Assignment 1

IoT Project: Viettel's NB-IoT Network Deployment in Ho Chi Minh City

Viettel, a leading telecommunication company in Vietnam, has successfully deployed a Narrowband Internet of Things (NB-IoT) network across Ho Chi Minh City. This initiative positions the city as the first in Vietnam to achive comprehensive NB-IoT coverage, facilitating the development of smart applications and sevices.

Benefits:

- Enhanced Connectivity: The NB-IoT network provides robust and wide-reaching connectivity, enabling various IoT applications such as smart metering, environment monitoring, and asset tracking.
- Smart City Development: This infrastructure supports the city's vision of becoming a smart city by enabling data-driven decision-making and improving public services.
- Economic Growth: The development encourages innovation and attracts investments in IoT-based solutions, fostering economic development in the region.

Challenges:

- Security Concerns: With the proliferation of connected devices, ensuring data security and protecting against cyber threats become critical challenges.
- Infrastructure Investment: Establishing and maintaining the NB-IoT network requires significant investment in infrastructure and technology.
- Interoperability Issues: Integrating various IoT devices and platforms may lead to compatibility and standardization challenges.

Privacy Considerations:

Viettel's NB-IoT network collects and transmits data from numerous devices across the city. It is essential to implement stringent data governance policies, ensure transparency in data usage, and comply with privacy regulations to protect citizens' personal information.

In summary, Viettel's NB-IoT network deployment in Ho Chi Minh City marks a significant step toward smart city transformation, offering numerous benefits while also presenting challenges that need to be addressed to ensure sustainable and secure implementation.

Assignment 2

Feature	Microcontrollers	Single-Board Computers (e.g., Raspberry Pi)
Processing Power	Low, designed for simple tasks like reading sensors and controlling small devices.	Higher, capable of running full operating systems and handing complex tasks.
Operating System	No OS, run a single program directly from flash memory.	Runs full OS like Linux, allowing multitasking and various applications.
Power Comsumption	Very low power consumption, ideal for battery-operated devices.	Higher power consumption due to more complex hardware.
Connectivity	Limited (e.g., basic serial, I2C, SPI)	Advanced connectivity (e.g., Wi-Fi, Bluetooth, Ethernet).
Programming	Uses simple programming (C, C++), directly interacts with hardware.	Supports multiple programming languages (Python, Java, C, etc.).
Use Cases	Best for real-time applications like embedded systems, automation, and IoT sensors.	Best for applications requiring processing power, such as AI, web servers, and media centers.
Cost	Typically cheaper.	More expensive due to advance features.

Assignment 3

Sensor: DHT11 Temperature and Humidity Sensor

1) What it does?

- The DHT11 sensor measures temperature and humidity and provides digital output data. It is commonly used in IoT projects, weather monitoring, and smart home systems.

2) The electronics/hardware used inside

- A thermistor to measure temperature.
- A capacitive humidity sensor to detect moisture levels.
- An 8-bit microcontroller inside the sensor to process and send data.

3) Is it analog or digital?

- Digital: It communicates using a single-wire digital signal.

4) Units and range of inputs/measurements

- Temperature range: 0℃ to 50℃ (±2℃ accuracy).
- Humidity range: 20% to 90% RH (±5% accuracy).
- Output format: Digital signal via a single-wire protocol.

Actuator: SG90 Servp Motor

1) What it does?

- The SG90 servo motor is a small motor that rotates to a specific angle based on input signals. It is commonly used in robotics, automation, and IoT applications.

2) The electronics/hardware used inside

- The SG90 consists of:
  - A DC motor that drives the movement.
  - A gearbox to control the speed and torque.
  - A control circuit that interprets PWM (Pulse Width Modulation) signals.

3) Is it analog or digital?

- Digital: It operates using PWM signals to control the angle of rotation.

4) Units and range of inputs/measurements

- Rotation range: 0° to 180°
- Operating voltage: 4.8V to 6V
- Control signal: PWM with pulse width between 1ms (0°) to 2ms (180°).

Assignment 4

1) Comparing AMQP to MQTT

Feature	MQTT	AMQP
Power Usage	Low power consumption, optimized for IoT devices with limited resources.	Higher power consumption due to its complex message structure.
Security	Supports SSL/TLS for encryption but has limited built-in security feature.	Stronger security with built-in authentication and authorization mechanisms.
Message Persistence	Supports Quality of Service (QoS) levels for messagedelivery but has limited persistence.	Supports message queuing and transactions, ensuring strong message persistence.

Summary: MQTT is lightweight and better suited for low-power IoT applications, whereas AMQP is more robust with better security and message persistence, making it ideal fir enterprise systems.

2) Comparing HTTP/HTTPS to MQTT

Feature	MQTT	HTTP/HTTPS
Power Usage	Very efficient designed for low-bandwidth devices.	High power consumption, not optimized for IoT applications.
Security	Uses SSL/TLS but lacks built-in authentication.	HTTPS is highly secure with strong authentication and encryption.
Message Persistence	Supports QoS levels for message delivery but is not designed for persistent connections.	Stateless protocol, requires extra effort to implement persistence.

Summary: MQTT is better for IoT applications due to its efficiency and low power consumption, while HTTP/HTTPS is more secure and widely used for web_based communication but is less efficient for IoT.