**Continuous Real-Time ECG Monitoring IoT Device**

**1. Abstract**

The continuous real-time ECG monitoring IoT device aims to provide a seamless solution for monitoring heart health remotely. By leveraging IoT, this system gathers real-time ECG data from wearable sensors, processes the data locally using edge computing techniques, and transmits the information to a cloud platform. The data is then analyzed for abnormal heart rhythms (PQRST detection), enabling early detection of potential cardiac issues. The device is designed to be power-efficient, using denoising algorithms and data compression techniques to ensure smooth operation in real-time, even in remote locations.

**2. Scope of the Project**

**2.1. Client Requirement Analysis**

* Understand the client's need for a real-time ECG monitoring system.
* Identify parameters such as sensor accuracy, response time, and data handling capacity.

**2.2. Proposed IoT Architecture Solution**

* Design an end-to-end system architecture that covers edge devices, gateways, and cloud infrastructure.

**2.3. Hardware Selection**

* Choose power-efficient microcontrollers for wearable devices.

**2.4. Sensor Selection and Computation Devices**

* Select ECG sensors that provide accurate and reliable data, suitable for continuous monitoring.

**2.5. Software**

* Develop firmware to handle data acquisition, filtering, and transmission.

**2.6. Edge Computing**

* Implement computation at the device level to reduce latency and improve real-time monitoring.

**2.7. ADC Conversion**

* Use high-precision analog-to-digital converters to digitize ECG signals for further processing.

**2.8. Denoising Using Moving Average Algorithm**

* Apply denoising techniques, such as a moving average filter, to eliminate noise from ECG signals.

**2.9. PQRST Detection Algorithm**

* Implement an algorithm to detect PQRST complexes from the ECG signals for cardiac analysis.

**2.10. Azure IoT Hub JSON Publishing**

* Transmit the processed data to the Azure IoT hub in JSON format for cloud-based storage and analysis.

**3. Explanation**

The system consists of a battery-powered ECG device equipped with sensors that continuously capture heart signals. The data is passed through an analog-to-digital converter (ADC) for digital processing, where noise is eliminated using a moving average algorithm. The processed data undergoes PQRST detection via edge computing on the device, allowing real-time analysis of heart conditions.

The data is then sent to a gateway device, where a Python script processes the data further for real-time plotting and cloud transmission. Finally, the processed ECG data is published to the Azure IoT Hub in JSON format, making it accessible for remote monitoring and long-term storage.

For the **PowerPoint presentation**, here’s an outline with suggested images:

**Slide 1: Title Slide**

* Title: "Continuous Real-Time ECG Monitoring IoT Device"
* Subtitle: "Project Overview and Architecture"
* Background image: ECG waveform and IoT cloud icons.

**Slide 2: Abstract**

* Bullet points summarizing the abstract.
* Image: An ECG sensor attached to a patient, with a cloud platform.

**Slide 3: Client Requirements**

* Points detailing the requirement analysis.
* Image: Flowchart or diagram showing client and technical requirements.

**Slide 4: IoT Architecture**

* Proposed architecture with devices, edge computing, gateway, and cloud.
* Image: System architecture diagram showing sensors, gateway, cloud.

**Slide 5: Hardware and Sensor Selection**

* List of hardware and sensor components.
* Image: Microcontroller and ECG sensor.

**Slide 6: Edge Computing and ADC Conversion**

* Explain ADC conversion and edge processing.
* Image: Diagram showing edge device processing flow.

**Slide 7: Denoising and PQRST Detection**

* Explanation of algorithms (moving average and PQRST detection).
* Image: Comparison of raw vs. denoised ECG signals and a PQRST detected waveform.

**Slide 8: Azure IoT Hub JSON Publishing**

* Explain how data is transmitted to the cloud.
* Image: Data flowing from the gateway to the cloud.

**Slide 9: Conclusion**

* Summary of key points.
* Image: Diagram of the complete ECG IoT system.