AI bracelet for health monitoring

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Main Objective

- To develop an AI-powered system that can detect early signs of heart sclerosis using continuous, non-invasive physiological data collected from a smart bracelet.
- The system will analyze patterns in heart rate variability (HRV), pulse waveform morphology, activity levels, and other biosignals to identify anomalies associated with myocardial fibrosis.
- **Today's Update:** The results of foundational AI model and new smart watch that we will use

AI Learning & Development Process

- **Model Selection Process:** Evaluated multiple machine learning algorithms including XGBoost (98.6%), Random Forest (98.2%), Neural Networks (95.8%), and Logistic Regression (91.6%) to understand which approaches work best for physiological data

- **Feature Engineering:** Learned how to extract meaningful features from PPG signals including HRV metrics, pulse morphology, and signal quality indicators

- **Validation Techniques:** Gained experience with cross-validation methods (k=5 folds showing 98.2% ± 1.2% for XGBoost) and cross-dataset testing to ensure model reliability

- **Data Quality Impact:** Understood the critical importance of clean, filtered data versus noisy real-world sensor data. Motion artifacts can corrupt up to 44.6% of data windows.

- **Key Insights:**
  - PPG-based wearable sensors can capture sufficient physiological information for heart health monitoring
  - XGBoost demonstrated the best overall performance with 98.6% accuracy and 99.4% sensitivity
  - Motion artifacts are a major challenge requiring specialized handling strategies

Hardware Progress Update

- Successfully integrated accelerometer with heart rate sensor (PPG - MAX30102)
- Obtained clean, synchronized data from both sensors
- tried to connect the heart rate sensor directly to the T-Watch S3 Plus - devices detect each other but still we need to have improvements on this, because it’s not possible to wear for now. Most probably we will work with the constraints.

Next Hardware Step: Bangle.js 2 Smart Watch

- We have ordered the Bangle.js 2 smartwatch which addresses our current hardware limitations (Built-in Heart Rate Monitor, accelerometer, GPS, magnetometer, pressure sensor) + it has a good battery life (Up to 4 weeks normal use)
- Connectivity: Bluetooth LE for data transmission

Next Steps

- Complete Data Collection System
- Optimize Bangle.js 2 Configuration
- Optimize connection communication for smooth, automatic reconnection.
- To create a user-friendly design for the watches so they could really be wearable.
- Implement buffering and timestamp synchronization between accelerometer and PPG.
- Clean and structure signals for later correlation (e.g., HRV, activity trends, HR spikes).