Assignment #1

Upsides and Downsides of AI-Based Mosquito Detection via Audio

Upsides	Downsides
Non-Intrusive & Privacy-Friendly: Only detects mosquito wingbeat frequencies, not images or human voices.	**Noise Interference**: Background sounds (fans, rain, voices) can disrupt detection.
Accurate Species Identification: AI can distinguish virus-carrying mosquitoes from harmless ones.	**Limited Range**: Sensors must be close to mosquitoes for accurate results.
Cost-Effective & Scalable: Uses inexpensive microphones, works in all lighting conditions, and allows remote monitoring.	**Potential Misclassification**: Some insect sounds overlap, requiring refined AI models.
Continuous 24/7 Detection: Functions at night when mosquitoes are most active.	**Data & Power Challenges**: Needs reliable power and network for real-time monitoring.

Privacy Considerations

- Filters out human voices, processes audio locally to avoid cloud risks.
- Uses encryption and follows privacy laws like GDPR.

Assignment #2

Feature	Microcontroller	Single-Board Computer (SBC)
Definition	A compact integrated circuit designed for specific control tasks.	A fully functional computer on a single board with CPU, RAM, and storage.
Processing Power	Low-power, limited processing capability.	Higher processing power, capable of running a full OS.
Operating System	Typically does not run an OS (bare-metal programming or real-time OS).	Runs a full OS like Linux or Windows.
Power Consumption	Very low, can run on batteries for long periods.	Higher power consumption, often requires a dedicated power supply.

Complexity	Simple, designed for single-purpose tasks.	More complex, capable of multitasking.
Cost	Generally cheaper (a few dollars).	More expensive (can range from $30 to $100+).
Connectivity	Limited connectivity (few I/O options).	Extensive connectivity (USB, Ethernet, Wi-Fi, HDMI).
Use Cases	Ideal for embedded systems, automation, and IoT.	Suitable for computing applications, networking, and multimedia.

Reasons to Use a Microcontroller Over an SBC:

- **Power Efficiency**: Microcontrollers consume significantly less power, making them ideal for battery-powered applications.
- **Real-Time Performance**: They provide deterministic real-time performance, crucial for applications like motor control and industrial automation.

Reasons to Use an SBC Over a Microcontroller:

- **Higher Processing Power**: Suitable for tasks requiring multitasking, such as running web servers or AI applications.
- **Better Connectivity & Expandability**: Supports peripherals like USB devices, displays, and networking options, making it ideal for applications requiring user interaction.

Assignment #3

Type	Sensor: Light Dependent Resistor (LDR)	Actuator: LED (Light Emitting Diode)
Function	Measures ambient light intensity. When light levels drop, its resistance increases.	Emits light when powered. Used as an indicator of environmental changes.
Hardware & Electronics	Made of semiconductor materials that change resistance based on light exposure.	Made of semiconductor diodes that emit light when current flows.

Analog or Digital	Analog – Provides a continuous range of values.	Digital – Operates in an ON/OFF state controlled by a microcontroller.
Units & Measurement Range	Resistance values (Ohms, Ω), typically from a few hundred Ω (bright light) to over 1MΩ (darkness).	Voltage (typically 2-3V) and current (usually 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

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