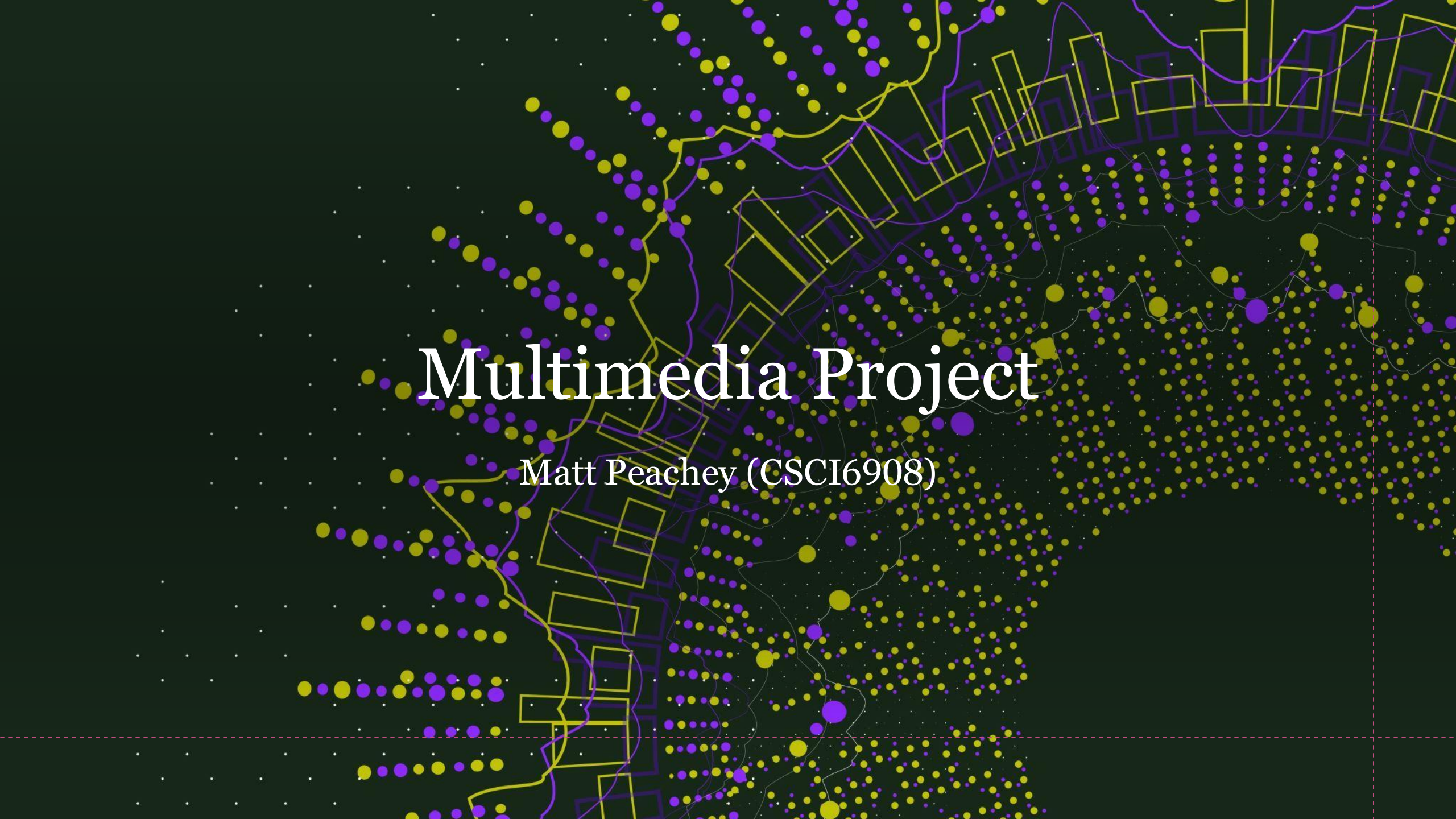


Multimedia Project

Matt Peachey (CSCI6908)

Contents

Introduction

Sonification: The use of non-speech audio to represent or convey data.

This project explores the sonification of sporting activities.

How can this idea be applied to DMIs or NIMEs?

Background

Sonification Dimensions

Physical Domain: **Kinematics**, kinetics, matter, **time**, dimensions.

Auditory Domain: **Pitch-related**, **timbre**, loudness-related, spatial, temporal, combinations of the above.

"It thus becomes an aesthetic choice to determine which of these aspects to include, and most of all, how." [1]

IMUs

Inertial Measurement Units -> Accelerometers, Gyroscopes, Magnetometers.

LSM6DS3 Sensor: Accelerometer (-4 | +4 g @ 104hz) -> Embedded in Arduino Nano.

Digital Synthesis

Subtractive synthesis, physical models, etc.

Motivation

There are **many** kinds of sporting activities, each with unique characteristics.

Cyclical: Sprint Canoe Stroke, Rowing Stroke, Running, etc.

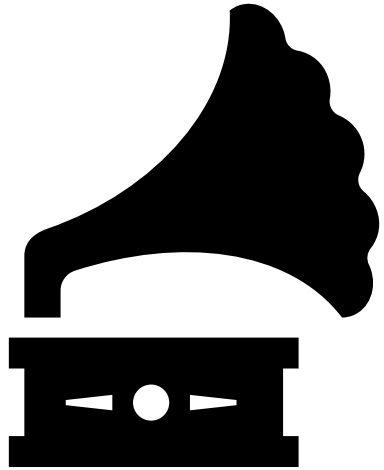
Noncyclical: Kicking Soccerball, Golf Swing, Throwing Football, etc.

Does activity category for matter for sonification? Aesthetically?

Approach

Project Goals:

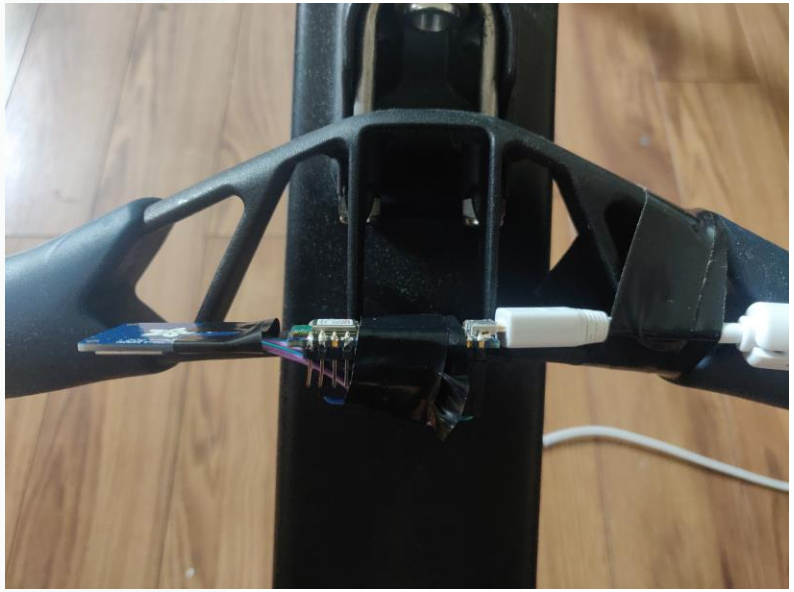
1. Capture acceleration data.
2. Visualize captured data.
3. Map data to synthesis parameters.
4. Enjoy!



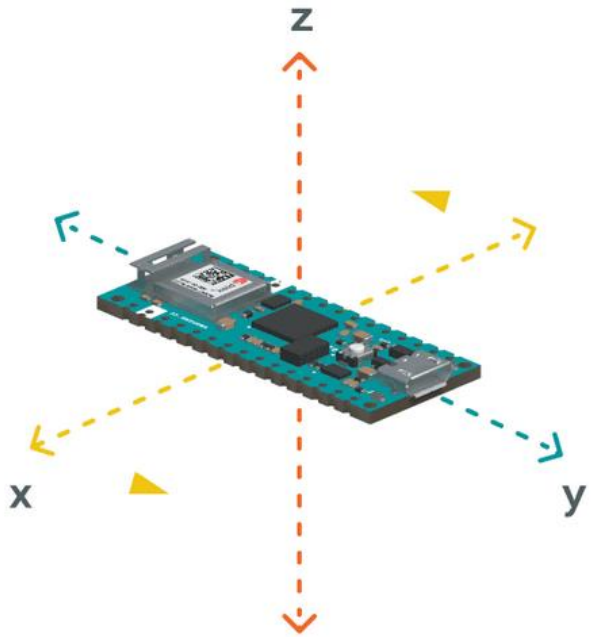
Approach (Capture Data)

Arduino Nano 33 IoT.

Adafruit SD Card Reader

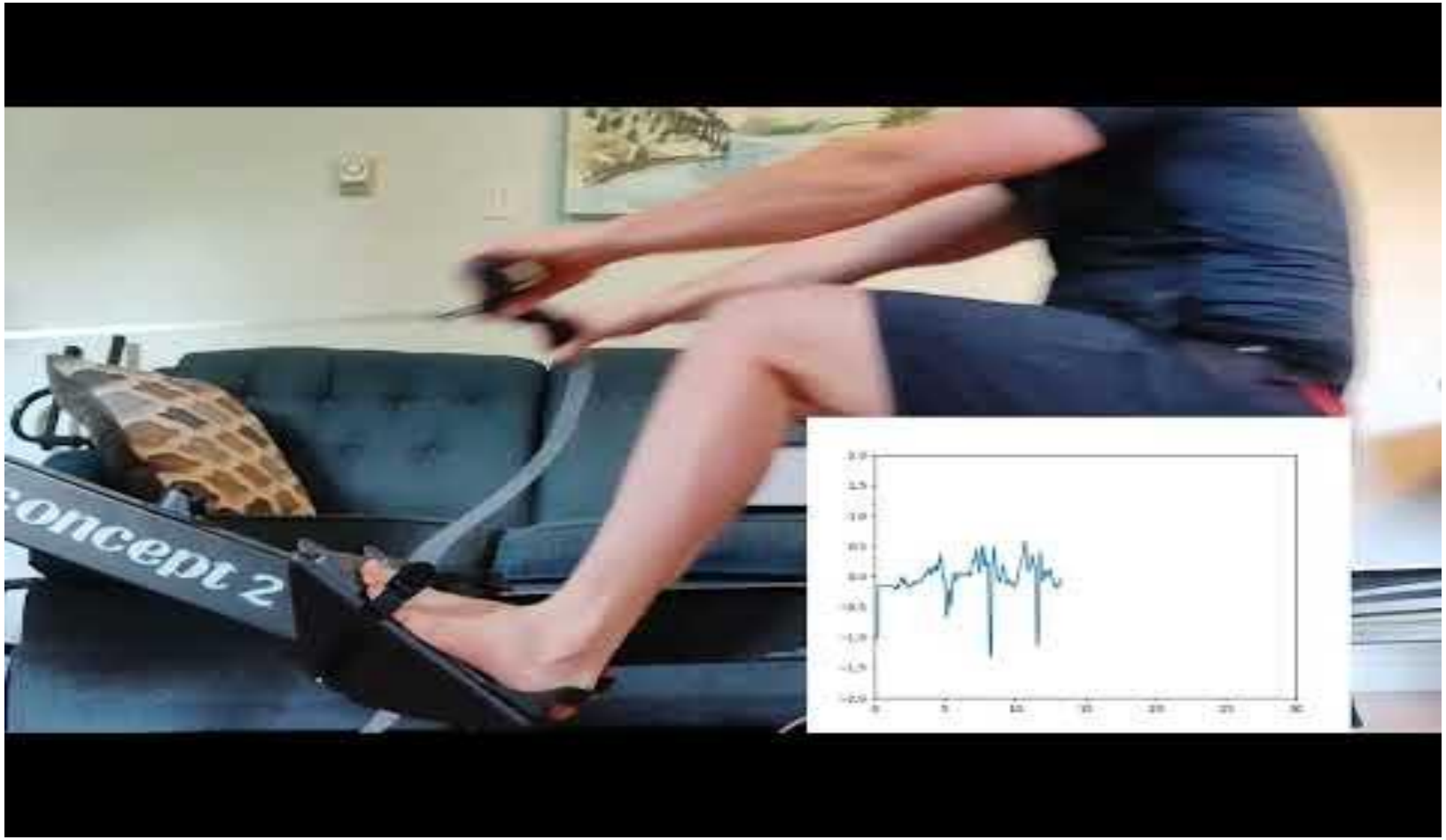


Arduino mounted to Ergometer Handle



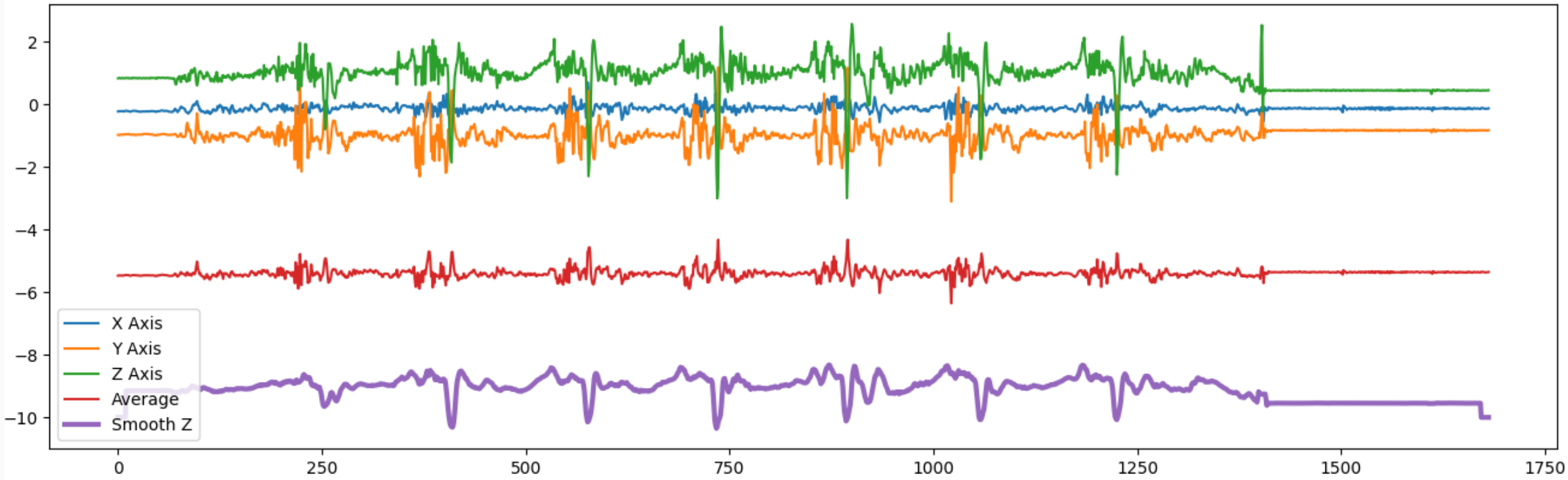
Z-axis is normal to the Arduino.

Demo & Results



Video + Data Visualization

Demo & Results



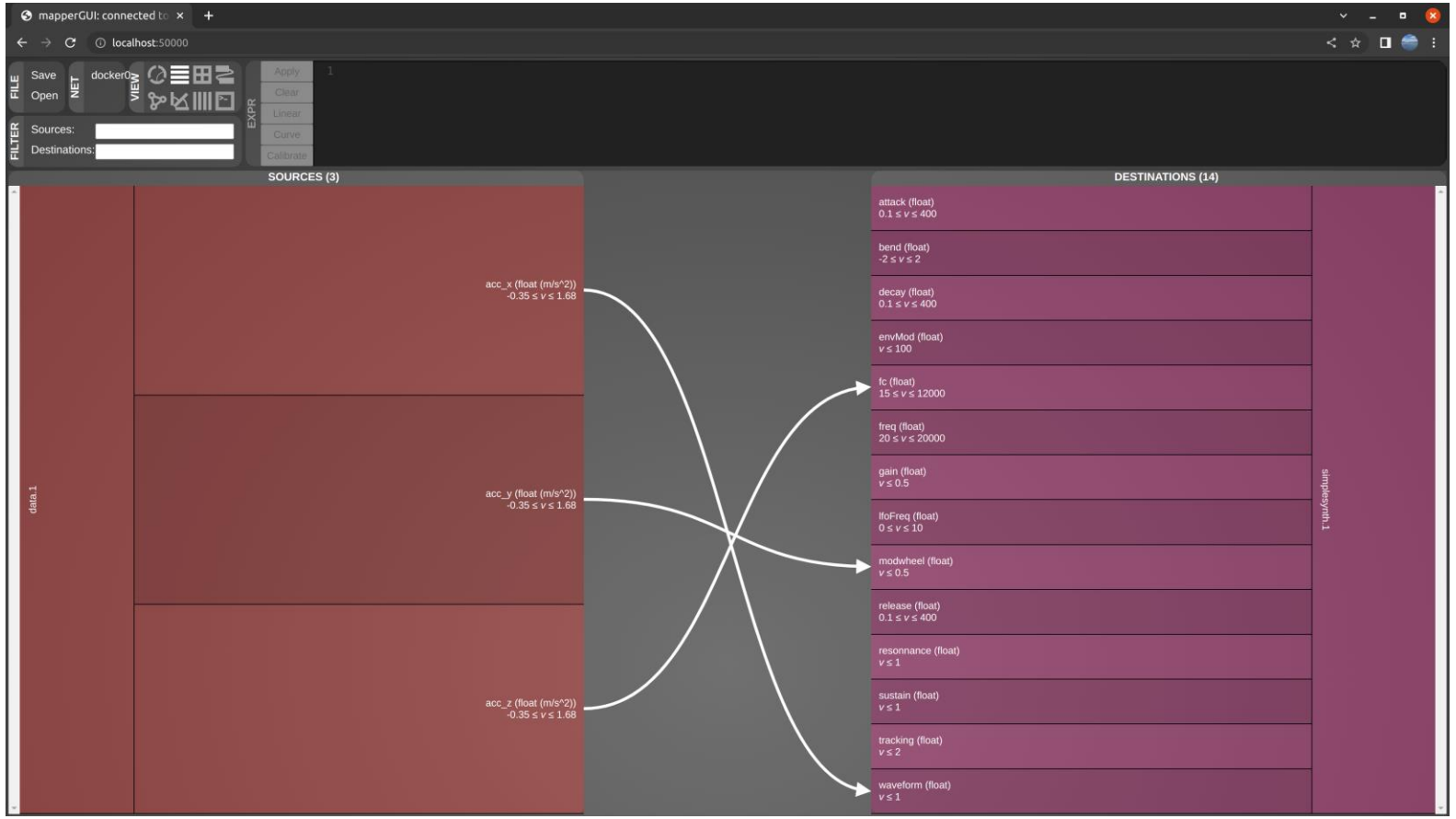
Accelerometer Data Visualized (Ergometer Trial)

Demo & Results

What to do with this data?

1. Map each axis to a different synthesis parameter [2].
2. Map average to a single synthesis parameter.
3. Map average to a gate trigger.

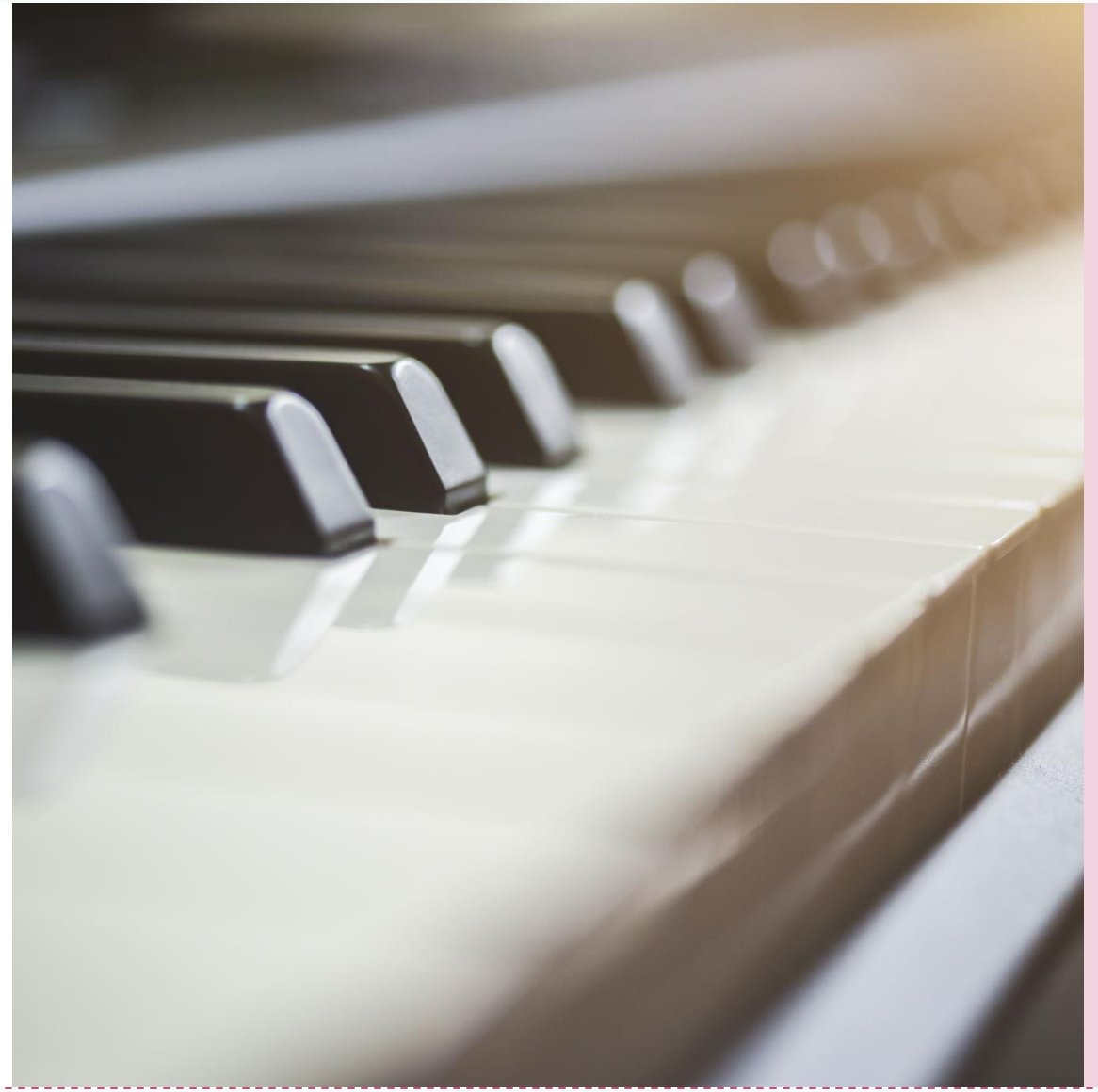
Demo & Results



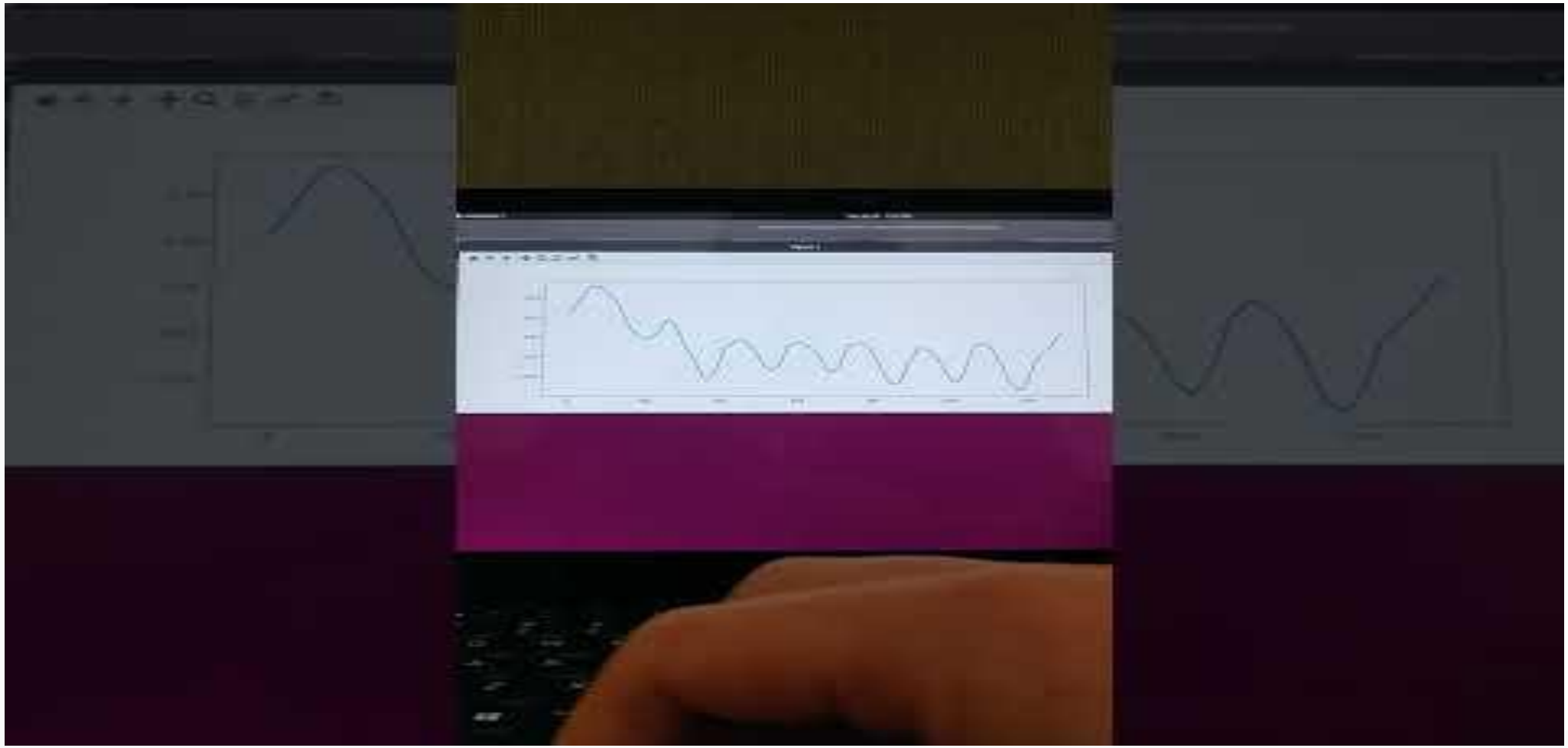
Accelerometer Data mapped to Synthesizer parameters (via webmapper).

Live Demo

Time for a live demo (scary!)



Demo & Results



Demo & Results

Sounds are medium-decent, not amazing …. why?

- data capture?
- mapping choices?
- Too much happening?

How to improve?

- More data pre-processing?
- Better mappings?

Challenges & Lessons Learned

This project faced many roadblocks:

- Broken SD card reader.
- No 9V battery support.
- No USB power-bank support.
- Data Synchronization.
- Lack of effective enclosure.

Lessons Learned:

- Add time for hardware bugs.
- Imagination is not as important as execution.

Conclusion

Sonification is an interesting field of HCI. Applying sonification to sporting activities is not new, but is an interesting field. How does activity type determine sonification choices?

Future Work

- More sports!
- More mappings!
- Wireless operation / real-time playback.

- **Study**: Do musicians have aesthetic choices based on activity choice? Do athletes? Are they the same?

References

[1]: Grond, Florian, and Thomas Hermann. "Aesthetic strategies in sonification." AI & society 27.2 (2012): 213-222.

[2]: Fox, Jesse and Jennifer Carlile. “SoniMime: Movement Sonification for Real-Time Timbre Shaping.” NIME (2005).

Additional references included with report.