Assignment #1

Upsides and Downsides of AI-Based Mosquito Detection via Audio

Upsides:

Non-Intrusive & Privacy-Friendly: Only detects mosquito wingbeat frequencies, not images or human voices.

Accurate Species Identification: AI can distinguish virus-carrying mosquitoes from harmless ones.

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

Continuous 24/7 Detection: Functions at night when mosquitoes are most active.

Downsides:

Noise Interference: Background sounds (fans, rain, voices) can disrupt detection.

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

Potential Misclassification: Some insect sounds overlap, requiring refined AI models.

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 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

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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

Research on Sensors and Actuators

Sensor: Light Dependent Resistor (LDR)

Function: An LDR is a light sensor that measures ambient light intensity. When light levels drop, its resistance increases, and when light is strong, its resistance decreases.

Hardware & Electronics: LDR is made of semiconductor materials that change resistance based on light exposure.

Analog or Digital: Analog – It provides a continuous range of values.

Units & Measurement Range: The LDR outputs resistance values (Ohms, Ω), typically ranging from a few hundred Ω (bright light) to over 1MΩ (darkness).

Actuator: LED (Light Emitting Diode)

Function: The LED is an output device that emits light when powered. It is used as a simple actuator to indicate changes in environmental conditions.

Hardware & Electronics: LEDs are made of semiconductor diodes that emit light when current flows through them.

Analog or Digital: Digital – It operates in an ON/OFF state controlled by a microcontroller.

Units & Measurement Range: 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