

1. IoT Project Investigation

Project: OneGov Digital Transformation Pilot in Thu Duc City, Ho Chi Minh City, Vietnam. VNPT and HCMC People's Committee are collaborating to build digital infrastructure and platforms using IoT technologies to integrate databases from health, education, environment, and more.

Upsides: - Improved government services and citizen experience - Integrated data for informed decision-making - Enhanced business efficiency and service delivery - Foundation for sustainable urban development

Downsides: - Data privacy and security risks - High infrastructure and integration costs - Complexity of coordinating multiple agencies - Potential digital divide among citizens

Privacy Considerations: The OneGov system employs data encryption in transit and at rest, strict access controls, and user consent management to protect personal data. Regular security audits and adherence to Vietnamese data protection regulations are conducted.

2. Microcontrollers vs Single-Board Computers

Feature	Microcontrollers	Single-Board Computers
Price	Affordable	More expensive
Usage	Dedicated control tasks	Development & deployment
Memory	Limited (KBs)	Higher (MBs/GBs)
Physical size	Small	Larger
Framework & OS	No OS or RTOS	Full OS support

2 Reasons to Prioritize Microcontrollers: 1. **Affordability:** Low-cost hardware ideal for budget-sensitive projects. 2. **Simplicity:** Easy to program and deploy for single-purpose tasks.

2 Reasons to Prioritize Single-Board Computers: 1. **Large-Scale Operations:** More processing power and memory for complex applications. 2. **Versatility:** Runs full operating systems, supports multitasking and networking.

3. Sensor and Actuator Research

Sensor: Soil Moisture Sensor - Function: Measures moisture content in soil. - **Components:** Fork-shaped probe, signal processing module, LM393 comparator. - **Analog/Digital:** Provides analog output (0–1023) and digital output (0 or 1). - **Range:** Voltage proportional to moisture; digital threshold output.

Actuator: Relay Module - **Function:** Acts as an electrical switch to control high-power devices. - **Components:** Electromagnet coil, mechanical switch, driver circuit. - **Digital:** Triggered by HIGH/LOW signals (e.g., 5V control input). - **Range:** Switches loads up to 250V AC or 30V DC.

4. Communication Protocols: MQTT vs AMQP vs HTTP/HTTPS

Protocol	Power Usage	Security	Message Persistence
MQTT	Low (lightweight)	TLS & authentication	Yes (QoS levels)
AMQP	Higher (more overhead)	Encryption & auth	Yes (built-in queuing)
HTTP/HTTPS	High (stateless)	TLS (HTTPS)	No (requires extra handling)

Summary: - **MQTT** is ideal for IoT with low power usage and built-in message persistence. - **AMQP** suits enterprise use cases needing strong security and reliable queuing. - **HTTP/HTTPS** is widely supported but less efficient for real-time IoT messaging.