KeylessPiano

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Project Overview

Problem to solve:

Traditional piano learning can be intimidating and dull, deterring beginners.

Goal:

- Transform piano learning into an exciting, accessible experience with Cozmo.

- Utilize gesture-based controls to simplify the learning process, allowing anyone to start without prior musical knowledge and engage users with interactive, real-time feedback.

Approach

Leveraging advanced computer vision and real-time audio processing to create a dynamic virtual piano experience on Cozmo.

- **Computer Vision:** Utilize OpenCV and MediaPipe to detect and interpret hand landmarks.

- **Gesture Mapping:** Each finger corresponds to specific piano key.

- **Sound Synthesis:** Integrate Pygame to generate and mix piano sounds in real-time as fingers press virtual keys.

- **Dynamic Interaction:** Implement real-time hand tracking to keep the user's hand centered by adjusting Cozmo's orientation and hand angle.
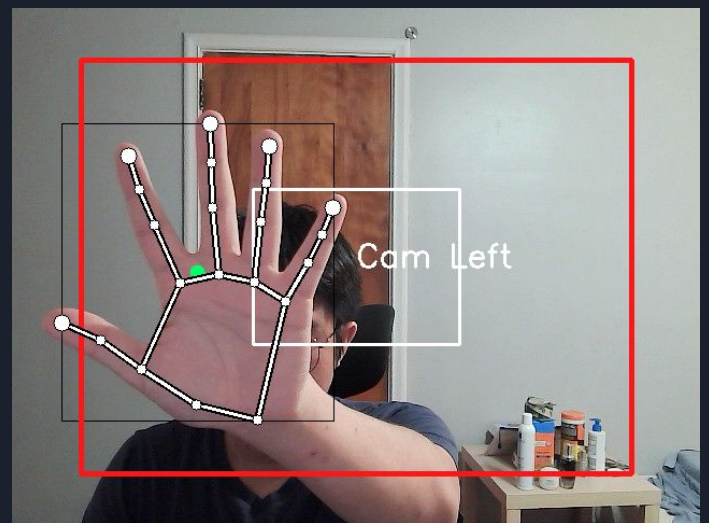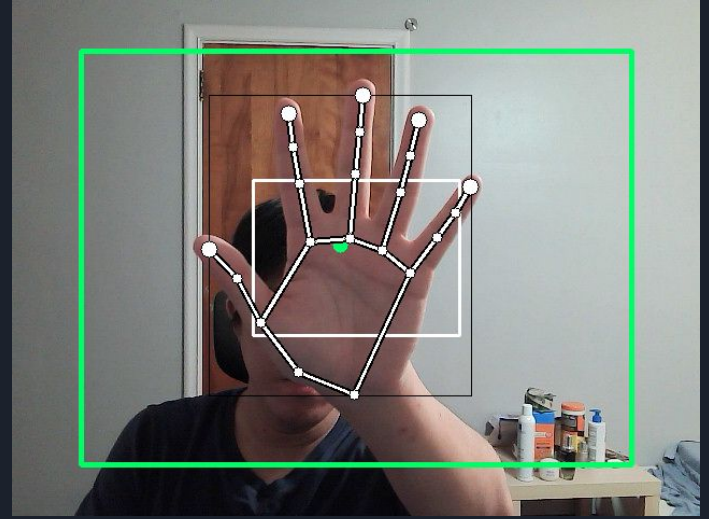
Hand Recognition

- Utilized MediaPipe model to recognize hand and figure out the position of each hand landmark.

- I set up thresholds for each finger to compute which fingers are pressed down.
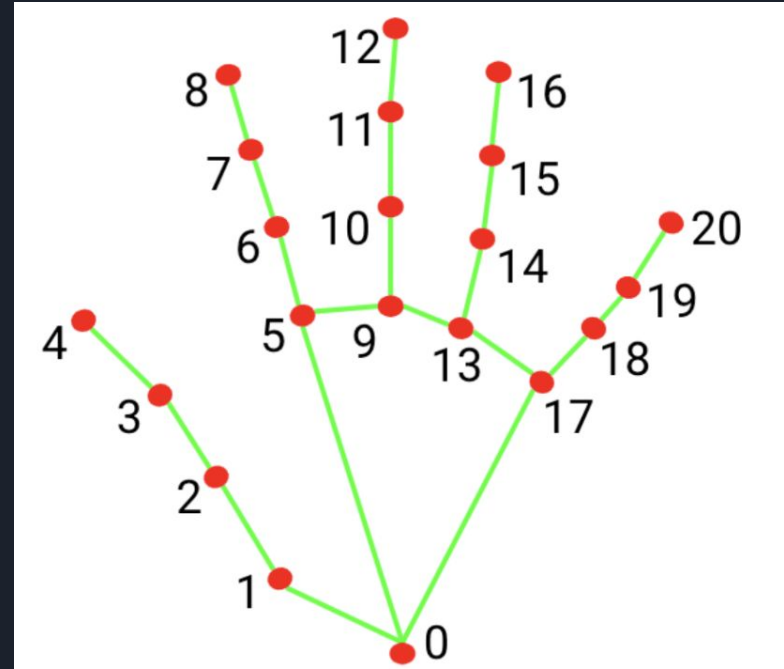
Dynamic Hand Tracking

When the detected hand is not on the center of camera view, Cozmo will turn itself or adjust its head angle to keep the hand on the center of view.

Result

Work:

- Hand Recognition
- Detect which finger pressed
- Hand Tracking and auto centered
- Play sound, with capability of mix multiple keys together.

Not Work:

- I want to use Cozmo's speaker to play the sound, but it's not able to mix multiple keys together.

Demo: https://drive.google.com/file/d/1IjKFksGwSB8OfJ3CJj1j3biAJZQ0icB2/view?usp=sharing

Future Work

- Integrate GPT4 and voice recognition capabilities. The user can play a song and ask Cozmo "Do you like this song?" or so on.

- Add ability to play more piano keys, such as draw the keyboard on camera view and play related sound when press the keys.

- Add capability of playing different kinds of instruments.