PixelPiano

The interactive virtual piano

Creative Programming and Computing

GROUP 4

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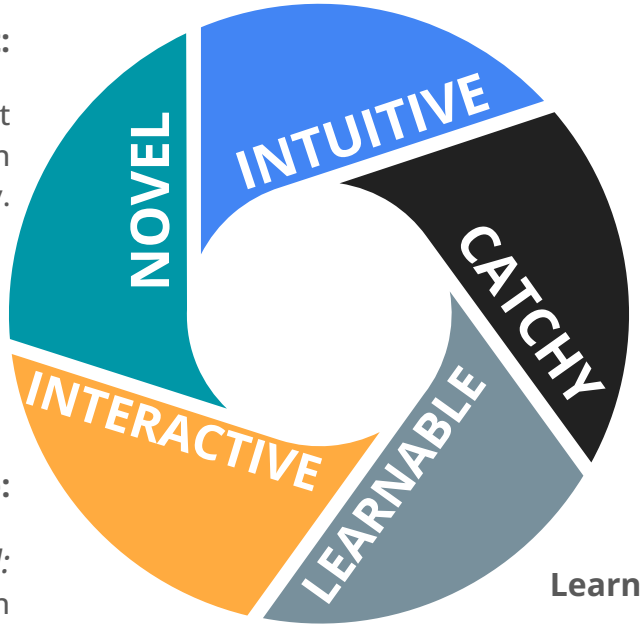
Context and Concept: *Novel Musical Instrument*

Intuitive:

Being the instrument based on a classic instrument, the user can intuitively use it from the first moment.

Novel Piano Instrument:

Revisitation of the best known musical instrument in modern key.



Catchy:

Multiple factors induce curiosity about the instrument and different modes provide entertainment for the user.

Interactive:

Fully-fledged conversational model: The user prompts the instrument, which produces sounds as well as informations in return.

Learning curve:

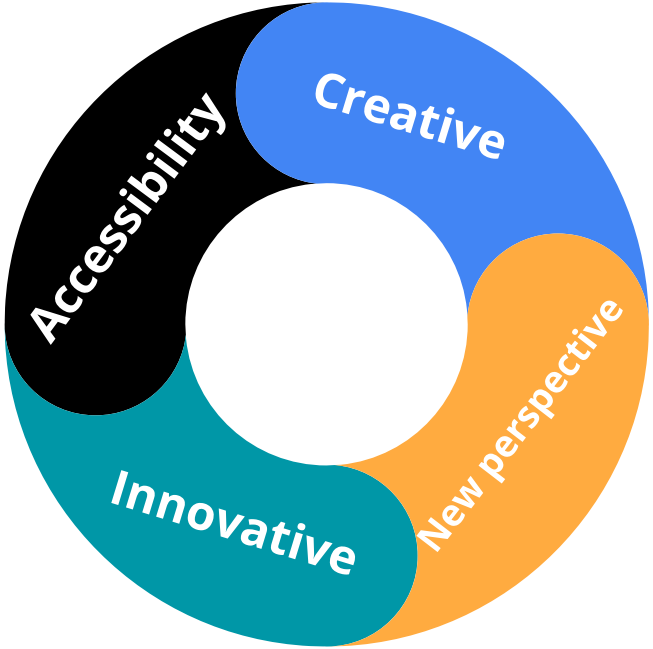
The user should practice the instrument in order to become more proficient and develop its skills.

Project Motivation

Motivation

Accessibility: playing the piano without the physical instrument both for novices and experienced players

Innovative learning: interactive and fresh tool for educational purposes



Creative expression: encouraging new forms of musical creativity and experimentation

New perspective: without moving far from the original physical instrument.

Project Structure

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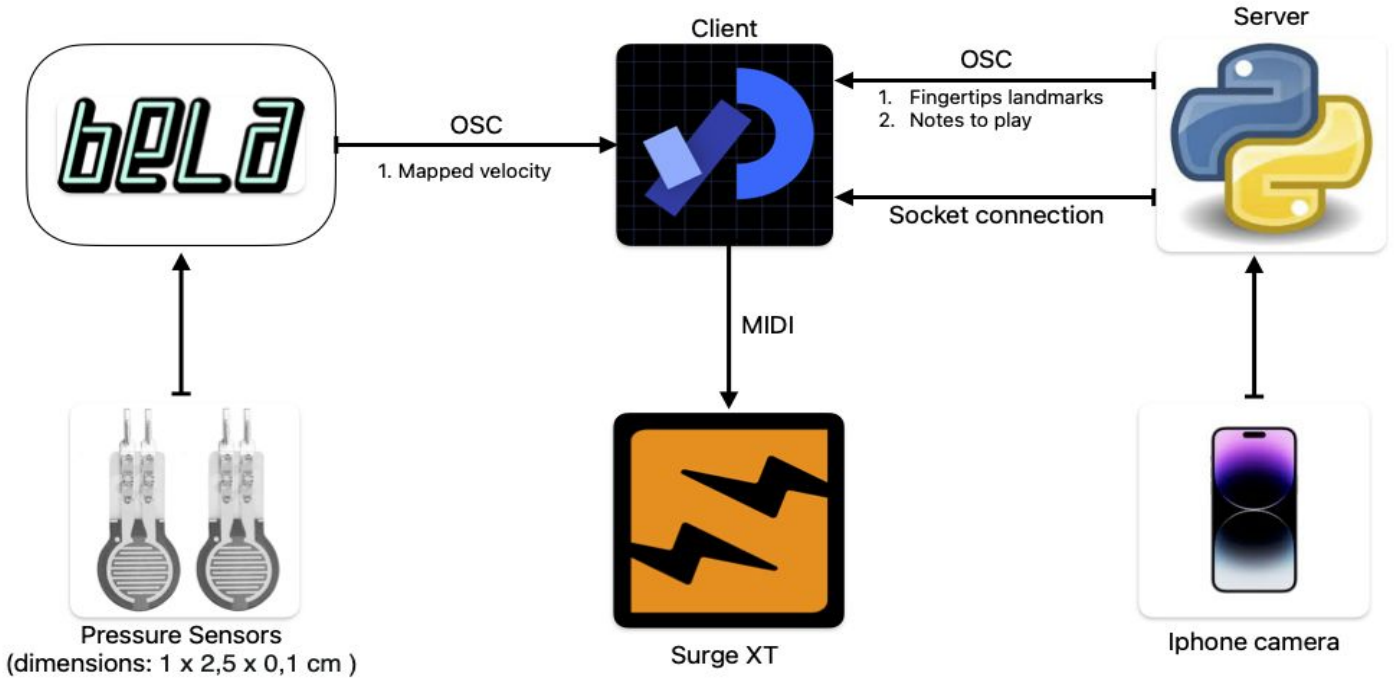
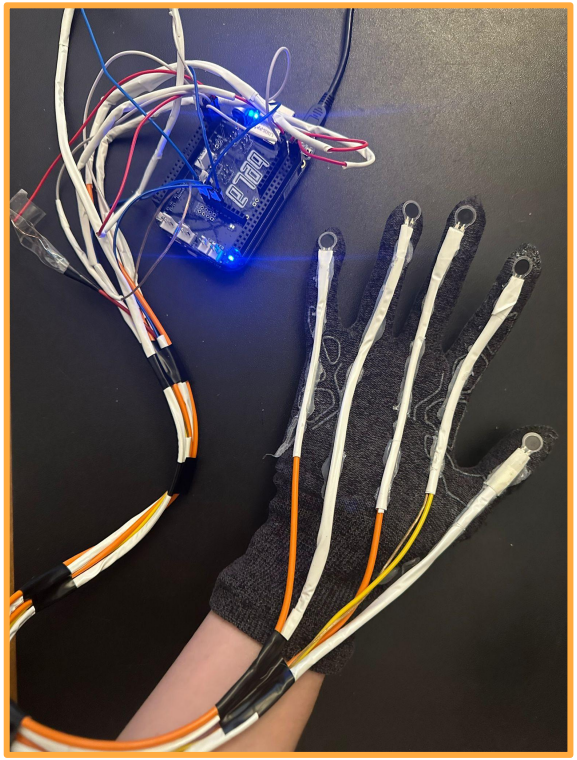


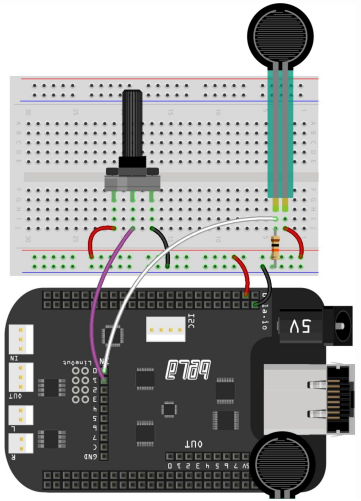
Python - MediaPipe

- **MediaPipe *hand landmarks*:** track hand movements with precision.
- Python maps the fingertips' **coordinates into MIDI** notes based on their position.
- **OSC messages:** send the necessary informations for the visuals in real time to Processing.
- **TCP Socket:** python server streams the camera video.

Bela - Pressure Sensor

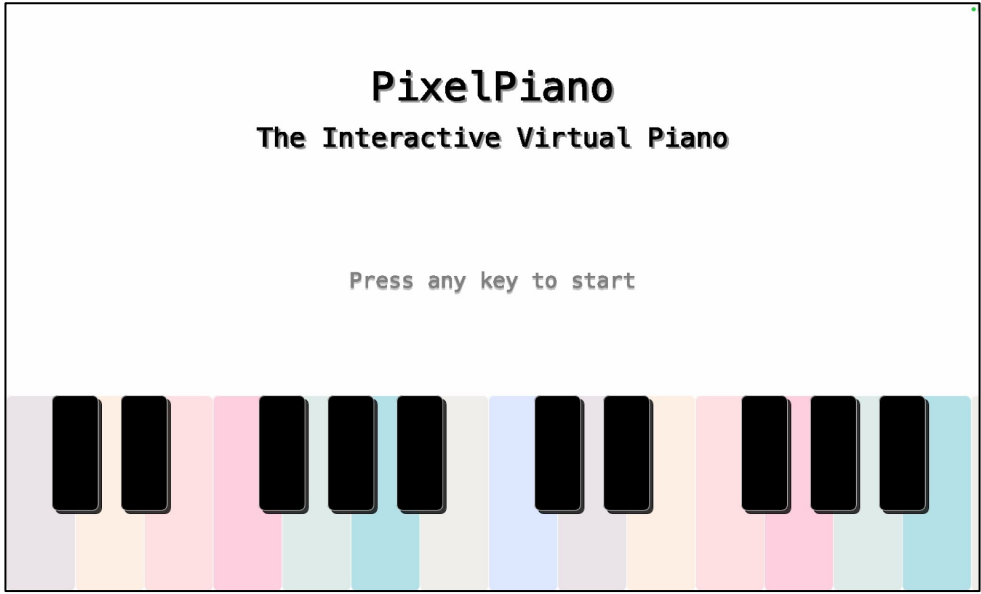
- **Pressure sensors** attached to the glove detect pressure and determine whenever to **play notes.**
- **C++** code executed on the Bela processes the received data.
- **OSC messages** are sent to Processing.





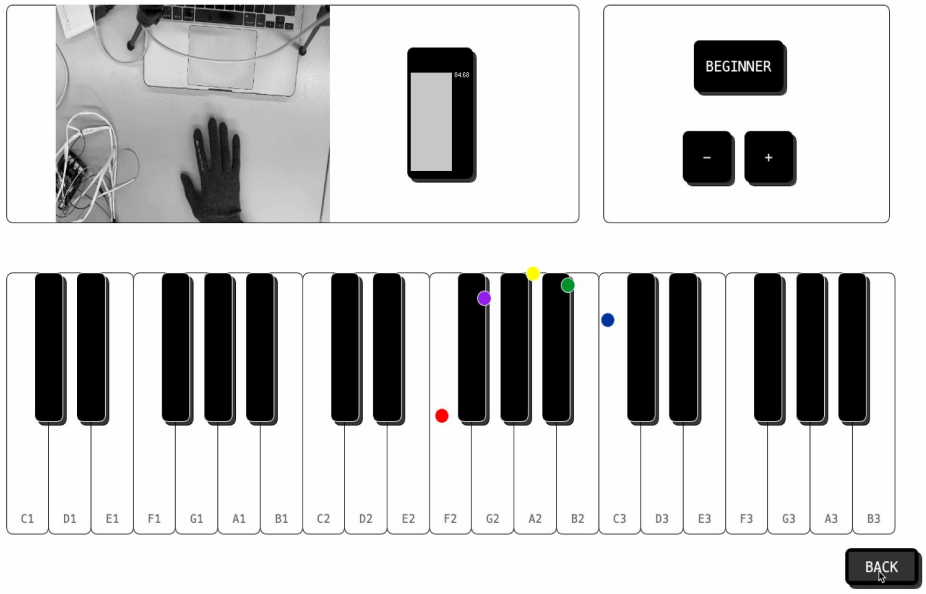
Processing - Application

- **Multi-Page** application.
- **Efficient** implementation: only current page is rendered.
- **Scalable** implementation: thanks to a modular architecture, adding new pages and feature is easy and sustainable.
- Features a **welcome** page, a **mode selection** page and **two** different **playing pages**.



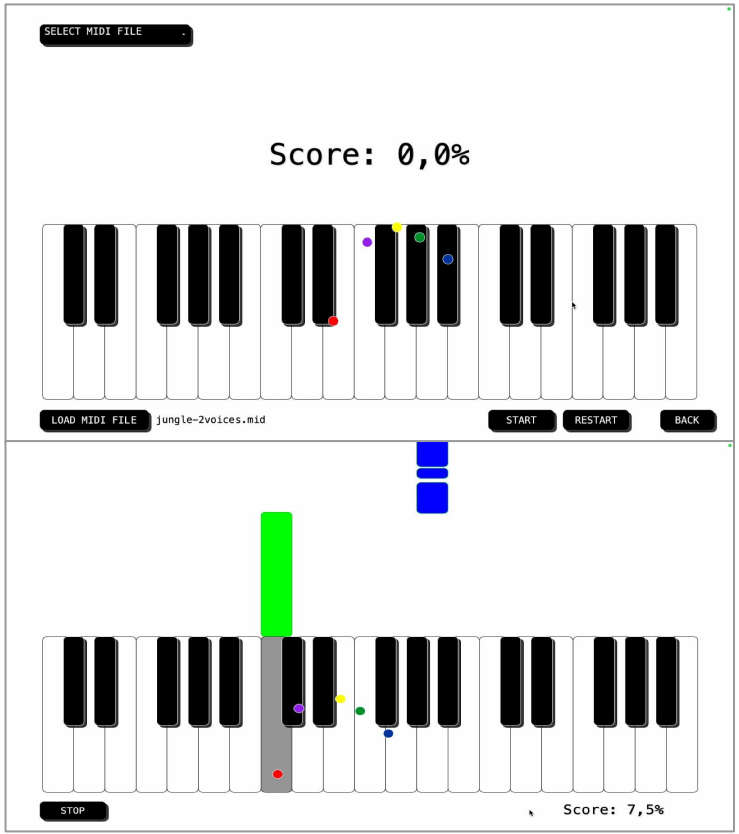
Processing - Playing

- Receives landmarks positions sent by OSC messages from python.
- Receives pressure sensors' positions sent by serial messages from Bela.
- Determines the **notes to play** using the informations received from Bela and python.
- The camera video stream from python is received by a socket client and displayed.



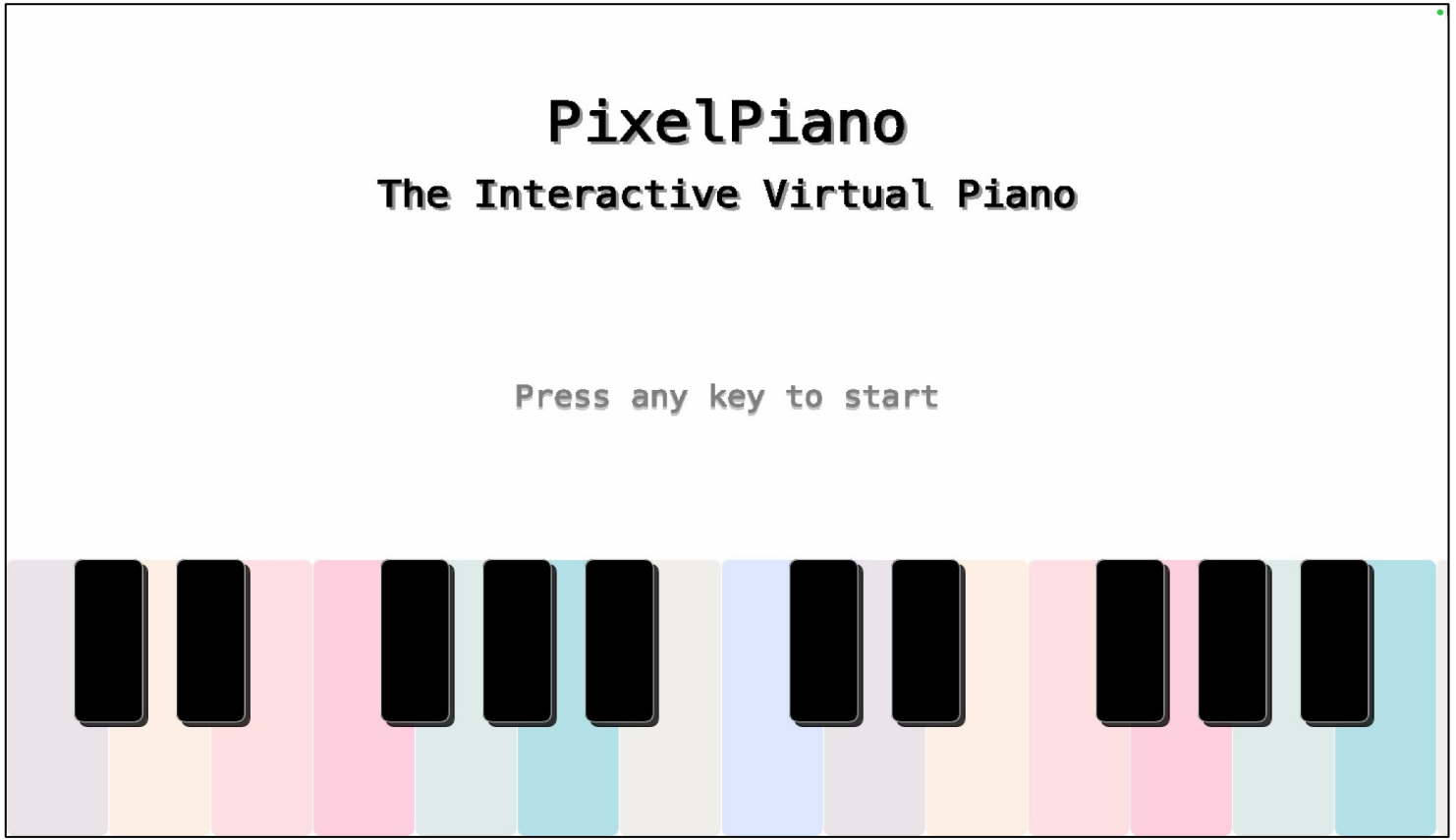
Processing - PianoHero

- Implements a novel **play-along** feature.
- **Selects, loads and reproduces MIDI** files using javax.sound.midi library.
- Displays a **graphical representation** of the notes playing in the MIDI file.
- Shows whether the note played is correct or not and keep track of the percentage **score** of correct note played so far.

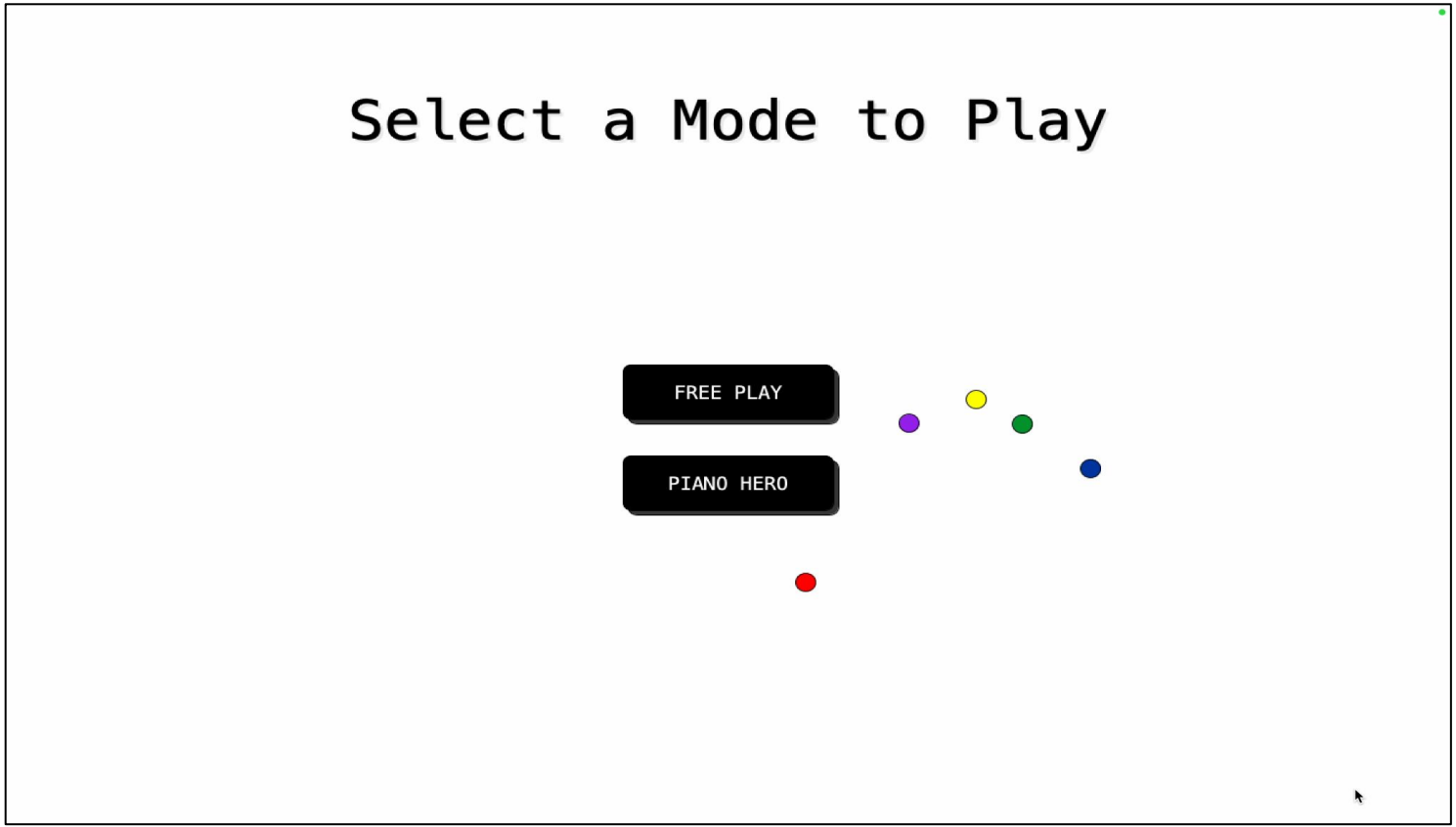


Graphical User Interface (GUI)

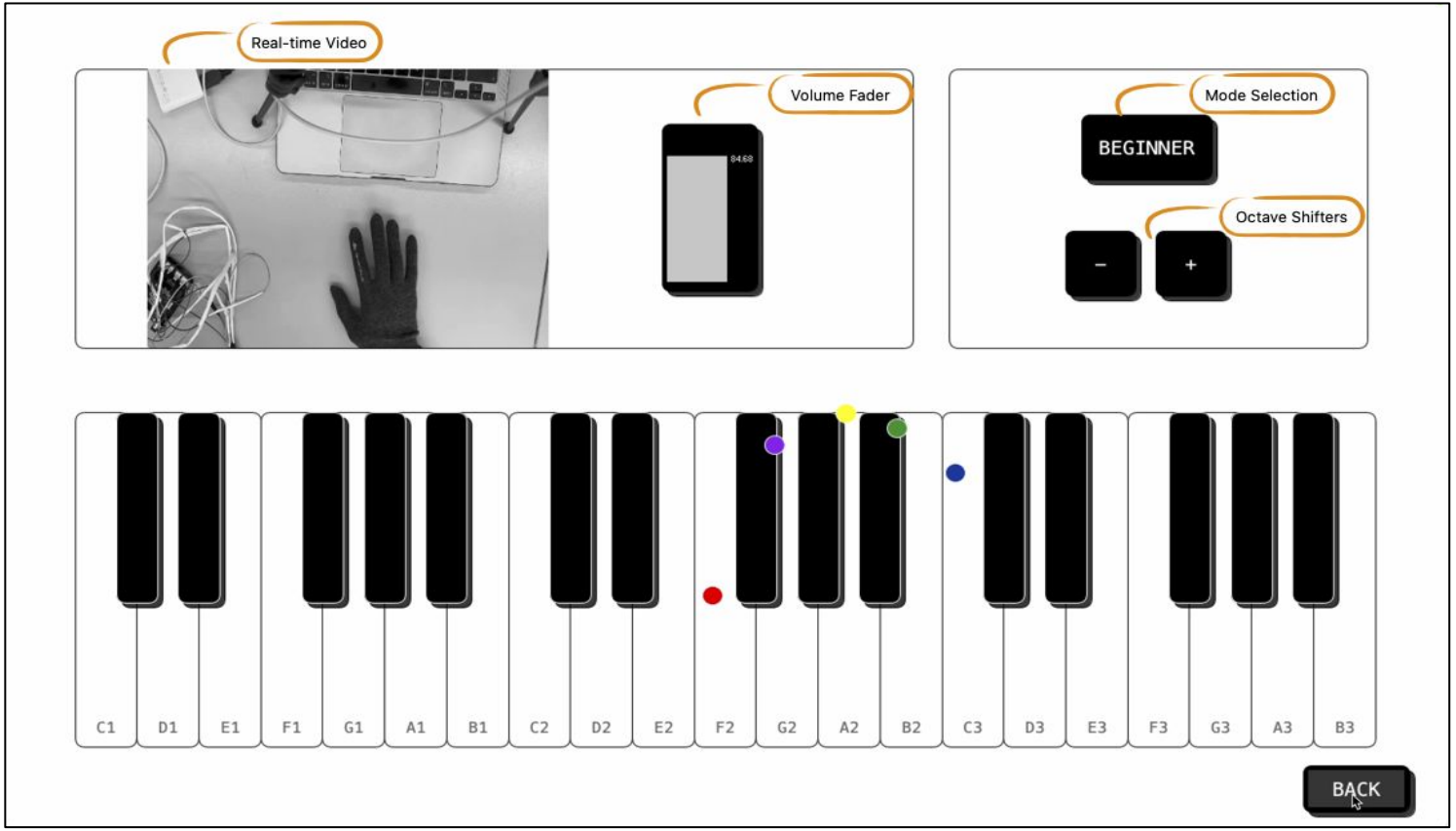
Starting Page



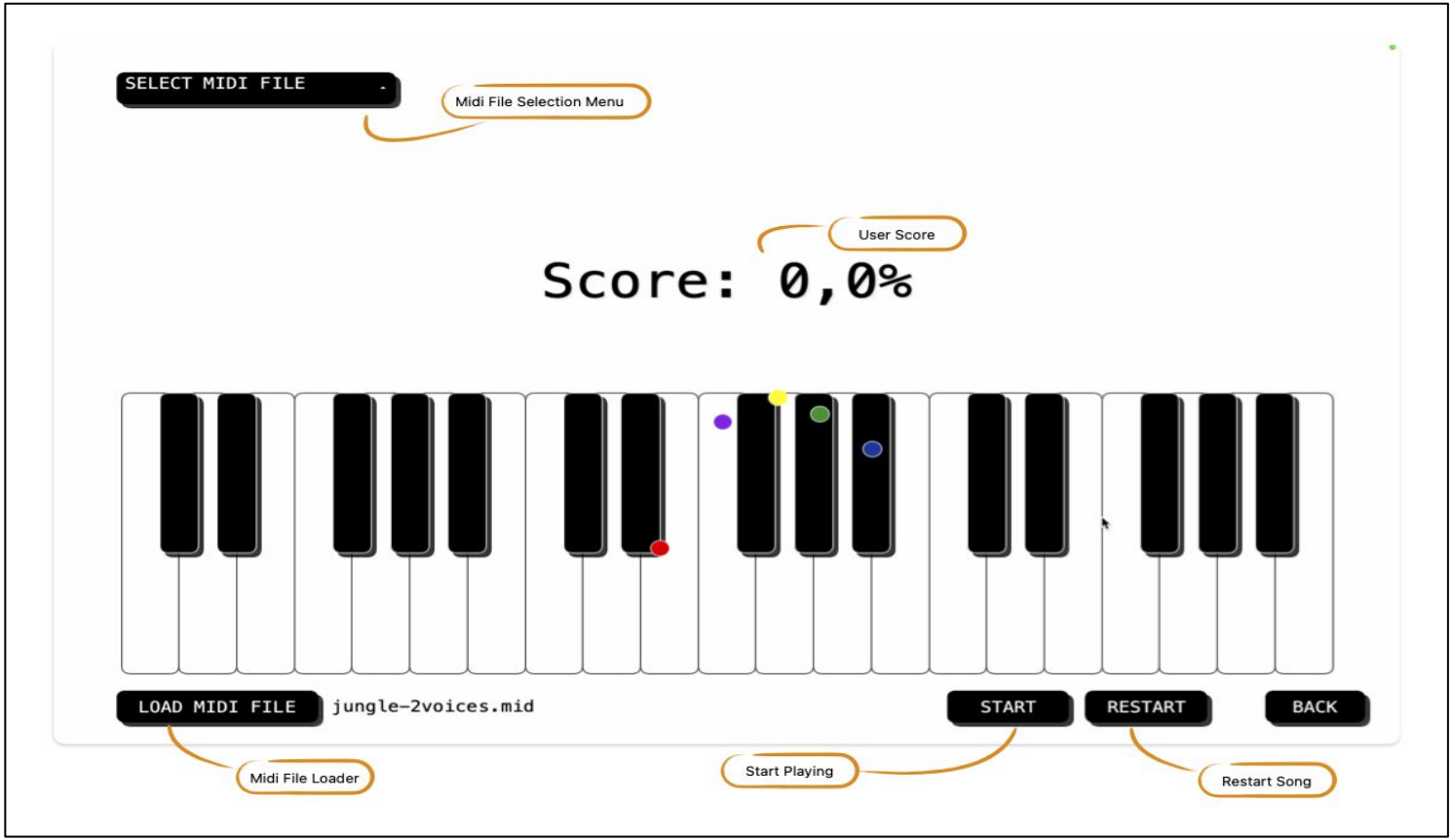
Mode Selection Page



Free Play Page



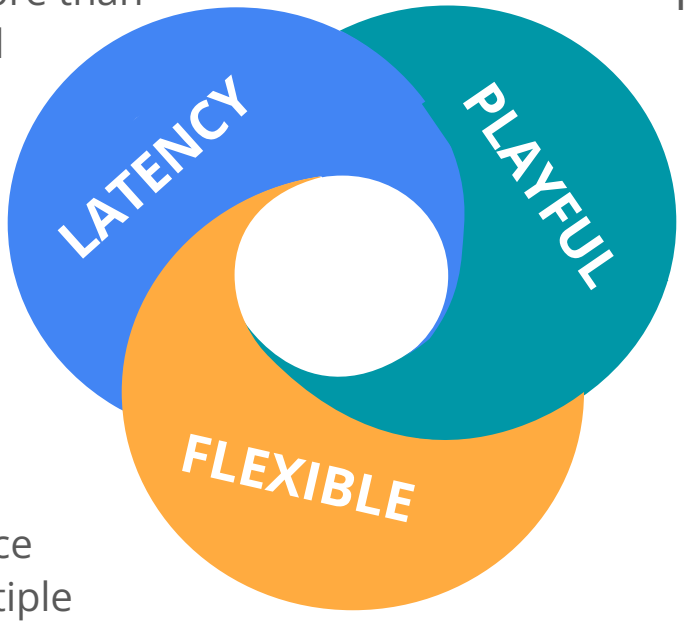
Piano Hero Page



Final Considerations

Results

The latency is more than **satisfactory** and allows for **fun** playing.



The playing feeling is easy from the start and the glove with the sensor is user-friendly, suitable and comfortable.

The virtual interface lends itself to multiple uses and its MIDI output can be connected to any virtual instrument.

Future Works

Future Works

POLITECNICO
MILANO 1863

M.S. Music and Acoustic Engineering

- Bela Wearable Kit
- Glove 2.0
- Notes Velocities
- User Evaluation

Thank you for your time and attention