SOP – Audio Recording with ESP32 Trigger (3 Tap Detection)

Title: SOP for Audio Recording and Tap Trigger Synchronization using ESP32/ Arduino UNO and Python.

Objective

To record 10 seconds of audio from a PC microphone while synchronizing with an ESP32 device that detects 3 taps and sends a completion signal via serial communication.

Hardware Required

- PC / Laptop
- ESP32/ Arduino UNO board
- USB data cable
- Microphone **(recommended to use wire Microphone)**

Software Required

- CH340 , CP21X USB to TTL driver
- Jupyter Notebook
- Python 3.x
- Required Python libraries:
  - pyserial
  - sounddevice
  - scipy

Install using:

➔ pip install pyserial sounddevice scipy

Serial Configuration

Port: COM7 (change if needed)

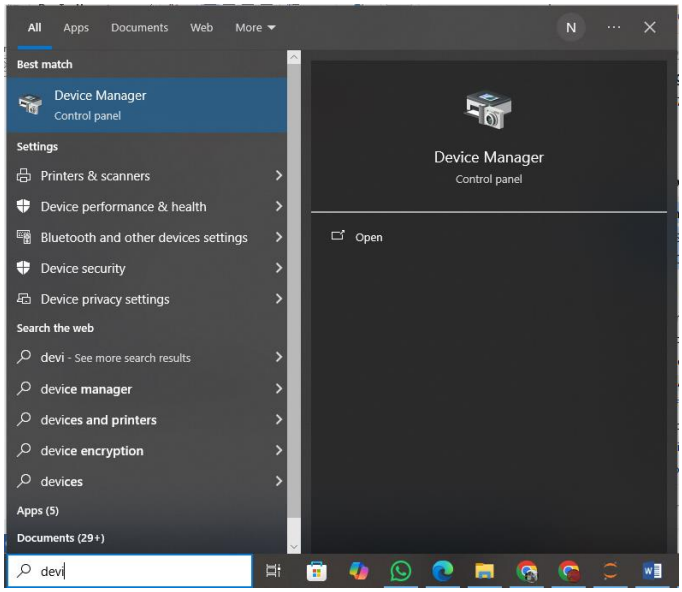
Baud rate: 115200

Timeout: 1 second

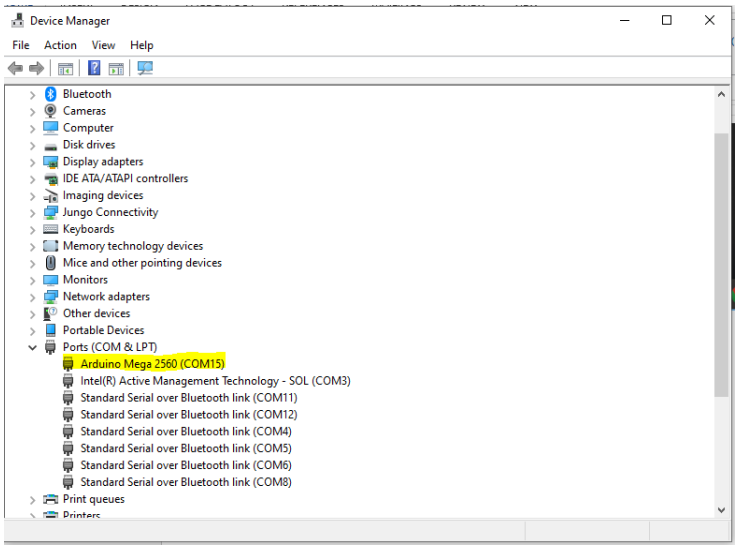
Procedure

Step 1 – Connect Hardware

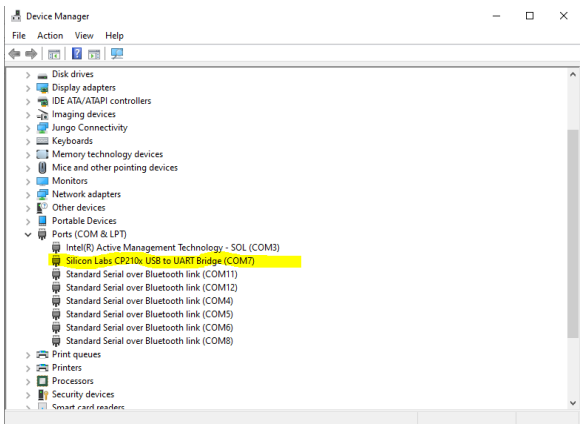
- Connect ESP32 to PC via USB.
- Confirm COM port in Device Manager



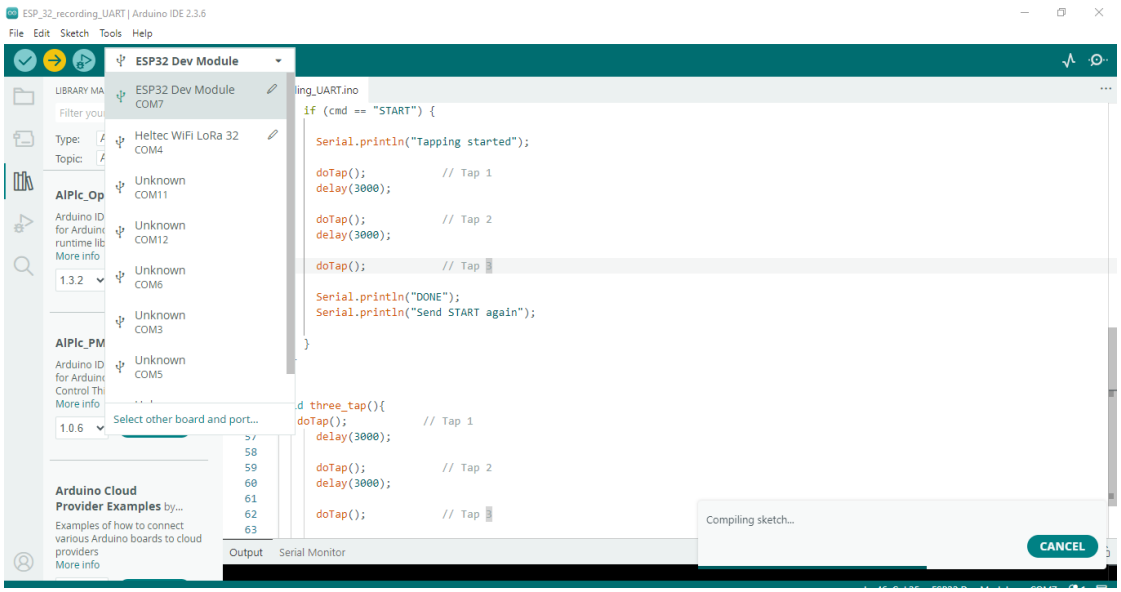
For Arduino



Esp32



Upload the Program in ESP32 dev OR Arduino



Servo Connection:

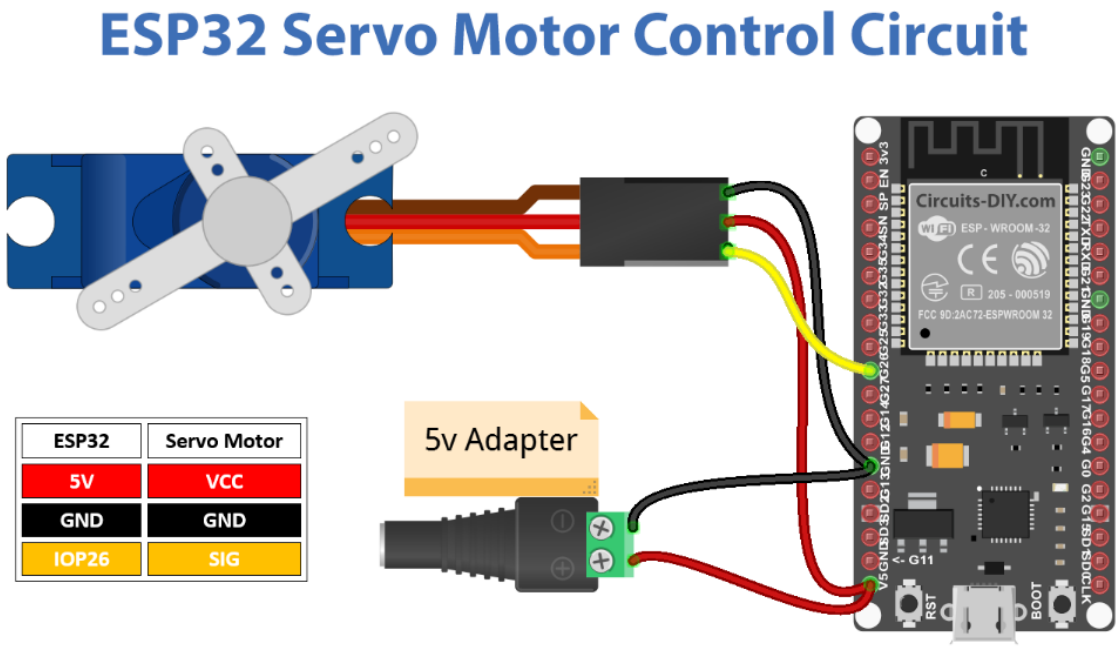


Fig.Esp32 Connection

** library ESP32 SERVO

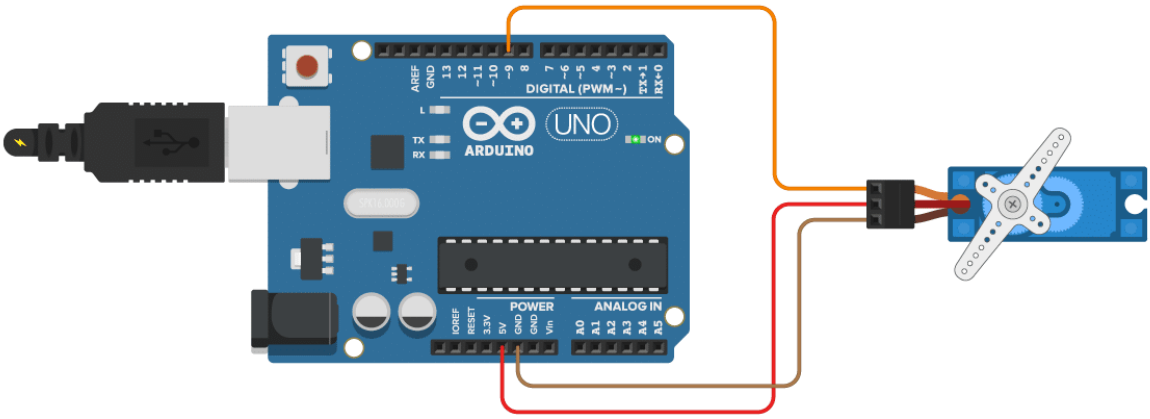


Fig. Arduino Hardware Connection

Library : SERVO

Step 2- Servo Motor Placement

- Mount the servo motor securely using a bracket or fixture.
- The servo tapping arm must be aligned **exactly at the geometric centre of the TV screen**.
- Ensure:
  - The tapping arm touches the screen perpendicularly.
  - The tapping force is consistent and controlled.
  - The servo is firmly fixed to prevent vibration shifting.

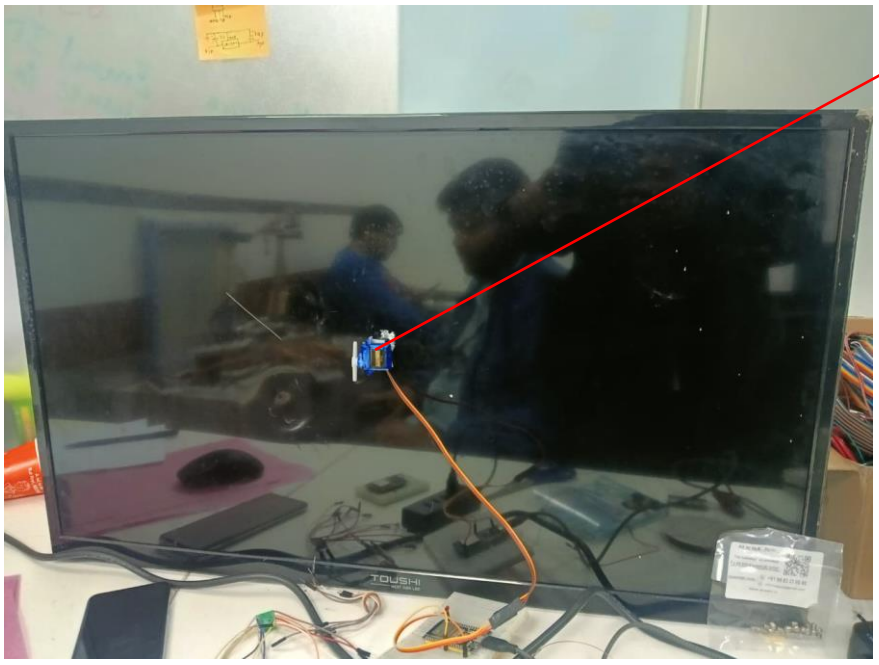


Fig. Servo Motor Placement

Microphone Placement

- Place the microphone **directly facing the centre of the TV screen**.
- Recommended distance: **30–50 mm from the screen centre**.
- Ensure:
  - No obstruction between microphone and tapping point.
  - Minimal ambient noise.
  - Microphone is placed at the same horizontal level as the tapping point.
  - Avoid contact with the TV or servo structure to prevent mechanical noise coupling.

Alignment Requirement

- Both **microphone and servo tapping point must be aligned to the exact center of the TV screen** to ensure consistent acoustic measurement.
- Maintain same placement for all test runs to ensure repeatability.

Step 3 – Run Python Script

- Script opens serial communication.
- Waits 2 seconds for ESP32 initialization.
- Starts 10-second microphone recording.
- Sends "START" command to ESP32.
- ESP32 performs tap detection.
- ESP32 sends completion message.
- Python waits for serial response.
- Audio recording completes.
- File is saved.

Step 4 – Output

- A WAV file is saved in project directory.
- File contains 10 seconds of recorded audio during tap event.

Safety & Precautions

- Do not apply excessive tapping force on TV screen.
- Ensure servo arm tip is padded (rubber or soft material).
- Maintain consistent placement across all tests.
- Avoid background noise during recording.

Expected Result

- Clear recording of 3 tap sounds.

- No clipping or distortion.
- Repeatable waveform characteristics.
- Unique timestamp-based file for each test run.