AI bracelet for health monitoring

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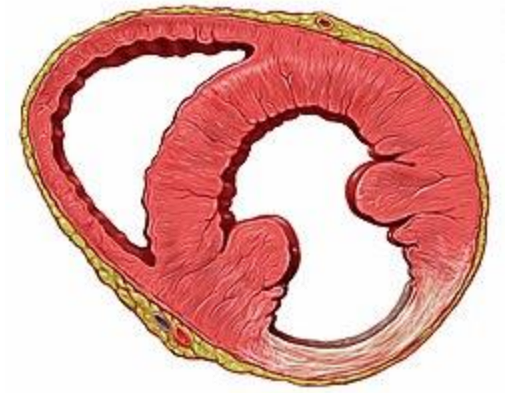
Definition of Heart Sclerosis (Cardiosclerosis)

Heart sclerosis (or *cardiosclerosis*) is a pathological condition characterized by the replacement of healthy heart muscle (myocardium) with fibrous or scar tissue.



It commonly results from:

- Myocardial infarction (heart attack)
- Chronic ischemia
- Myocarditis (inflammation)
- Degenerative aging processes

This scarring impairs the heart's mechanical and electrical functions, leading to serious clinical manifestations.

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.

Secondary Objectives

1. Develop software to collect and stream real-time sensor data from the smart bracelet (T-Watch S3 Plus + MAX30102 PPG sensor).
2. Conduct a pilot study to gather a dataset from volunteers (including healthy individuals and those with known cardiac conditions).
3. Train and validate an AI/ML model capable of flagging potential indicators of heart sclerosis based on wearable-derived metrics.
4. Correlate clinical symptoms of cardiosclerosis with measurable biosignals from wearable sensors (see next slide).

Symptom–Sensor Correlation Table

Clinical Manifestation of Heart Sclerosis	Relevant Wearable Sensor(s)	Measurable Signal
Arrhythmias / Irregular heartbeat	PPG (MAX30102)	Heart rate variability (HRV), inter-beat intervals
Fatigue, reduced exercise tolerance	Accelerometer + PPG	Activity level, step count, HR recovery post-exertion
Shortness of breath (dyspnea)	Accelerometer + HR trends	Resting HR elevation, abnormal HR response to minimal activity
Conduction abnormalities (e.g., bradycardia)	PPG	Sustained low HR, pauses in rhythm
Fluid retention / nocturnal symptoms	Longitudinal HR & activity trends	Nighttime HR spikes, reduced sleep quality (indirect)

Relevance & Societal Impact

- Early detection: Enables timely intervention before heart failure develops.
- Accessibility: non-invasive monitoring for at-risk populations (e.g., post-MI patients, elderly).
- Preventive healthcare: Continuous monitoring supports proactive management of cardiac health.

What We’ve Done So Far

- ❑ Ordered the T-Watch S3 Plus (main device)(link)
- ❑ Received the MAX30102/20 PPG heart sensor (ready to go!)
- ❑ Planned hardware integration:
  → Connect sensor to watch via I²C (community examples available)
  → Watch supports custom modules → ideal for our use case

We’re confident we can interface these two — sensor outputs I²C-compatible data, and the T-Watch has accessible GPIO pins + Arduino support.

How It Will All Work Together

Hardware Layer:
Sensor → I^2C → T-Watch → Wi-Fi/Bluetooth → Server

Firmware (T-Watch):
- Read raw PPG signal
- Preprocess: filter noise, average readings
- Send cleaned HR data as JSON over network

Backend & Cloud:
- Python Flask/FastAPI server receives data
- Store in SQLite/PostgreSQL
- AI/ML anomaly detection later

Future Visualization:
Web dashboard (React/HTML+JS) for real-time HR
+ alerts

What We're Doing Now (While Waiting for Bracelet)

Immediate Next Steps:

- Set up development environment: PlatformIO / Arduino IDE for T-Watch
- Test sensor with breadboard + Arduino Uno (validate I^2C comms)
- Write basic firmware to read sensor → display on watch screen
- Mock data transmission to local server (test API endpoints)