**Robotic Arm Simulation with Hand Gesture Control**

**Description**

This project is a simulation of a robotic arm controlled by hand gestures using OpenCV and MediaPipe in Python, and rendered using Processing.

The simulation shows a robotic arm in a 3D environment. The arm can move and detect if it's touching a cube in the scene. Movements and interactions are controlled by hand gestures detected through a webcam.

**Features**

* **3D Rendering**: Utilizes Processing with OpenGL for rendering 3D shapes.
* **Inverse Kinematics (IK)**: Computes the position and orientation of the robotic arm.
* **Client-Server Communication**: Receives hand gesture data from a Python client via TCP/IP.
* **Gesture Detection**: Employs OpenCV and MediaPipe to detect hand gestures, such as "thumb up" and "thumb down".

**Installation**

**Prerequisites**

* [Processing](https://processing.org/download/)
* [Python 3](https://www.python.org/downloads/)
* Python packages: **opencv-python**, **mediapipe**, **numpy**

**Clone the Repository**

git clone https://github.com/your-username/your-repository.git cd your-repository

**Python Setup**

Install the necessary Python packages:

pip install opencv-python mediapipe numpy

**Usage**

**Running the Python Client**

Open a terminal and navigate to the project directory.

Run the Python script:

bash

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python hand\_detector.py

This script initializes the webcam and starts detecting hand gestures.

**Running the Processing Sketch**

1. Open Processing.
2. Open the **robotic\_arm.pde** file in Processing.
3. Run the sketch.

**Controls**

* **Mouse Drag**: Rotate the camera view in the Processing window.
* **Hand Gestures**: Use gestures like "thumb up" and "thumb down" to control the z-position of the robotic arm.

**Acknowledgments**

* OpenCV
* MediaPipe
* Processing