accessed June 03, 2021. <https://www.verizon.com/info/definitions/bandwidth/>.

<sup>24</sup> "OBS Studio." OBS. Accessed June 03, 2021. <https://obsproject.com/>.

<sup>25</sup> “A vision mixer (or video mixer) is a device used to select between several different live video sources and, in some cases, compositing live video sources together to create visual effects.”; "Vision Mixer." Wikipedia. January 28, 2021. Accessed June 03, 2021. [https://en.wikipedia.org/wiki/Vision\\_mixer](https://en.wikipedia.org/wiki/Vision_mixer).

Additionally, making use of Palaki's Websocket Plugin for OBS<sup>26</sup>, it was possible to:

1. Create a website (hosted in <http://flyingratrecords.com/control>), that connects with OBS through a server, automatically updating based on the current scenes, allowing the clients to login using an authorisation code and switch between the different views offered.

2. Create a hardware controller allowing additional user-side control of OBS Scenes.

(Figure 1)

The hardware controller (operating on an Arduino Leonardo) was modelled in Fusion 360<sup>27</sup> and then the enclosure was 3D printed. The code turns the Arduino into a MIDI controller, which interfaces with a custom built software turning the Arduino's MIDI messages into Node.js commands. Subsequently, routing them internally through the same port the Websocket server is set up in.

These extra steps are necessary to be able to control OBS while it's running on the background — meaning it's not necessary to ever leave the DAW screen while running a session.

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<sup>26</sup> Palakis. "Palakis/obs-websocket." GitHub. Accessed June 05, 2021. <https://github.com/Palakis/obs-websocket>.

<sup>27</sup> "Fusion 360: 3D CAD, CAM, CAE & PCB Cloud-Based Software." Autodesk. May 31, 2021. Accessed June 05, 2021. <https://www.autodesk.com/products/fusion-360/overview?term=1-YEAR>.



Figure 1. Hardware Controller Prototype 1

## Audio

In order for the artist to monitor what's being recorded, ListenTo by Audiomovers was used — providing a high-fidelity audio stream.

For communicating with the artist, the talkback microphone is set up in OBS and then routed into the video conferencing software. Allowing the use of the custom built hardware controller to engage and disengage the talkback microphone.

By routing the output of Zoom into the DAW, it is possible to then route it to both the studio speakers, and musician's monitoring system.

The internal audio routing can be achieved with an application like SoundFlower<sup>28</sup> or VB Audio Cable<sup>29</sup>.

A wiring diagram can be found in Figure 2 detailing all the connections.

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<sup>28</sup> "Soundflower." Rogue Amoeba. Accessed June 05, 2021. <https://rogueamoeba.com/freebies/soundflower/>.

<sup>29</sup> Burel, Vincent. "VB-Audio Cable." VB. Accessed June 05, 2021. <https://vb-audio.com/>.

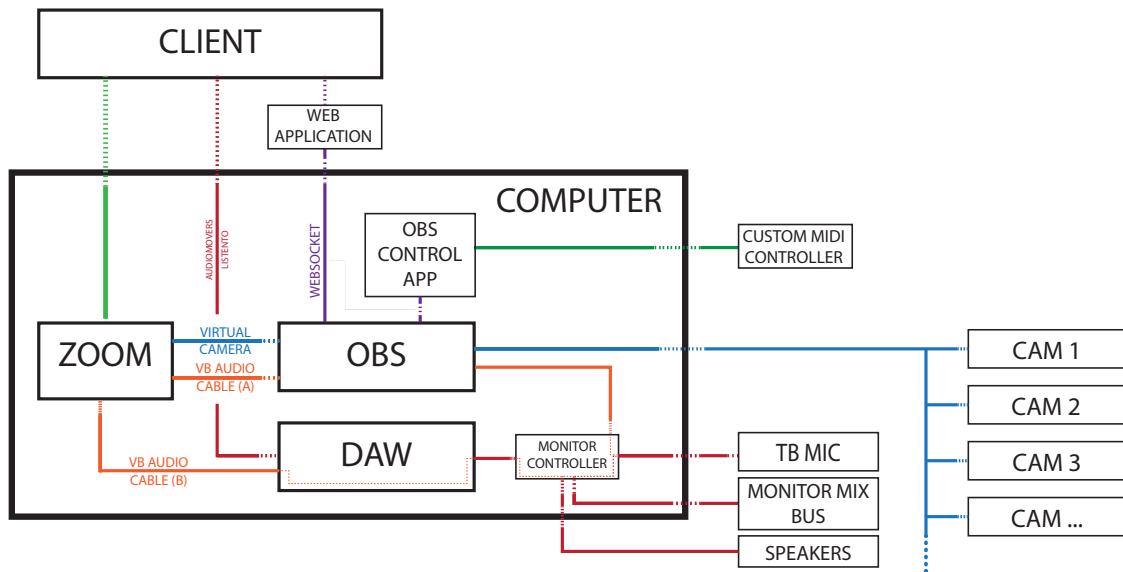


Figure 2. Hardware Controller Prototype

#### 4. Innovative Aspects

This project is not innovative in its individual parts. It is the sum of them, and how they interact with each other to create something new and improved, that makes innovative.

Remote recording is not new, but in context with the current pandemic state of the world it has never been more relevant. Furthermore, it is believed that a more remote approach to working will become increasingly standard.<sup>30</sup> Acknowledging that information, it is reasonable to consider, and procure new ways to improve and adapt the remote workflow in a studio environment, as well as client's experience with this "new" reality.

Lastly, the author also believes that this project is innovative as a commercial opportunity — as a service, sold to studios/labels as a way to expand their networks, and allow a new better remote workflow.

<sup>30</sup> Bick, Alexander, Adam Blandin, and Karel Mertens. "Work from Home Before and After the COVID-19 Outbreak." *SSRN Electronic Journal*, 2021. Accessed June 8, 2021. doi:10.2139/ssrn.3786142.

## **5. New Skills Acquired**

Firstly, the biggest challenge encountered was with coding. Prior to this project, the author didn't have any real experience with any coding language, and therefore had to learn about HTML and Node.js — as well as basic server functionality and operating principals.

Secondly, this project has also allowed the author to expand his existing knowledge about electronic circuit design, and soldering — by constructing the hardware controller.

As a byproduct of producing, recording, mixing and mastering the 7 songs involved in this project, improvements in these disciplines were also noted.

Finally, and arguably more important — time management, as it was a big part of this thesis. Dealing with artists on different time zones, and managing/scheduling recording sessions presented a challenge, that helped the author refine this skill.

## **6. Challenges**

As previously mentioned, prior to this project, the author didn't have experience with coding, and therefor this aspect of the thesis presented the biggest challenge. It was possible to overcome these difficulties with the assistance of the author's thesis advisors, and expert colleagues.

An unexpected challenge was finding ways to work around the artists's poor internet connections. By scheduling recording sessions at a time of low internet traffic on the client's side, or having them connect directly to the router with an Ethernet Cable which made it possible to run the sessions without major problems.

As far as client-side usability, there was a necessity to teach the clients how to use some of these softwares, which proved to be somewhat overwhelming for the artists (running



Audiomovers, DAW's, Zoom and the website all at the same time while trying to be in the session).

Finally, due to the author's own inexperience, the software had a few problems, making it moderately unreliable — sometimes needing restarts.

## **7. Future Ramifications**

As far as future ramifications go, there are two main aspects that should be considered:

Firstly, it would be beneficial to the project if the software aspect of it was re-written from scratch utilising a better integrated development environment (IDE) than Max MSP — making the software more reliable, fast and light.

Secondly, make this project commercially available. Offering a service that would implement this “package” into a studio, in a “stress-free” way for the clients. At this moment, this idea is being considered and developed.

## **8. Conclusions**

In summary, by utilising different available technologies (ex: OBS, Zoom, Audiomovers), linking them together, and finding way to make them work in tandem — together with the created proprietary software and custom hardware, it was possible to create a suggested methodology on how a recording studio can be set up for better accommodating remote recording sessions. This project was also able to conceive a stable, streamlined, and “stress-free” workflow where this technology aids music creation instead of impeding it.

In addition, seven songs were also created fully remotely with artists all over the world allowing the author to fully test the suggested system.

## 9. Appendix

**Table 1. Resources & Budget**

<b>MATERIALS (DISPOSABLES)</b>	Initial (per song)	Running Budget
Hard Drives	€5,00	€7,62
<b>EQUIPMENT</b>		
<b>HARDWARE</b>		
Computer	€60,00	€760,00
Controller Parts		€20
<b>SOFTWARE</b>		
Zoom	€35,00	€0,00
AudioMovers	€50,00	€64,99
<b>PERSONNEL</b>		
Musicians	€350,00	€1610,00
Engineers	€60,00	€240,00
<b>STUDIO</b>		
AKSS	€100,00	€700,00
STAD	€100,00	€700,00
<b>TOTALS</b>	<b>€760,00</b>	<b>€4102,61</b>

**Table 2. Updated Project Timeline**

Tasks	December				January				February				March				April				May				June				July			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Gather, Interview and Select Artists																																
Produce Demos																																
Final Adjustments on Demos																																
Basic Sessions																																
Overdubs																																
Overdubs (Last Minute Additions)																																
Post-Production																																
Revisions																																
Technological Developments																																

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[https://en.wikipedia.org/wiki/Vision\\_mixer](https://en.wikipedia.org/wiki/Vision_mixer).

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