Assignment #1
Pros and Cons of AI-Based Mosquito Detection Using Audio
✅ Pros:
Non-Intrusive & Privacy-Friendly: It detects mosquito wingbeat frequencies rather than images or human voices, ensuring privacy.

Accurate Species Identification: The system can tell apart virus-carrying mosquitoes from harmless ones.

Cost-Effective & Scalable: Uses affordable microphones, works in all lighting conditions, and supports remote monitoring.

24/7 Monitoring: Operates continuously, including at night when mosquitoes are most active.

❌ Cons:
Noise Interference: Background sounds like rain, fans, and voices can interfere with detection.

Limited Range: Sensors need to be close to mosquitoes for accurate results.

Misclassification Risk: Some insect sounds overlap, requiring fine-tuning of AI models.

Data & Power Needs: Requires a stable power supply and network connection for real-time monitoring.

Privacy Considerations:
Human voices are filtered out, and audio is processed locally to avoid cloud-related privacy issues.

Data is encrypted and follows privacy regulations like GDPR.

Assignment #2

Comparison Between Microcontrollers and Single-Board Computers (SBC)

Feature	Microcontroller	Single-Board Computer (SBC)
Definition	A small integrated circuit for specific control tasks.	A full computer on a single board with CPU, RAM, and storage.
Processing Power	Low processing power, designed for simple tasks.	Higher processing power, capable of running a full OS.
Operating System	Usually doesn't run a full OS (bare-metal programming).	Runs full OS like Linux or Windows.
Power Consumption	Very low; can run on batteries for a long time.	Higher power use; may need a dedicated power source.
Complexity	Simple, designed for single-purpose tasks.	More complex, capable of multitasking.
Cost	Cheaper (a few dollars).	More expensive ($30 to $100+).
Connectivity	Limited (few I/O options).	Extensive (USB, Ethernet, Wi-Fi, HDMI).
Use Cases	Ideal for embedded systems, automation, and IoT.	Suitable for computing, networking, and multimedia.

When to Use a Microcontroller Over an SBC:
Energy Efficiency: Uses less power, ideal for battery-powered applications.

Real-Time Performance: Provides predictable, real-time performance — great for motor control and automation.

When to Use an SBC Over a Microcontroller:
More Processing Power: Suitable for multitasking, like running web servers or AI tasks.

Better Connectivity & Expandability: Supports USB devices, displays, and network options — useful for user interaction

Assignment #3: Research on Sensors and Actuators
Sensor: Light Dependent Resistor (LDR)
Function: Measures light levels by changing resistance — high resistance in low light, low resistance in bright light.

Type: Analog (provides a continuous range of values).

Range: Outputs resistance from a few hundred ohms (bright light) to over 1MΩ (darkness).

Actuator: Light Emitting Diode (LED)
Function: Emits light when powered — used as an indicator for environmental changes.

Type: Digital (ON/OFF state controlled by a microcontroller).

Range: Voltage (2–3V), current (10–20mA).

Example: Automatic light system using LDR and LED.

Hardware Components:
LDR (Light Dependent Resistor)

10kΩ Resistor (for voltage divider)

LED

Arduino Uno

Assignment #4: Protocol Comparison for IoT

Criteria	MQTT	AMQP	HTTP/HTTPS
Protocol Type	Publisher-Subscriber	Message Queue	Request-Response
Power Consumption	Very Low	Medium	High
Transmission Speed	Fast	Medium	Slow
Message Persistence	Yes (QoS 1 & 2)	Yes (Durable Queues)	No
Security	SSL/TLS, Username/Password	SSL/TLS	SSL/TLS
Best for IoT?	Perfect	Good	Not suitable