Assignment-10

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- **Project Plan:**
  - **Scenario-Based: Edge Inferencing for Wearable Health Monitors**

- **Scenario Recap:**
  - A wearable health monitor company wants to improve device accuracy using machine learning models while preserving user data privacy by avoiding cloud-based processing.

- **How Edge Inferencing Can Help:**
  - **Real-Time Data Processing on Device:**
    - Edge inferencing enables machine learning models to run directly on the wearable device (e.g., smartwatch or fitness tracker). This allows for immediate analysis of biosignals like heart rate, blood oxygen, and ECG without the need to send data to external servers.
      Impact: Users receive instant alerts about anomalies (like arrhythmias or abnormal oxygen levels), improving health outcomes through quick action.
  - **Data Privacy and Security:**
    - Since sensitive biometric data (such as ECG, sleep patterns, or glucose levels) is processed locally, the risk of data breaches or misuse is significantly reduced. No raw personal data needs to leave the device.
      Impact: Builds trust and compliance with privacy regulations (like GDPR, HIPAA), especially important for health tech products.
  - **Personalized & Context-Aware Predictions:**
    - On-device ML models can continuously learn from a user's unique physiological patterns over time. This allows the device to customize

its understanding of "normal" vs. "abnormal", resulting in more accurate and tailored predictions for each user. Example: A resting heart rate of 90 BPM might be fine for one user but a risk signal for another; edge inferencing can distinguish such cases.

➢ **Offline Functionality & Accessibility:**

  ▪ Wearables with edge inferencing don't rely on a constant cloud connection. This enables users to access health insights in **remote, rural, or network-constrained areas** without delay or functionality loss. **Impact:** Useful for field workers, athletes, travelers, and elderly users in areas with limited internet access.

➢ **Cost and Power Efficiency:**

  ▪ Reducing dependency on cloud computing lowers bandwidth usage, data transmission costs, and battery drain caused by continuous data uploads. Impact: Extends battery life of wearables and reduces infrastructure costs for the company.

➢ **Enhanced Model Responsiveness:**

  ▪ Edge inferencing allows for low-latency execution of models, which is critical for real-time alerts like fall detection, seizure alerts, or stress monitoring.
  Example: A smartwatch detecting a fall can notify emergency contacts within seconds without needing to ping the cloud.

- **Key Points About Wearable Health Monitors:**

  ➢ Monitor real-time vitals: heart rate, ECG, temperature, SpO_2, blood pressure.
  ➢ Detect stress, fatigue, falls, and abnormal events.
  ➢ Help in chronic disease monitoring (e.g., diabetes, hypertension).
  ➢ Require robust data privacy to ensure user trust.
  ➢ Should work independently of internet for reliability.
  ➢ Can support remote patient monitoring (RPM) in telehealth models.