

Preliminary Report on Final Year Project

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Degree programme	Beng Electronics with Music
Working Title of Project	Live Music Performance over the Net
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Academic year	2024/2025

1. Introduction:

Since the COVID-19 pandemic, several online platforms have been created to allow remote interaction between peers. This allowed for business and education activities, such as meetings and lectures, to carry on despite having to stay at home. In the area of music, however, most of the commonly used apps, such as Zoom or Teams, do not provide the experience of a live rehearsal or performance.

This is mainly because their client-server models do not prioritize low-latency communication. This causes delays in real-time streaming that make it unsuitable for online performances and rehearsals. Although online performances have been carried out, these are mostly pre-recorded to a click-track, lacking the sense of interactivity of live music.

Solution: This project aims to develop an online service specifically design for musicians. Focused on reducing audio streaming latency, and providing a real-time audiovisual experience, while using consumer-friendly hardware available for the average consumer. I will aim to provide this service using Linux communication protocols and external audio and video processing libraries to achieve real time communication.

2. Aims and Objectives:

- . Primary aim: to develop a platform for musicians to rehearse and perform from remote locations, with low-latency audiovisual transmission. The main focus will be on minimizing communication delays to provide a user-friendly real-time experience for easy-access hardware.

- . Core Objectives:

- . Research similar services already on the market (such as Jamulus, JamKazam or NinJam), and get familiar with Linux protocols and libraries (UDP sockets for network transmission, ALSA for audio processing, JackTrip for low-latency audio transmission; or WebRTC for real-time peer-to-peer communication)

- . Create a prototype platform that implements low-latency, low-resolution audiovisual streaming. Focus on ensuring satisfactory performance on a closed network for a limited number of connections.

- . Implement and test different communication structures (UDP vs TCP) and services (WebRTC, JackTrip)

- . Test and improve prototype platform to enhance performance and make it suitable for more simultaneous connections, prioritizing low-latency communication. Also, gather information on user feedback and audiovisual quality for further development.

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.Develop a user-friendly interface, to facilitate easy setup and use.

3. Contingency Planning:

- . Technical challenges: transmission tools might not meet the expected performance requirements. Solution: explore other audio transmission methods and possible hybrid approaches. (JackTrip or PulseAudio).
- . Network protocols related problems: If the chosen UDP communication protocols do not perform as expected, compare performance of UDP and TCP communication protocols to test latency and general reliability.
- . Fallback strategy: Low-latency transmission of both audio and video data, might become unmanageable for multiple simultaneous transmissions. In that case I will prioritize quality audio transmission, with a lower resolution video stream, or even offer video transmission as an optional feature.
- . Testing limitations: One of the main challenges when testing might be finding multiple musicians available or how the program interacts with their set-up. In this case I will test the platform using recordings or simple voice set-ups.

4. Resources:

- . Software: C++ development environment; Linux operating system for easier protocol implementation; Linux-based tools and libraries for communication and data processing (UDP libraries, ALSA, etc.)
- .Hardware: several computers to test communication and overall functionality (instead of single-board computers due to lack of accessibility and potential delivery delays). Audio peripherals such as USB microphones and headphones for initial testing; and simple external sound cards for further development.
- .Network: Access to a local network for initial test and evaluation in a controlled environment. Software that can accurately measure latency in connection (Network Performance Monitor).
- .Human resources: Different collaborators to test the platform at different stages of development; and access to communities willing to test the final product and provide feedback.

5. Risk Assessment:

Since this project is fully computer based, there are few risks when it comes to experimentation and hardware handling. There are related risks that need to be taken into account such as prolonged screen exposure, causing headaches or other health issues related to posture or proper hydration.

Since this is also a music related project, there is risk to damage hearing due to high volumes or unexpected noises, which need to be controlled and accounted for.