

# Robotic Arm

## Team Members

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# Overview

This project integrates computer vision, machine learning, and robotics to create a system that combines real-time image processing, gesture recognition, serial communication, and precise robotic control to achieve seamless translation of visual inputs into physical outputs.

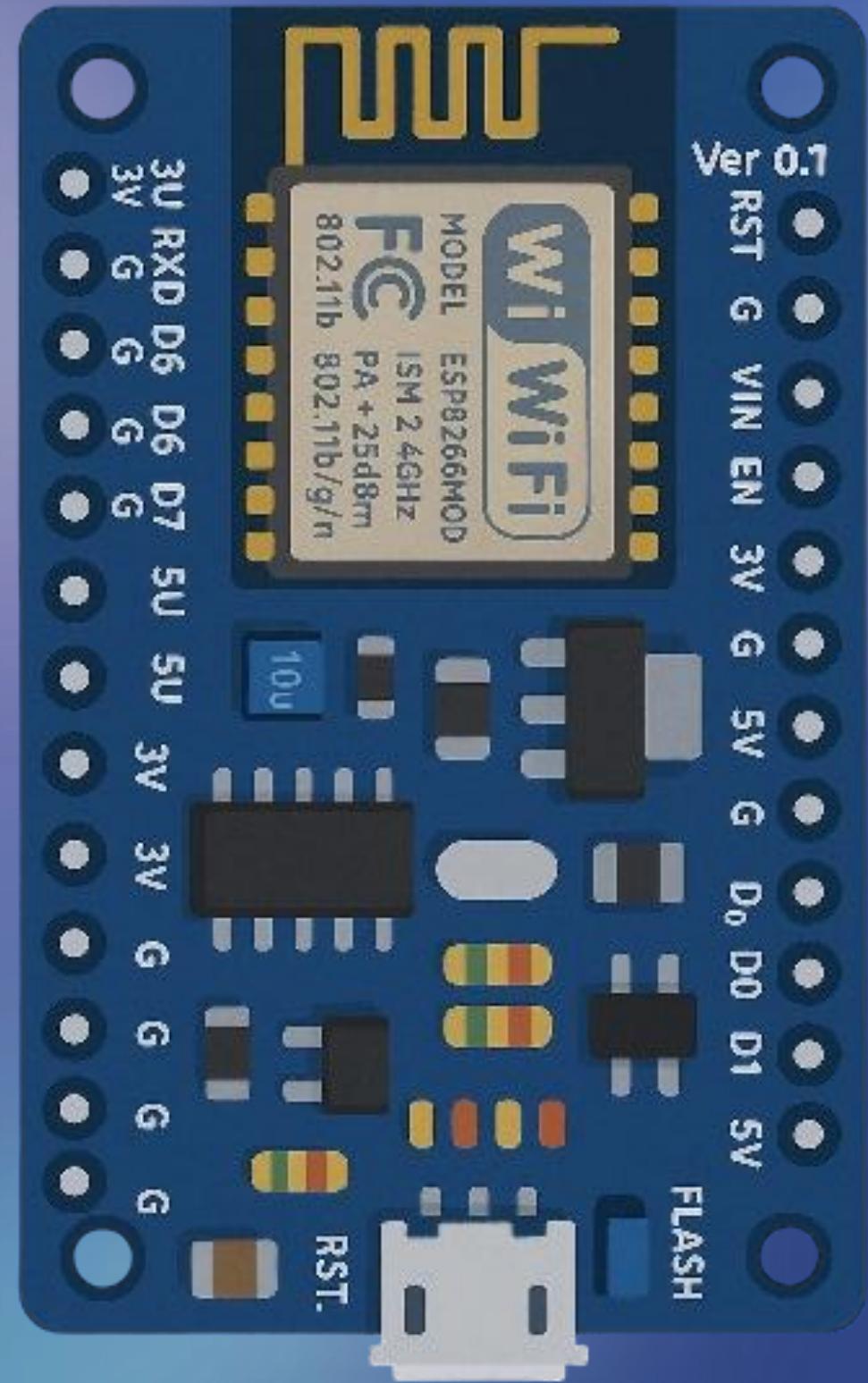


## components used

- 7 Servo Motors
- Arduino UNO
- ESP8266
- bread boards
- 3 batteries (3.7v each)
- Wires
- Buck Adapter
- LCD I2C

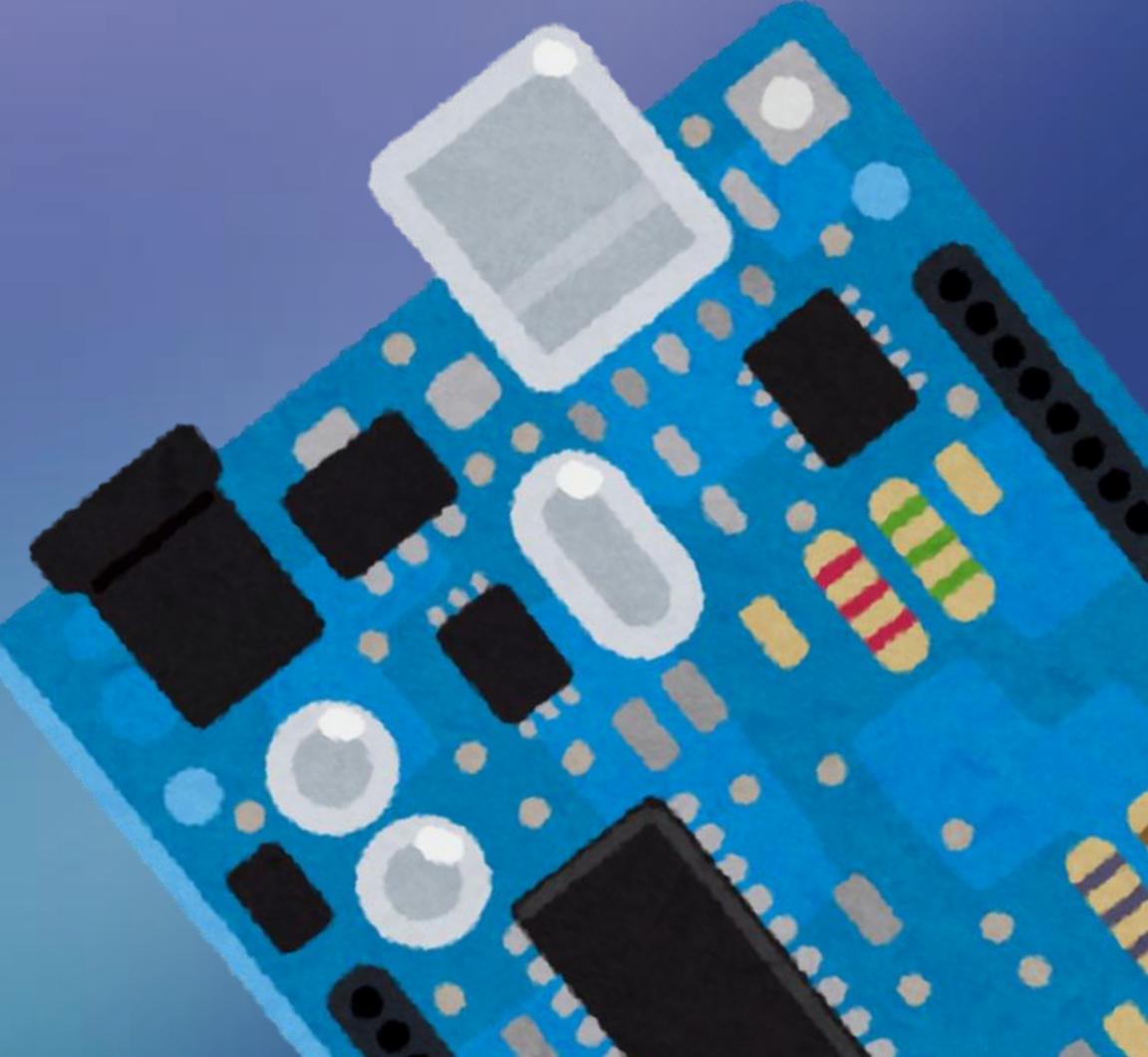
# ESP8266

The ESP uses WebSocket Protocol to receive data from another device wirelessly (e.g., a cell phone or computer) over the network and sends it to the Arduino.



# Arduino Uno

- The Arduino receives input data from the ESP module via Serial
- It processes the received data to translate the gesture to the matching letter.
- Based on the input, it sends precise control signals to the corresponding servo motor in the Robotic Arm.
- Each servo controls a specific finger of the robot arm, enabling coordinated movement.



# Servo Motors

In the robotic arm, servo motors are pivotal for mimicking hand gestures, with each servo dedicated to controlling one finger. Each motor precisely adjusts the angle of its corresponding finger, enabling the arm to replicate specific letter gestures



# Batteries and Adapters

The robotic arm's power system is driven by 3.7V batteries and a buck adapter to ensure reliable operation. These 3.7V batteries supply power to the servo motors and Arduino, providing the necessary energy for consistent gesture execution.

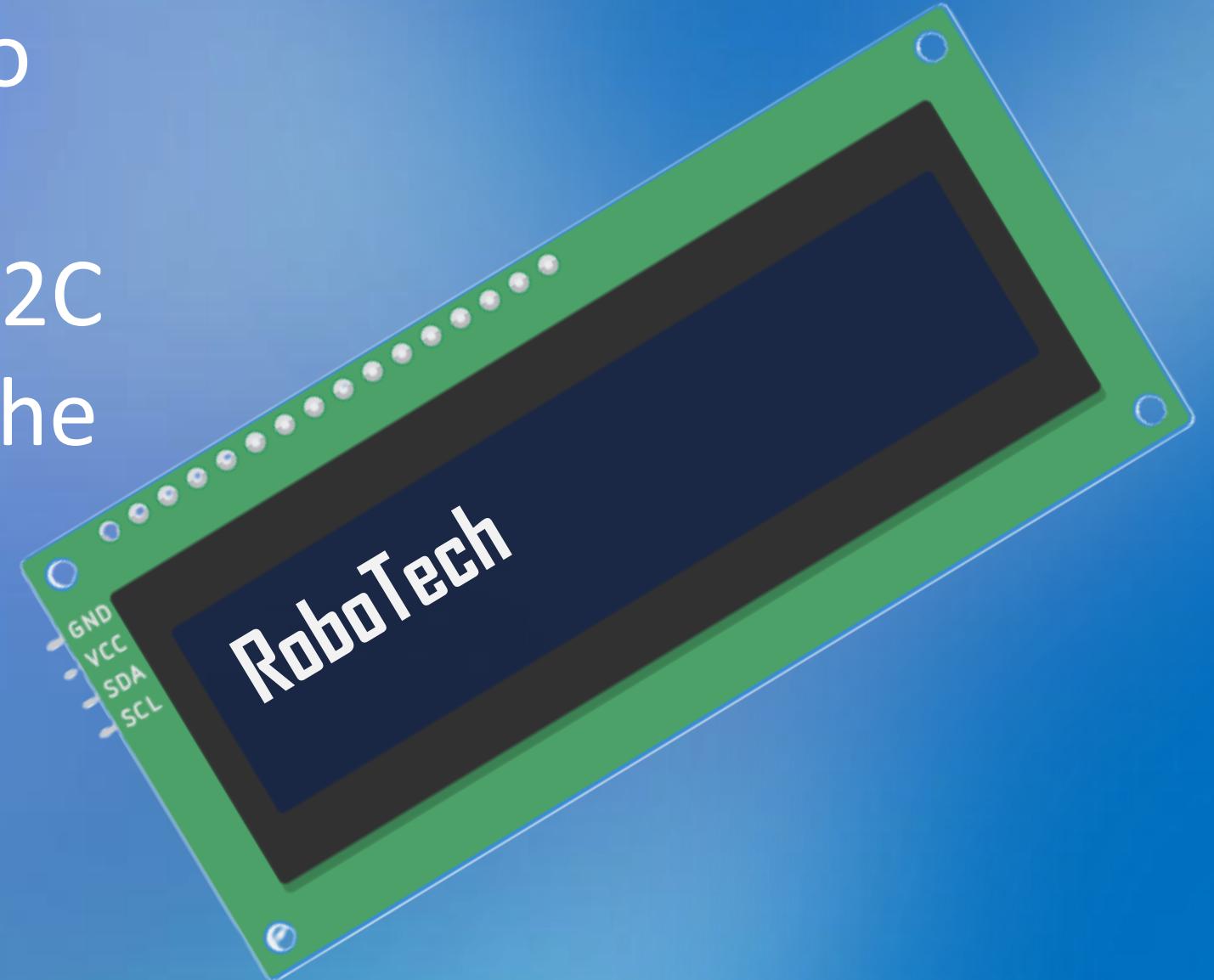
A buck adapter regulates the battery voltage as required by the Arduino and servos, protecting components from voltage fluctuations.

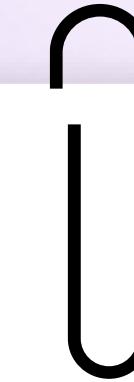
This configuration guarantees steady power delivery, supporting the arm's precise movements during gesture translation without interruptions.



# LCD I2C

The system incorporates an LCD I2C module to provide real-time feedback and enhance user interaction. This 16x2 LCD, interfaced via the I2C protocol, displays the recognized letter from the gesture recognition process, as well as the robotic arm's status, such as "Gesture: A". This display offers a clear, immediate visual confirmation of the system's operation, improving usability and debugging during gesture translation.





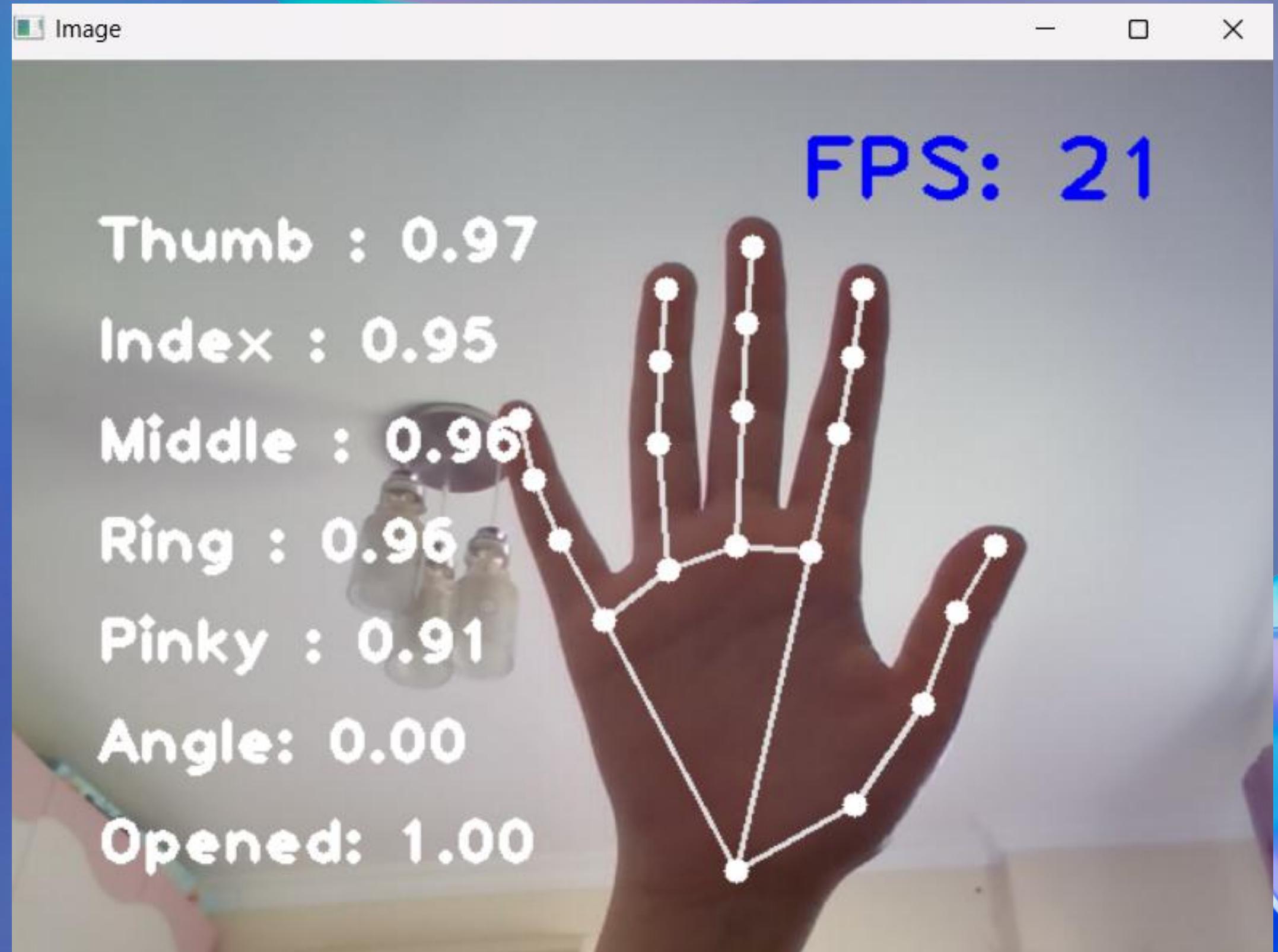
## Computer Vision libraries :

- **OpenCV (cv2)**

- is an Open-source computer vision library used here for capturing video frames, image processing and displaying results.

- **MediaPipe**

- Is a framework, provides pre-built solutions for tasks like hand tracking, face detection, pose estimation, object detection, and more.



# Project Flow

1. Captures hand gestures using a webcam.
2. Processes and classifies gestures into corresponding letters (e.g., American Sign Language alphabet).
3. Sends the classified letter to an Arduino via serial communication.
4. Controls a robotic arm to mimic the gesture corresponding to the letter.
5. The letter is displayed on an LCD

The background features several abstract, organic shapes in shades of blue and purple. There are two large, thick, curved tubes on the left, one in a light lavender shade and another in a teal shade. On the right side, there is a large, circular, spiral shape resembling a thick ribbon or a cross-section of a tube, with a gradient from dark blue to light purple. Above it, a smaller, rounded, teardrop-like shape hangs. The overall aesthetic is soft and fluid.

Thank You ^^