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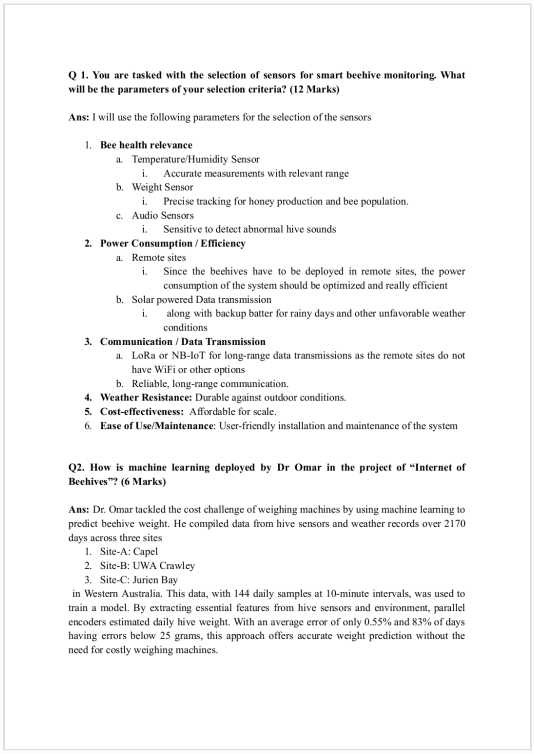

Q 1. You are tasked with the selection of sensors for smart beehive monitoring. What will be the parameters of your selection criteria? (12 Marks)

Ans: I will use the following parameters for the selection of the sensors

1. **Bee health relevance**
   a. Temperature/Humidity Sensor
      i. Accurate measurements with relevant range
   b. Weight Sensor
      i. Precise tracking for honey production and bee population.
   c. Audio Sensors
      i. Sensitive to detect abnormal hive sounds
2. **Power Consumption / Efficiency**
   a. Remote sites
      i. Since the beehives have to be deployed in remote sites, the power consumption of the system should be optimized and really efficient
   b. Solar powered Data transmission
      i. along with backup batter for rainy days and other unfavorable weather conditions
3. **Communication / Data Transmission**
   a. LoRa or NB-IoT for long-range data transmissions as the remote sites do not have WiFi or other options
   b. Reliable, long-range communication.
4. **Weather Resistance:** Durable against outdoor conditions.
5. **Cost-effectiveness:** Affordable for scale.
6. **Ease of Use/Maintenance**: User-friendly installation and maintenance of the system

Q2. How is machine learning deployed by Dr Omar in the project of "Internet of Beehives"? (6 Marks)

Ans: Dr. Omar tackled the cost challenge of weighing machines by using machine learning to predict beehive weight. He compiled data from hive sensors and weather records over 2170 days across three sites

1. Site-A: Capel
2. Site-B: UWA Crawley
3. Site-C: Jurien Bay

in Western Australia. This data, with 144 daily samples at 10-minute intervals, was used to train a model. By extracting essential features from hive sensors and environment, parallel encoders estimated daily hive weight. With an average error of only 0.55% and 83% of days having errors below 25 grams, this approach offers accurate weight prediction without the need for costly weighing machines.