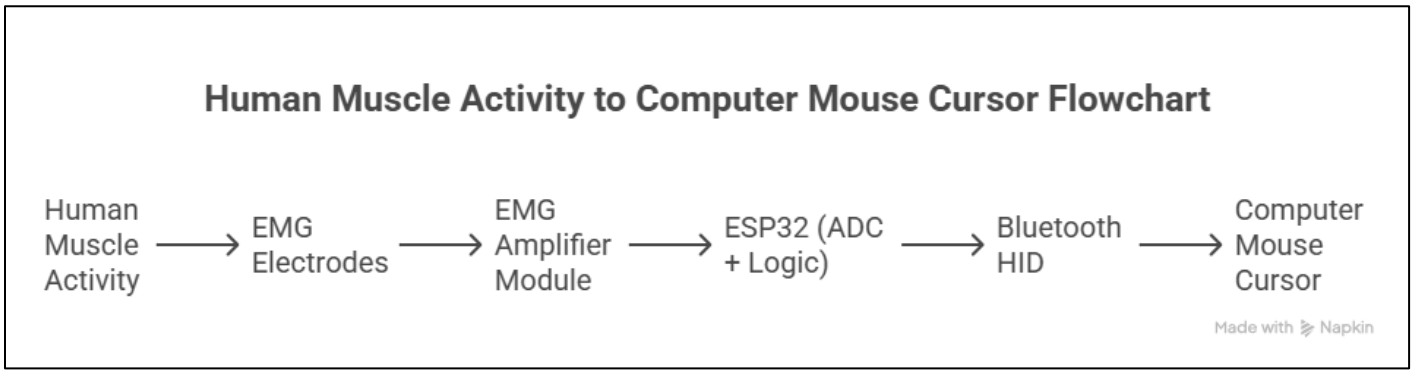
Neurovex

- **HANDS-FREE MOUSE CONTROL USING EMG & ESP32**

- **WHAT YOU ARE BUILDING (ONE-LINE)**
  A hands-free mouse system where facial muscle activity (blink / jaw movement) is detected using EMG electrodes, processed by ESP32, and sent to a computer as Bluetooth mouse commands.



COMPONENTS USED (WRITE THIS IN REPORT)

Component	Purpose
EMG Electrodes	Capture muscle bio-signals
EMG Amplifier Module	Amplify weak signals
ESP32 Dev Board	Processing + Bluetooth
Jumper Wires	Interconnections
Laptop	Cursor display

WHY EMG (EXAMINER LOGIC)

- EMG signals are stronger than EEG
- Easy to detect blink & jaw movement
- Safe, non-invasive
- Highly reliable
- Ideal for assistive technology

HARDWARE INTERFACING (MOST IMPORTANT)

EMG MODULE → ESP32 CONNECTION

EMG Module Pin	ESP32 Pin
VCC	3.3V
GND	GND
OUT	GPIO 34 (ADC)

GPIO 34 is input-only → perfect for EMG

ELECTRODE PLACEMENT (DRAW THIS)

Use 3 electrodes:

Electrode	Placement
+	Forehead
–	Near eye / cheek
GND	Ear / neck

Detects:

- Blink → short spike
- Jaw clench → long spike

ELECTRICAL WORKING (CLEAR CONCEPT)

1. Muscle movement generates micro-voltage
2. Electrodes capture signal
3. EMG module amplifies signal
4. ESP32 ADC reads 0–4095
5. Logic compares thresholds
6. Bluetooth command sent

ESP32 AS A MOUSE (KEY CONCEPT)

7. ESP32 uses Bluetooth HID profile.
8. Laptop detects ESP32 as:
9. 🖱️ “Bluetooth Mouse”
10. No driver required.

MOUSE COMMANDS (YOU MUST REMEMBER)

Cursor Movement

bleMouse.move(X, Y);

X Movement

+ Right

− Left

Y Movement

+ Down

− Up

Mouse Click

bleMouse.click(MOUSE_LEFT);

bleMouse.click(MOUSE_RIGHT);

SIGNAL → ACTION MAPPING (EXAM GOLD)

EMG Signal	**Mouse Action**
Short spike (blink)	Left Click
Long spike (jaw)	Right Click
Light muscle activity	Move Right
Strong activity	Move Left
No activity	Stop

FULL WORKING CODE (REFERENCE)

You already have the **complete working code** I gave earlier.
That code:

- Reads EMG
- Applies thresholds
- Sends mouse movement
- Sends mouse clicks

(This is sufficient for final-year project.)

DEMO PROCEDURE (WRITE THIS)

1. Power ESP32 via USB
2. Wear electrodes
3. Pair Bluetooth “EMG_Mouse”
4. Blink → Left click
5. Jaw clench → Right click
6. Muscle tension → Cursor moves

SAFETY (VERY IMPORTANT FOR VIVA)

The system is non-invasive and passive. It only senses muscle bio-potentials and does not inject any current into the human body. Operating voltage is limited to 3.3V.

APPLICATIONS (WRITE 3–4)

- Assistive technology for disabled users
- Hands-free computer control
- Human-computer interaction
- Biomedical signal processing research

LIMITATIONS (EXAMINER LOVES THIS)

- Limited precision
- Noise sensitivity
- Requires calibration

- Not suitable for complex tasks

FUTURE SCOPE

- AI-based classification
- Cursor up/down control
- Gesture-based scrolling
- EEG integration