IoT Design (30P)

You are given the task of building an IoT (medicinal) cannabis-plantation controller communicating over MQTT. The plants are arranged in 5 rows, each row featuring 5 zonal climate-units which allow setting of the temperature and humidity of the air, lighting units that illuminate the plants and watering units. There are 10 temperature/humidity sensors spread evenly throughout each zone. Every tenth plant within the zone features an individual soil-humidity sensor and every twentieth features a leaf-humidity sensor. The leaf humidity sensor measures the internal humidity of the leaf which is dependent on the amount of water the plant has taken from the soil. It takes approx. 20 minutes for the leaf humidity to change after watering.

a.) Briefly state the concept of a digital twin (2P)

b.) Explain whether data-point or object-oriented abstraction would be more suitable for this use-case (3P)

c.) Identify the control loops (1P)

d.) Allocate components for this application and draw the resulting architecture (4P)

e.) Map the tasks onto the architecture (2P)

f.) You must define a sampling time for the three types of sensors – on what do you base your recommendation? (1P)

g.) Design a topic scheme (4P)

h.) What QoS level do you recommend- explain your answer? (1P)

i.) Data encoding: explain whether SenML or CBOR would be best suited (2P)

j.) Is a Last Will and Testament required? Explain your answer (1P)

k.) What is session retention and explain whether it should be used in this task or not? (2P)

l.) What time synchronisation, if any, would you recommend? Explain your answer (1P)

m.) Explain oneM2M and whether it is suitable for utilisation in this system (2P)

n.) Explain the principle of a triple-buffer (2P)