B.M.S. COLLEGE OF ENGINEERING BENGALURU
Autonomous Institute, Affiliated to VTU

OOMD Mini Project Report

SMART YOGA MAT

Submitted in partial fulfillment for the award of degree of

Bachelor of Engineering
in
Computer Science and Engineering

Submitted by:

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2025-26

B.M.S. COLLEGE OF ENGINEERING

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

DECLARATION

We, Aishwarya R (1BM23CS018), Ananya N Gowda (1BM23CS034), Anthra Vikram (1BM23CS044) students of 5th Semester, B.E, Department of Computer Science and Engineering, BMS College of Engineering, Bangalore, hereby declare that, this OOMD Mini Project entitled "**SMART YOGA MAT**" has been carried out in Department of CSE, B.M.S. College of Engineering, Bangalore during the academic semester August 2025- December 2025. We also declare that to the best of our knowledge and belief, the OOMD mini Project report is not from part of any other report by any other students.

Signature of the Candidate

Aishwarya R (1BM23CS018)

Ananya N Gowda (1BM23CS034)

Anthra Vikram (1BM23CS044)

B.M.S. COLLEGE OF ENGINEERING

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

CERTIFICATE

This is to certify that the OOMD Mini Project titled "**SMART YOGA MAT"** has been carried out by Aishwarya R (1BM23CS018), Ananya N Gowda (1BM23CS034), Anthra Vikram (1BM23CS044) during the academic year 2025.

Signature of the Faculty in Charge (Your Guide Name)

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Smart Yoga Mat Application Overview

This is an interactive yoga practice companion that connects to a smart yoga mat with built-in sensors. Here's what each section does:

Dashboard (Home Screen)

- Shows your yoga practice overview with key stats: total sessions completed, average accuracy, current streak, and total practice time
- Displays recent session history with dates, durations, and accuracy scores
- Features a prominent "Start Session" button to begin your practice
- Includes a profile button to access your settings

Live Session Screen

- **Real-time pose tracking**: Shows current pose accuracy percentage (85% in the demo)
- **Heart rate monitoring**: Displays live BPM from the mat's sensors
- **Breathing guide**: Animated circle that expands/contracts to guide your breath timing
- **Session timer**: Tracks how long you've been practicing
- **End session button**: Saves your data when you're done

Session Summary

- Shows your overall performance score after completing a session
- Breaks down key metrics: accuracy, duration, heart rate, and poses completed
- Provides detailed insights on posture quality, balance stability, and breath control
- Offers an action button to try a new session or return to dashboard

Profile Page

- Displays your user stats: total sessions, average accuracy, streak days, and total minutes
- Shows your experience level and preferences (session duration, voice guidance, haptic feedback)
- Lists connected devices (the smart mat and heart rate monitor) with connection status

The app creates a complete yoga practice experience with real-time feedback, progress tracking, and personalized insights to help improve your practice over time.

I'll explain what this Smart Yoga Mat application does:

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Chapter 2: Software Requirement Specification

Part A: Introduction

Purpose of the Document

The purpose of this document is to define the requirements for developing a Smart Yoga Mat integrated with AI technology. The system will assist users in performing yoga correctly by tracking posture, providing real-time feedback, and monitoring overall wellness.

Scope of the Document

The Smart Yoga Mat will:

- Detect yoga poses using embedded sensors and AI.
- Provide real-time feedback on posture correction.
- Track performance and progress (calories burned, time spent, accuracy of poses).
- Integrate with mobile applications for visualization and personalized training plans.
- Support both beginners and advanced users.

Overview

This system combines IoT (sensors on the mat) with AI (pose detection and feedback) to create a smart wellness device. It ensures correct posture, prevents injury, and enhances yoga practice efficiency.

Part B: General Description

- The system consists of a yoga mat with pressure sensors, accelerometers, and gyroscopes.
- Data from sensors is processed using AI algorithms to recognize yoga poses.
- Feedback is provided through a mobile app or voice assistant.
- The system will store user progress and offer personalized recommendations.

Part C: Functional Requirements

1. Detect and classify yoga poses in real-time.
2. Provide corrective feedback (audio/visual).
3. Track session statistics (duration, calories, pose accuracy).
4. Sync data with the mobile app.
5. Allow user profile creation and personalization.
6. Support offline and online modes.

Part D: Interface Requirements

- **Hardware Interface:** Sensors embedded in the mat, Bluetooth/Wi-Fi connectivity.
- **Software Interface:** Mobile application (Android/iOS).
- **User Interface:** Interactive dashboard with statistics, pose library, and recommendations.
- **Voice/Audio Interface:** Real-time corrective guidance.

Part E: Performance Requirements

- Real-time feedback with latency less than 1 second.
- Pose recognition accuracy ≥ 90%.
- Battery life of at least 8 hours of continuous use.
- Support up to 1000 stored sessions per user.

Part F: Design Constraints

- Lightweight and foldable mat design.
- Cost-effective hardware components.
- Must work in indoor environments with stable connectivity.
- Limited processing power (edge computing with some cloud support).

Part G: Non-Functional Attributes

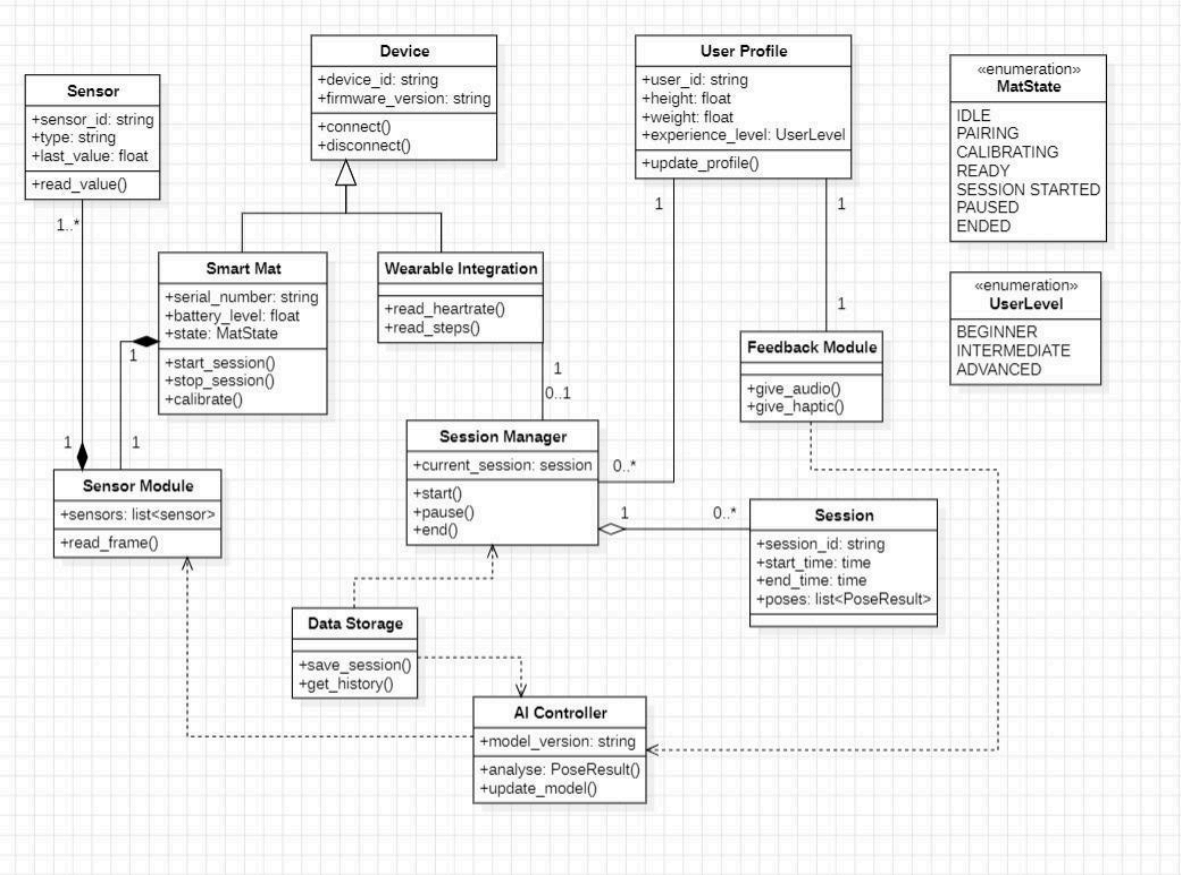
- **Usability:** Easy to use for all age groups.
- **Reliability:** Should function consistently for long durations.
- **Security:** Data encryption for user privacy.
- **Scalability:** Support for multiple users on one app.
- **Maintainability:** Software updates via app.

Part H: Preliminary Schedule and Budget

- **Schedule:**
    - Research & Design: 1 month
    - Hardware & AI Model Development: 3 months
    - Integration & Testing: 2 months
    - Deployment & Launch: 1 month

- **Budget (Estimated):**
    - Hardware (sensors, mat, connectivity): ₹15,000–20,000
    - Software development: ₹2,50,000
    - AI model training: ₹50,000
    - Marketing & Distribution: ₹1,00,000
    - **Total:** ~₹4,20,000

Chapter 3: Class Modeling



Sensor
Represents a single embedded sensor in the mat. It stores its type (e.g., pressure, temperature) and last reading. It provides a read_value() method to retrieve live measurements. These sensors form the data foundation of the smart mat.
Sensor Module
Contains and manages all sensors. It offers a read_frame() method that collects one full batch of sensor data at a time. This module is the bridge between hardware sensors and the rest of the system.
Device (Abstract)
A generic class for any connected hardware. It defines shared attributes like device ID and firmware version, and basic methods such as connect() and disconnect(). Both the smart mat and wearables inherit from this.
Smart Mat
A specialized device that represents the physical yoga mat. It tracks battery level and operating state (e.g., READY, SESSION STARTED). It can calibrate itself and control session start/stop. This is the core physical product.

Wearable Integration
Represents optional external wearable devices like smart watches. It can read heart rate and step count. This allows the platform to combine mat motion data with biological measurements.
User Profile
Stores user attributes such as height, weight, and yoga experience level. The system uses these values to personalize feedback and progression. The user can update their profile over time.
Session Manager
Controls the yoga session lifecycle. It can start, pause, and end a session, while tracking which session is currently active. It coordinates components like AI and feedback during a workout.
Session

Represents one completed yoga workout. It stores start and end times along with a list of pose analysis results. Session history supports progress tracking and performance reviews.

Feedback Module

Responsible for real-time coaching. It can give audio instructions (e.g., “straighten spine”) or haptic vibrations through the mat. It reacts to sensor and AI data during the session.

AI Controller

Analyzes sensor data and determines pose accuracy under analyse(). It also supports model updates over time. This is the intelligence component that evaluates yoga posture quality.

Data Storage

Saves completed session data and retrieves history when needed. This enables long-term performance analytics and progress visualizations.

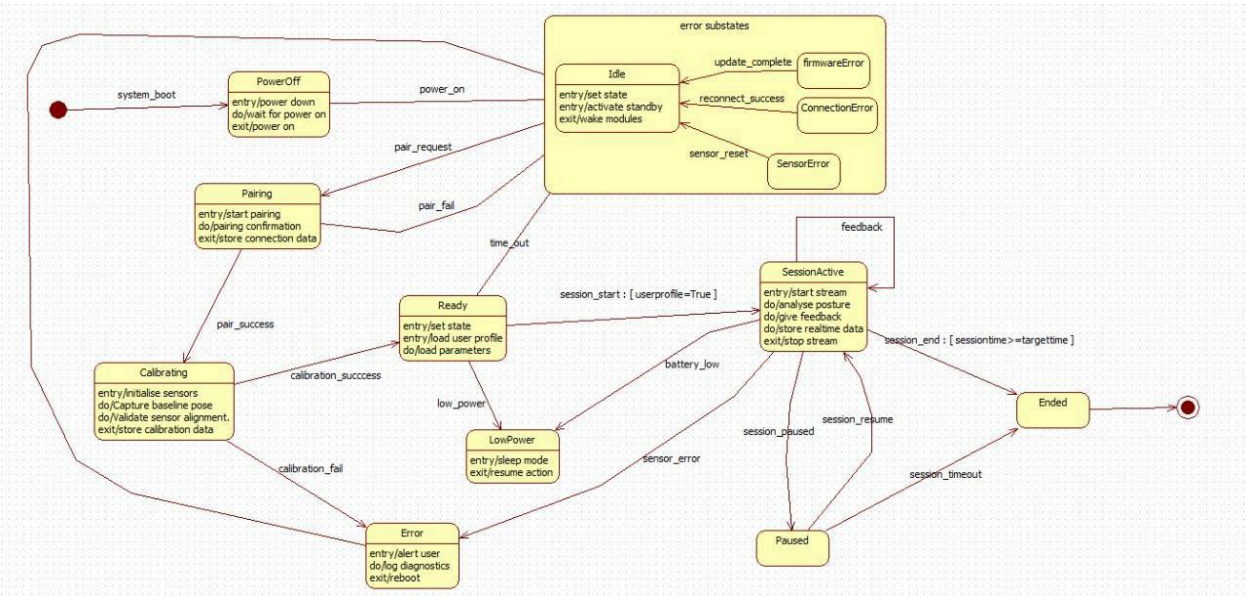
Enumerations

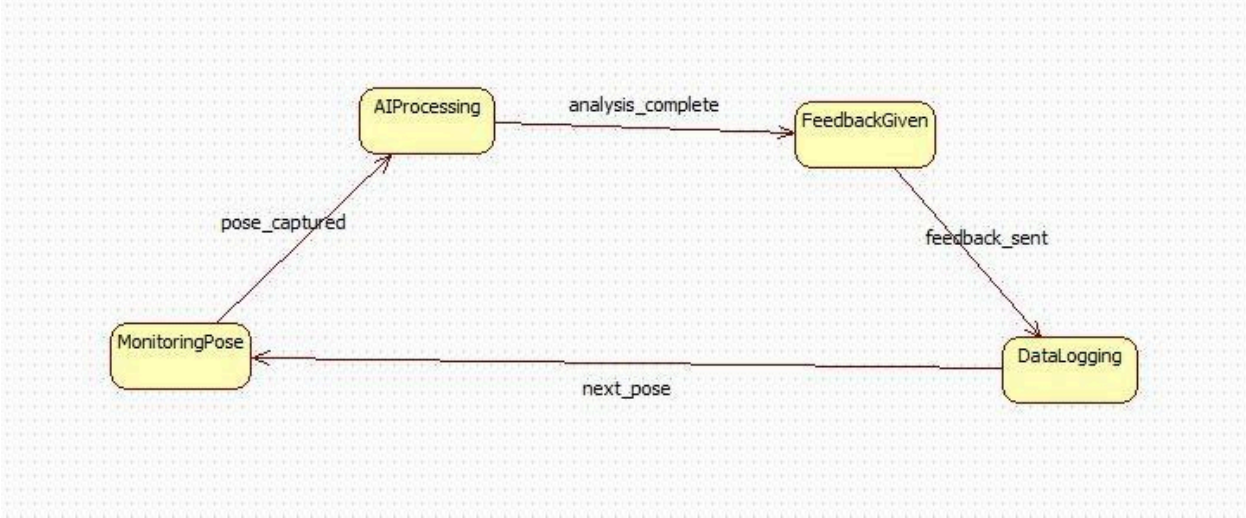
MatState defines mat operating states (IDLE, READY, SESSION STARTED, etc.).

UserLevel defines user experience categories (BEGINNER, INTERMEDIATE, ADVANCED).

These enums help enforce consistent state control.

Chapter 4: State Modeling





MAIN STATES

PowerOff

The mat is shut down and waiting to turn on. It protects battery and prevents accidental activation.

Idle

The system is powered and waiting for instructions. It keeps modules ready but inactive.

Pairing

The mat tries to connect to the user's phone or app. Successful pairing enables personalization and tracking.

Calibrating

Sensors are aligned and baseline posture is recorded. This ensures accurate pose recognition.

Ready

The mat is paired and calibrated. User profile and parameters are loaded, waiting for a session to begin.

SessionActive

The mat streams live sensor data, analyzes posture, and gives real-time feedback during yoga practice.

Paused
The session is temporarily stopped but can resume without losing progress.
Ended
The session is finished, either by the user or by timeout. Data is saved to history.
LowPower
The mat lowers power usage to avoid shutdown during use.
Error
A serious problem occurred (sensor or firmware failure). The system alerts the user and stops unsafe operation.

EVENTS

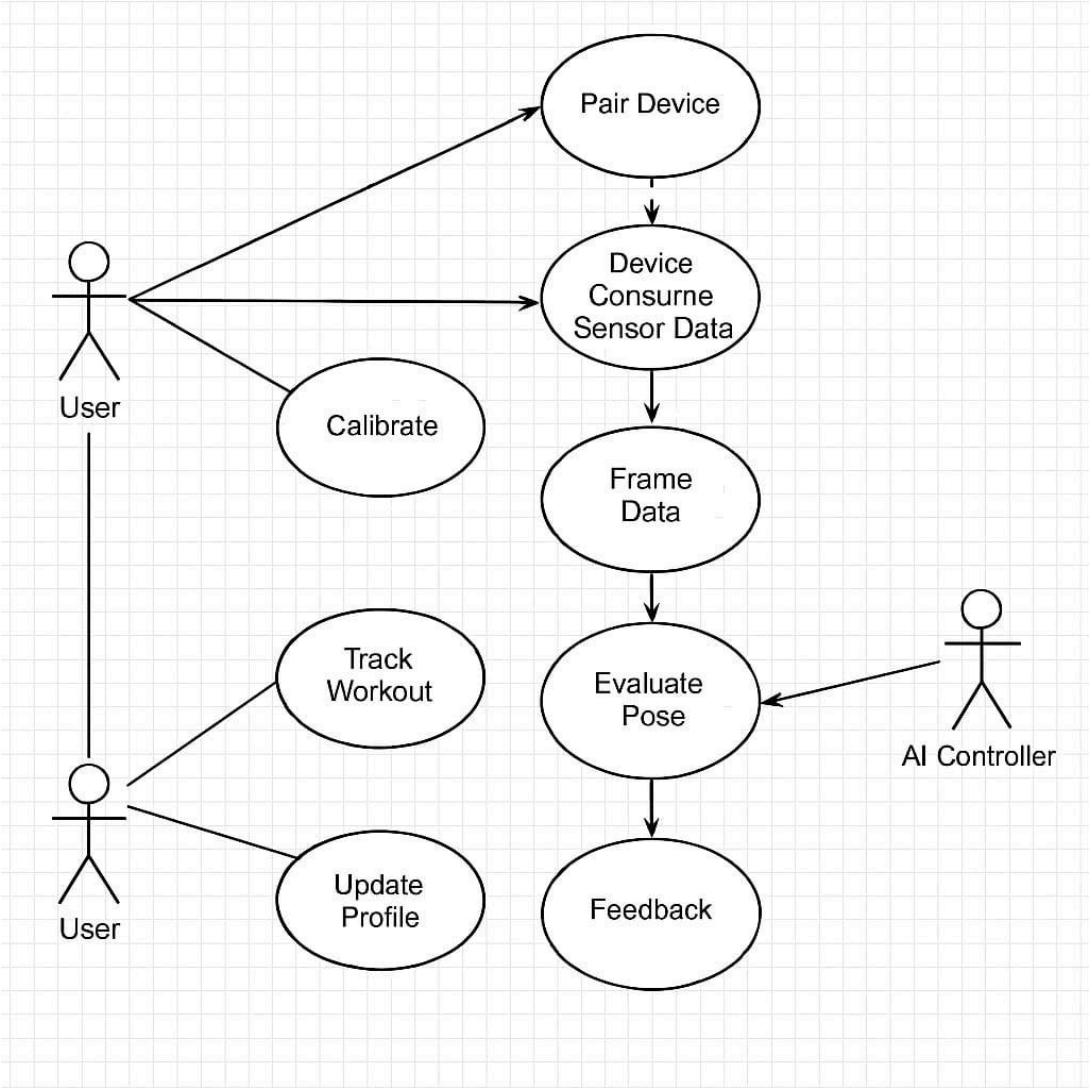
power_on – Moves from shutdown into idle.
pair_request / pair_success – Connects user account and device.
calibration_success – Confirms sensors are reliable.
session_start – Begins posture tracking and feedback.
session_paused / session_resume – Allows safe breaks.
session_end – Finalizes results and ends recording.
battery_low – Protects device from sudden shutdown.
sensor_error – Prevents giving wrong posture feedback.
feedback – Triggers audio or haptic coaching.
update_complete – Confirms firmware update finished safely.

POSE PROCESSING SUB-STATES

MonitoringPose
Sensors watch for a stable pose.
AIProcessing
The posture is analyzed by the AI model.
FeedbackGiven
User receives spoken or haptic correction.
DataLogging
Pose results are stored for progress tracking.
The loop restarts when the user moves to the next pose.

Chapter 5: Interaction Modeling

Use Case Diagram



ACTORS

User

The User is the primary actor who interacts with the smart yoga mat system. They pair the device, perform yoga sessions, receive feedback, track their workout progress, and update their personal profile. Their actions drive the entire system workflow.

AI Controller

The AI Controller is an external system or module that processes sensor data to evaluate user posture. It does not interact directly with the user, but supports the system by providing pose analysis, enabling real-time intelligent feedback.

USE CASES

Pair Device

Allows the user to connect the smart mat to their phone or app. This enables personalized tracking, settings synchronization, and secure data communication.

Calibrate

The user initializes sensor calibration before starting a workout. Calibration ensures that the mat correctly interprets posture pressure and alignment signals.

Device Consume Sensor Data

The mat continuously reads raw data from embedded sensors. This allows real-time detection of user movements and pose changes.

Frame Data

The system transforms raw sensor streams into usable data frames. This makes the information suitable for AI analysis and posture evaluation.

Evaluate Pose

The AI Controller analyzes formatted sensor data and determines whether the user is performing a yoga pose correctly. This is the core intelligence of the system.

Feedback

The system provides real-time guidance—audio, visual, or haptic—based on AI evaluation. This helps the user adjust their posture immediately.

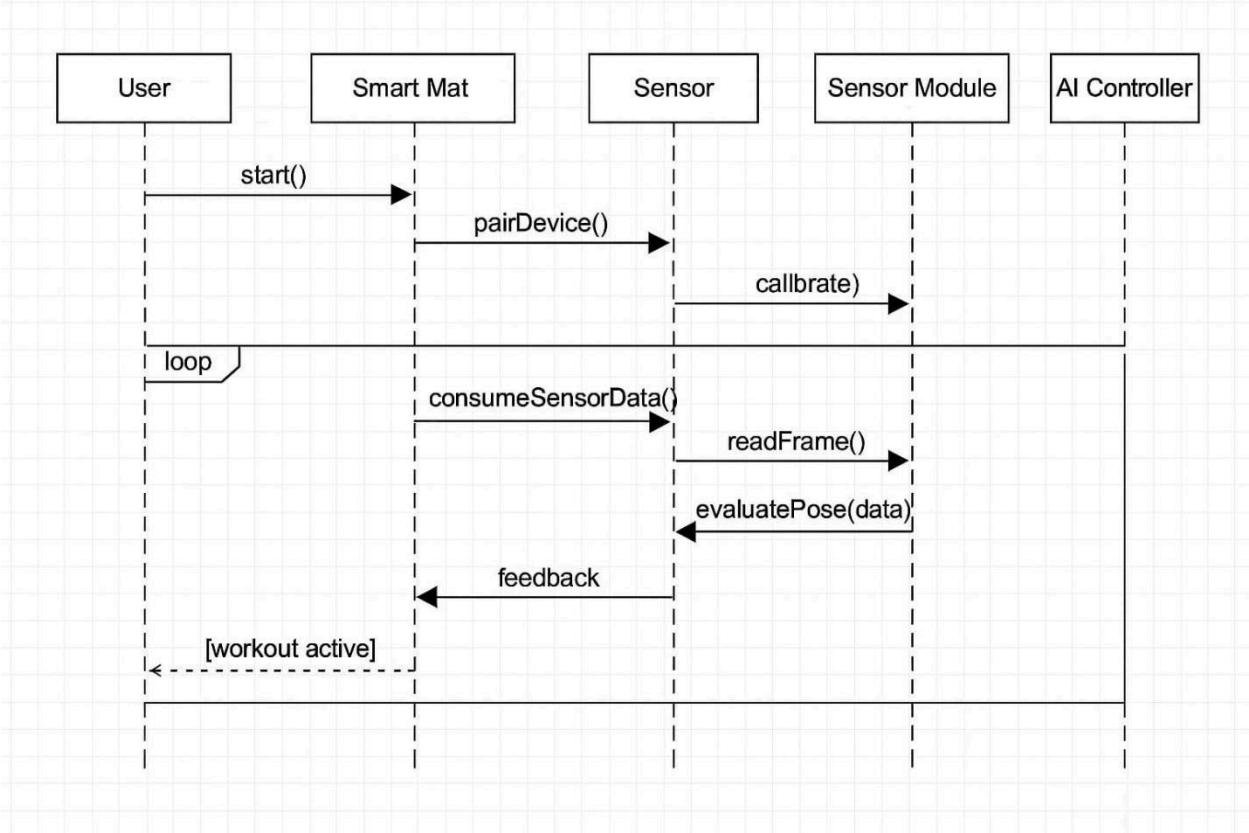
Track Workout

Allows the user to view session summaries such as pose accuracy, duration, calories burned, or improvements over time. Supports personal progress tracking.

Update Profile

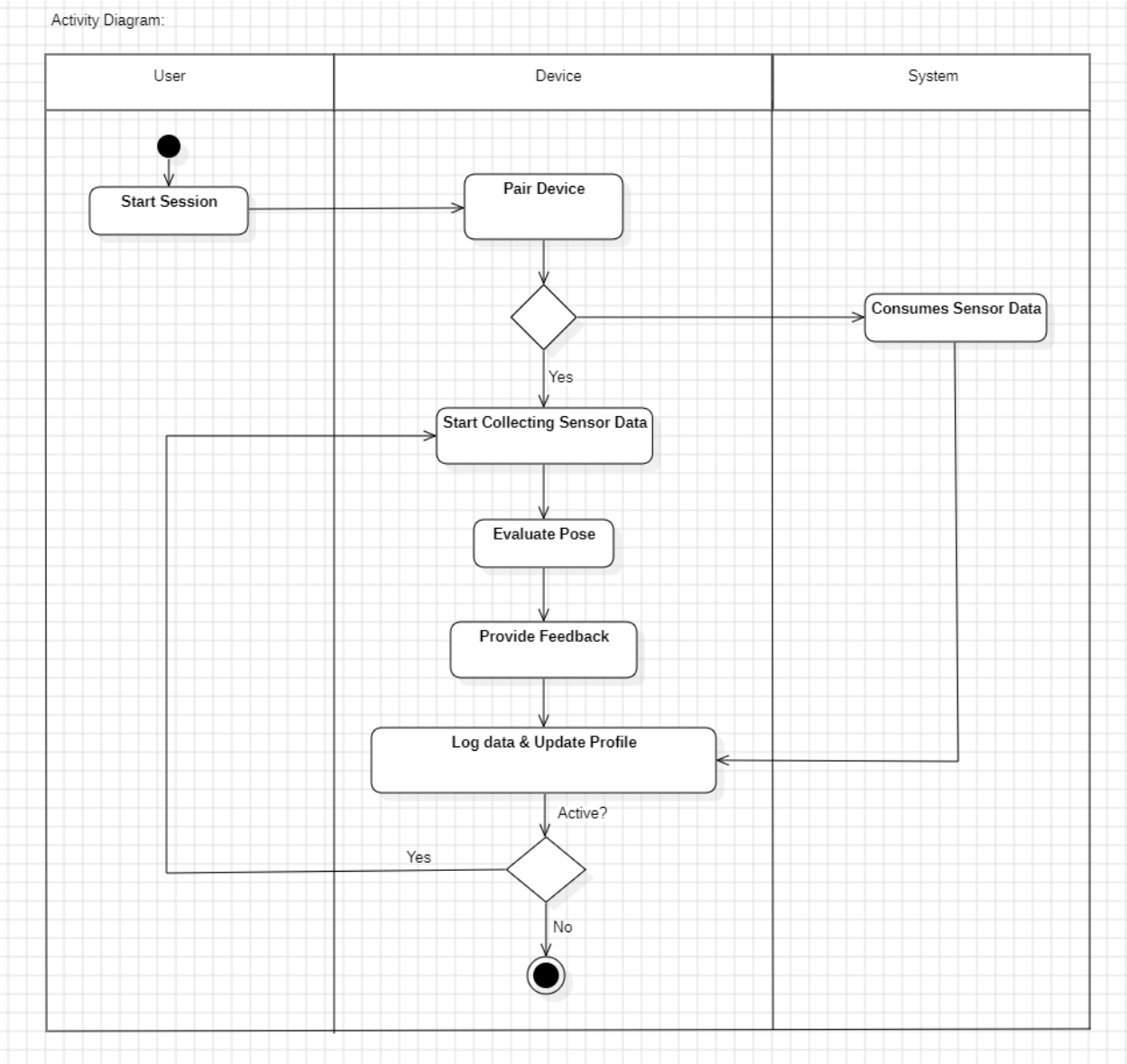
The user can update body measurements, skill level, or preferences. This helps the AI adapt feedback to different experience levels and physical conditions.

Sequence Diagram



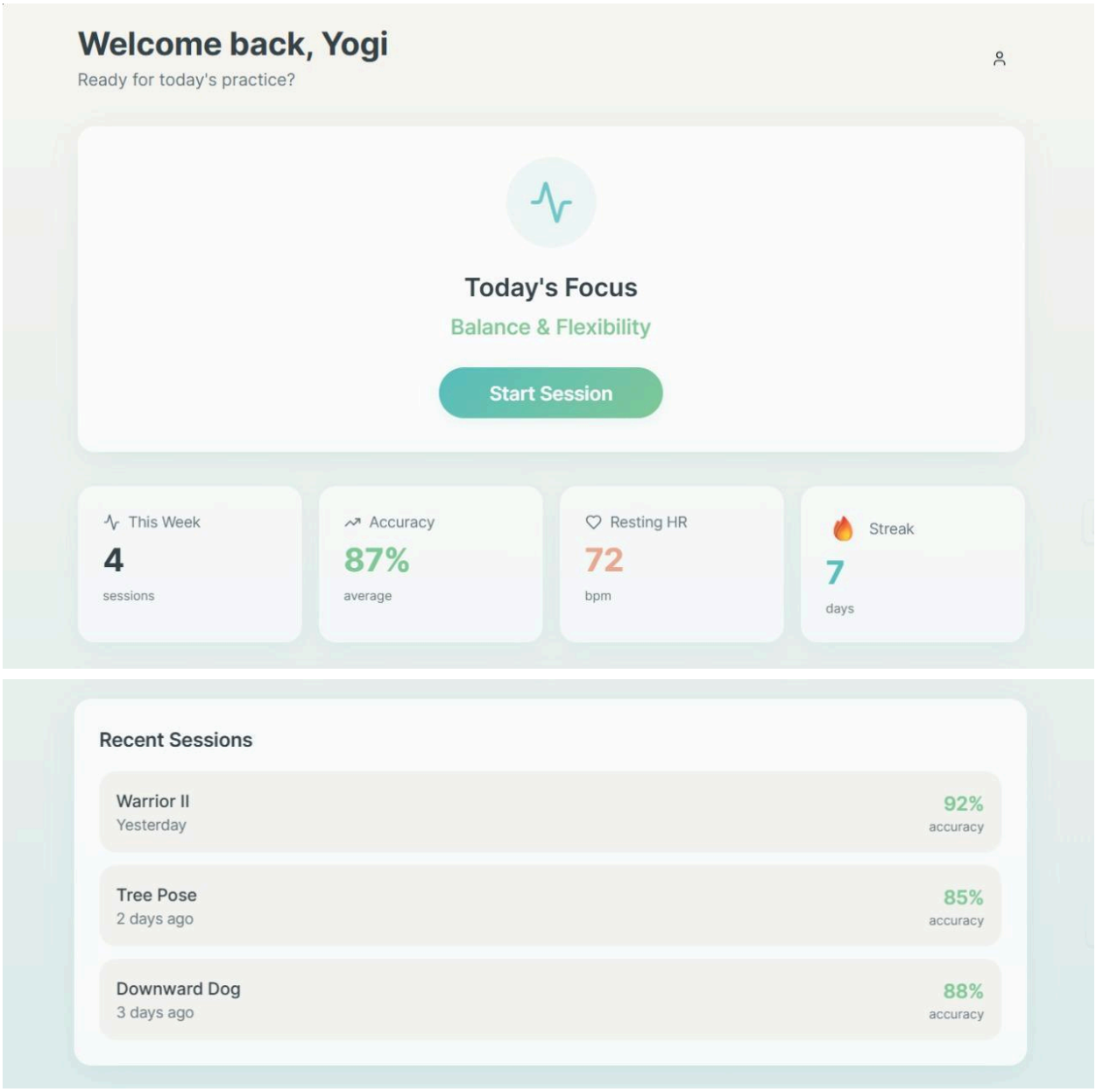
1. User sends start() to begin the yoga session.
2. Smart Mat calls pairDevice() to connect to sensors.
3. Smart Mat triggers calibrate() so sensors align correctly.
4. A workout loop begins while the session is active.
5. Smart Mat calls consumeSensorData() to get live readings.
6. Sensor Module runs readFrame() to collect sensor values.
7. Smart Mat sends data to AI using evaluatePose(data).
8. AI returns posture results and the Smart Mat gives feedback.
9. The loop repeats until the workout ends.

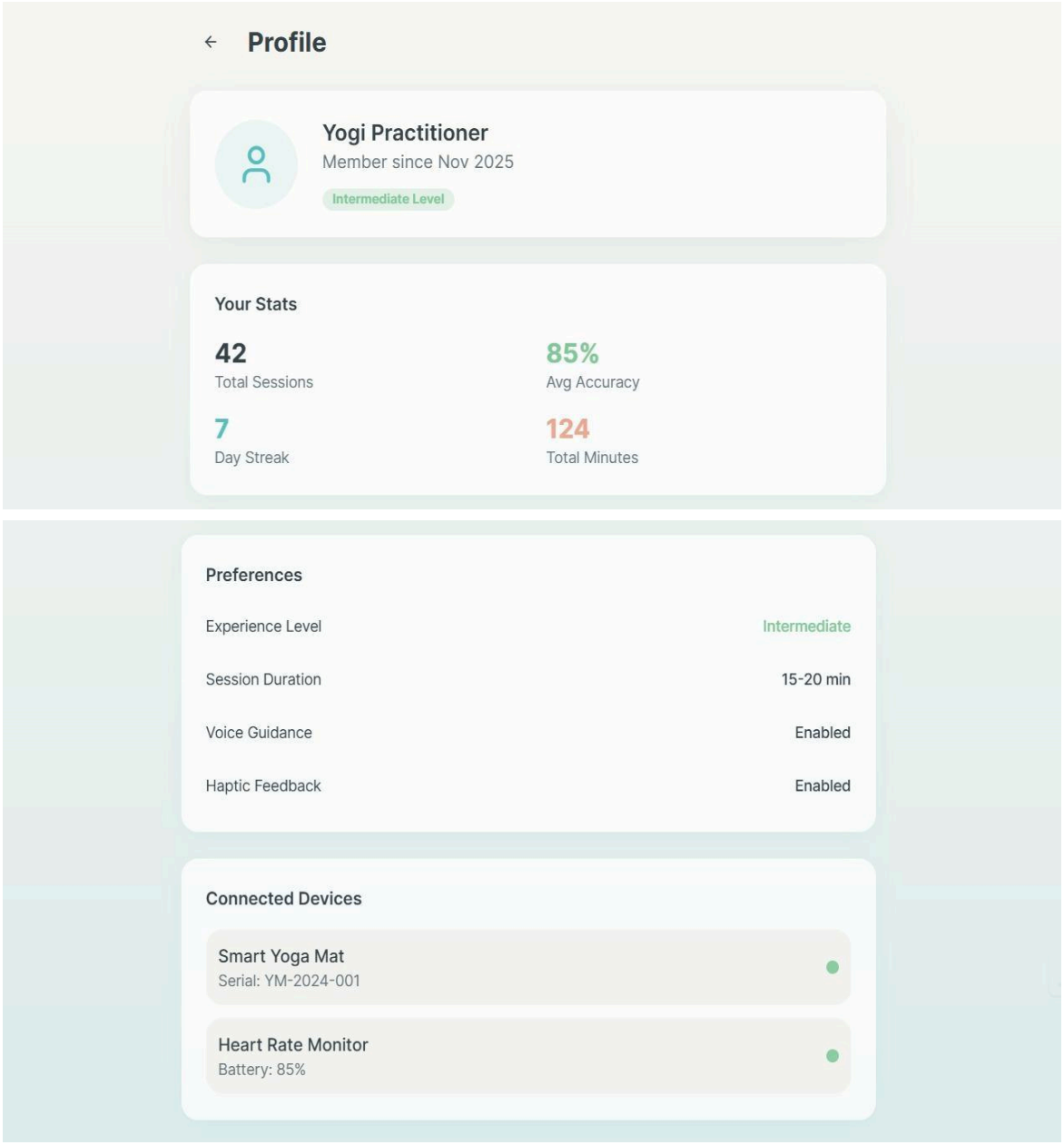
Activity Diagram

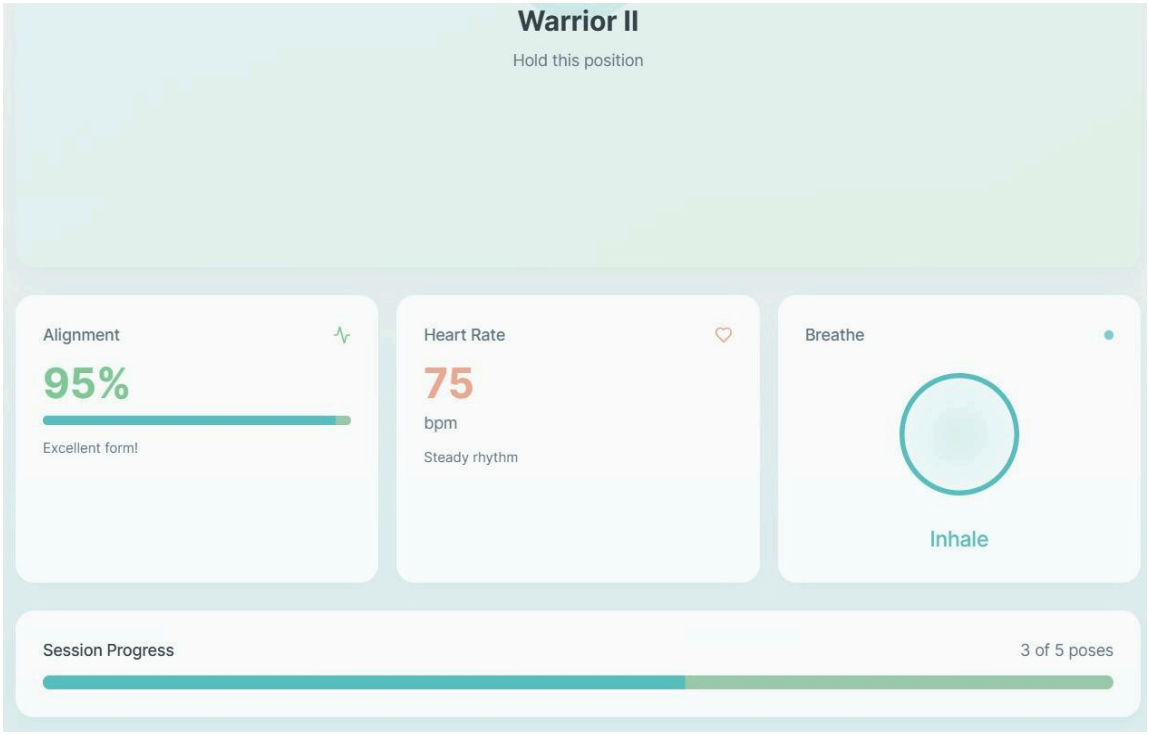


The activity diagram shows how a user session flows in the smart yoga mat system: the user starts a session, the device pairs, and if pairing is successful, it begins collecting and processing sensor data. The system evaluates the user's pose, gives feedback, and updates their profile. As long as the session is active, the cycle repeats. When the user stops, the session ends.

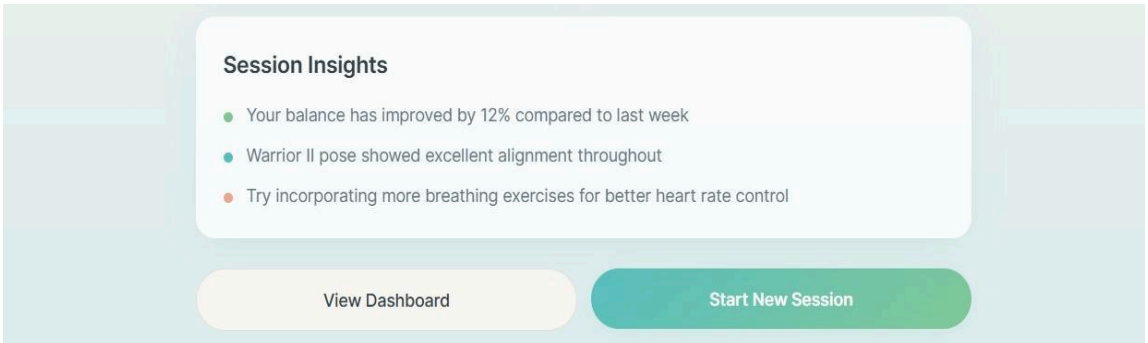
Chapter 6: UI Design with Screenshots




Profile
Yogi Practitioner
Member since Nov 2025
Intermediate Level
Your Stats
42
Total Sessions
85%
Avg Accuracy
7
Day Streak
124
Total Minutes
Preferences
Experience Level
Intermediate
Session Duration
15-20 min
Voice Guidance
Enabled
Haptic Feedback
Enabled
Connected Devices
Smart Yoga Mat
Serial: YM-2024-001
Heart Rate Monitor
Battery: 85%


Warrior II
Hold this position
Alignment
95%
Excellent form!
Heart Rate
75
bpm
Steady rhythm
Breathe
Inhale
Session Progress
3 of 5 poses


Outstanding Practice!
Session complete
0 min
Duration
95%
Avg Accuracy
82
Avg Heart Rate
3
Poses Completed


Session Insights
Your balance has improved by 12% compared to last week
Warrior II pose showed excellent alignment throughout
Try incorporating more breathing exercises for better heart rate control
View Dashboard
Start New Session