Introduction to IoT End Sem Exam (Spring 2023)

Total Marks: 70

Duration: 3 hours

1. Assume you are designing a hardware system for an IoT application, and you want to use some interfacing protocols in your design. It would help if you knew some details of the hardware interfacing protocols. Please answer the following. **(6 marks)**
    a. Can SPI, UART, and I2C be used interchangeably in all applications? Explain your answer.
    b. What are the main advantages & disadvantages of the three communication protocols (SPI, UART, I2C)?

2. Please answer the following based on your observations while building the course project. **(10 marks)**
    a. List the sensors used in your project.
    b. For each sensor type, what was the type of data recorded (mention the units also)?
    c. For each sensor type what was the was the approximate sensitivity (range of detection or value as recorded) in design setup?
    d. If similar sensors (low cost and low accuracy) were to be deployed in real-life IoT network, how would you reduce the sensor failure?

3. You are given a task to deploy a data storage layer to manage the data coming from various IoT devices (for example 5 Air Quality, 3 Water Quality and 3 Solar Energy Monitoring devices). **(10 marks)**
    a. Design and draw the CSE Base to handle the incoming data.
    b. List out and describe the various resources used in your CSE base
    c. Draw the basic block diagram of data storage layer.
    d. If the data rate of Air Quality, Water Quality, Solar Energy devices are 1 data-point/15 seconds, 1 data-point/ 60 seconds, 2 data-points/15 seconds and mni is 5 per container. What is the maximum number of data instances stored at any point of time in the CSE Base.

4. For any critical IoT system, data security is of utmost importance. Please answer the following security related concerns in an IoT system. **(6 marks)**
    a. List out various security concerns in IoT
    b. Briefly describe the basic encryption solutions and compare them.
    c. Which encryption technique is suitable for a device with very less processing capacity.

5. Please describe what communication protocol is suitable for the following scenarios and why. **(8 marks)**
    a. communication between transport truck and control room managing logistics for the furniture company.
    b. communication between hundreds of nodes in an IoT system deployed in a forest to monitor the movement and health of certain endangered species of animals.

6. Describe a simplified IoT stack (including all the layers) for a CCTV based system. **(6 marks)**

7. Assume that there is a requirement from the municipality to design an IoT system for camera-based traffic monitoring and prediction. Please answer the following questions in this context. **(12 marks)**

   a. What kind of cloud architecture model will you use and explain your reasons?
   b. What is a better data processing architecture other than cloud-based processing that will be better for the above system? Please describe the architecture and why it is better. Also explain how the data will be processed.
   c. What kind of analytics techniques can be deployed in the architecture you described in question 7(b)? Please mention 3 techniques.

8. A team is looking for a feasible IoT solution to enable conditional decision-making through multiple sensors in a factory automation system. It should be possible to monitor various parameters of the machine's health and performance. If MQTT is being used as the application-level protocol, please answer the following. **(12 marks)**

   a. Suggest a suitable QoS level for critical and non-critical machine parameter data assuming there is reliable network support, but cost constraints.
   b. Concerning the MQTT protocol, design a block diagram to exchange data between multiple controllers in a factory automation system and explain with 2 examples of data exchanged. (5 marks)
   c. The following convention is used for naming the controller devices "/FactoryAutomation/Floor_Number/Machine_Number/Device_ID"
      i. How can you get the data of all the devices within a floor in the factory?
      ii. How can you get data from all the devices with a unique device id?