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15	Student Paper	
16	magnificent-cannoli-cd951c.netlify.app Internet Source	
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Executive Summary

EmotiTrack is a mobile and wearable supportive system to help emotional wellbeing of university students and other users who face stress related patterns, emotional overload or inability to regulate themselves. The system incorporates a mobile app, a smartwatch, a grounding and breathing exercise tool, wellbeing reminders and notifications, a historical overview and consent-based SOS support via the system.

The proposed solution is a combination of Artificial Intelligence and Machine Learning, Internet of Things, Cloud Computing and Big Data Analytics technologies. Using these technologies, authorised indicators of biometrics and behaviour can be analysed, real-time communication can take place, data can be held securely, and long term wellbeing insights can be provided. The project also takes into account privacy and security controls, such as encryption, role-based access control, consent management and audit logging, for sensitive user information.

The project was organised using Agile-Scrum into multiple development sprints – research, requirements, architecture, UI/UX design, prototyping, implementation, and evaluation. To support the creation of the high-fidelity alpha prototype, storyboard flows, navigation design, usability analysis, along with a coded breathing-exercise function were created in Figma which used HTML, CSS, and JavaScript. Examples of visual guidance, timing, audio feedback and user interactions are illustrated in the coded function.

EmotiTrack as a whole showcases the synergies that can be achieved by integrating mobile, cloud and wearable technologies to deliver accessible and proactive emotional wellbeing support. The program is designed not to diagnose mental health and/or distress disorders or to replace professional services. Rather, it seeks to make better use of emotional awareness, to aid in self-regulation, and to facilitate access to appropriate support to follow suit.

1.0 Introduction

Emotional well-being among students who are in university has become an increasingly visible concern, with many students experiencing stress, sensory overload, anxiety, and even difficulty regulating their emotions as part of everyday academic life. While a considerable number of digital tools already exist to support mental well-being, most of them depend on the user actively opening the application and choosing to engage with it, which is not always realistic during a moment of genuine distress. This report presents EmotiTrack, a mobile and wearable-based emotional wellbeing support system developed to close that gap by combining passive biometric monitoring with proactive, AI/ML-driven intervention.

The report documents the design, requirements, architecture, and prototype development of EmotiTrack as carried out for this assignment. It builds on the concept first proposed in Assignment 1, extending it with a clearer technology integration, a detailed technical architecture, a high-fidelity clickable prototype, and one coded key function demonstrating the system's core stress-detection logic. The sections that follow set out the background and problem that motivated the project, the proposed solution and the technologies behind it, the project's scope and methodology, its system requirements and architecture, and finally the design, implementation, and evaluation of the resulting prototype.

1.1 Project Background

A unique set of pressures is surrounding university students, such as academic pressure, financial pressure, social adjustment, and medical conditions such as anxiety, panic, autism, or even sensory dependence. In addition, pressures are built gradually and rise quickly when a student is already in trouble and may not have enough courage to ask for help or use this complicated tool.

At the same time, wearable technology such as smartwatches has become widely accessible and increasingly capable of tracking physiological indicators like heart rate, breathing, and movement, indicators that are already understood to correlate with stress and emotional state. This creates an opportunity that most existing well-being applications have not yet taken advantage of: rather than waiting for a student to notice their own distress and manually open an app, a system can use this passively collected data to notice a stress-related pattern earlier and offer support before the situation worsens. EmotiTrack was conceived against this

background, as a system that pairs a mobile application with smartwatch monitoring to make well-being support available proactively rather than only on request.

1.2 Problem Definition

Most digital well-being tools place the entire burden of initiating support on the user, when they are most likely not able to do so. This addresses the core problem which our project covers. A student experiencing sensory overload, a panic attack, or acute stress may lack the motivation, focus, or cognitive capacity needed to open an app, navigate its menus, and select an appropriate coping tool. This means the very moments when support would be most valuable are often the moments in which conventional mood-tracking or wellbeing apps are least likely to be used.

A related problem is the lack of a reliable, consent-based way for a student to bring a trusted person into the picture during a genuine emergency, without giving up control over their personal data or relying on a channel that assumes the caregiver has the same app installed and open. Existing solutions tend to treat passive monitoring, self-directed coping tools, and emergency communication as separate concerns, rather than as parts of one connected support process that responds to the user's actual state.

1.3 Vision and Mission

The vision behind EmotiTrack is a well-being support system that stays quietly present in the background of a student's day and becomes actively helpful the moment it is needed, without requiring the user to recognize their own distress and seek it out first.

To work toward this vision, EmotiTrack's mission is to combine passive biometric monitoring, AI/ML-based stress pattern detection, and accessible, calming intervention tools into a single connected experience, one that respects the user's privacy and consent at every step and that clearly positions itself as a supportive well-being tool rather than a substitute for clinical or professional mental health care.

1.4 Target Audience

University students are the main target audience for EmotiTrack, particularly those who face physiological problems such as stress, anxiety, panic attacks, and reduced emotional control due to their academic and social lives. Such users will find EmotiTrack beneficial as it enables access to emotional assistance during times of trouble without putting much effort into finding help.

A secondary audience consists of the caregivers, friends, family members, or counsellors that a student may choose to designate as trusted contacts within the app. While this group does not use EmotiTrack's core monitoring and intervention features directly, they interact with the system reactively, through the caregiver portal, whenever a user's SOS alert or specific well-being update is shared with them under the user's consent.

1.5 Proposed Scenario

Envision a student wearing a smartwatch and utilizing EmotiTrack as they go through an exhausting week filled with assignments and exams. During the day, the smartwatch monitors the student's heart rate, breathing rate, and movement without any need for the student to access the app. While the week progresses, EmotiTrack notes that the heart rate and breathing rate of the student have increased with a decline in the student's movement, which are indicators of heightened stress levels.

Instead of expecting the student to identify the need for calming themselves, EmotiTrack sends them a friendly notification offering a simple breathing technique to try. The student does the exercise on their phone, while EmotiTrack tracks this activity for future reference. On another instance, should the student need more immediate help or feel unsafe, they can trigger the SOS function. This way, the system can inform the designated support person of the student’s current status, and, if preferred, their location. In both cases, the student keeps control of the information but the system allows the user to stay free from the worry of having to obtain first the data that needs to be shared.

In general, the introduction highlights the background, problem, target group, and proposed scenario for EmotiTrack. In this regard, the next section is the proposed solution, which discusses features, integration of technology, social implications, and future improvements.

2.0 Proposed Solution

EmotiTrack is proposed as a mobile and wearable based emotional wellbeing support system to be used by University students and others who may be experiencing stress-related patterns, sensory over or needing support with regulating the self. It extends on the idea which was developed in Assignment 1 and adds the following components: clearer integration with technology, monitoring using an IoT-based wearables, stress detection based on AI/ML, grounding and breathing support, SOS alerts, caregiver communication, and a longer-term wellbeing report.

An objective of EmotiTrack is to get proactive and accessible support while someone is struggling with their well-being, instead of users having to look up information when they need it. The system aims to empower people to monitor their moods, identify their well-being trends, be supported with interventions, and share key alerts with trusted care takers as desired. EmotiTrack does not diagnose mental health problems, nor should it be used in lieu of professional mental health care. Instead, it is a supportive digital tool to help people know about their emotions, manage them, and get help early.

2.1 Solution Overview

EmotiTrack takes care of the fact that many wellbeing applications require the user to open the app and manually choose to respond to support options. In stressful moments users can be overwhelmed and may lack motivation and/or ability to use complex interfaces. Hence, EmotiTrack aims to be a proactive and user-centred system, available with both mobile interactiveness and smartwatch monitoring, AI/Ml based analysis and cloud-based support.

The mobile app is the initial point of contact for users. Users can access the app's dashboard, record their mood, review monitoring information, complete grounding and breathing exercises, view journal and history records, manage notifications, activate the SOS function and manage their privacy settings by using the app. The system can gather indicators of wellbeing with the addition of a compatible smartwatch - including HR, movement and activity pattern. These indicators assist with recognising potential stress-related trends, and can help the system respond quickly with wellbeing support.

EmotiTrack can offer the user appropriate supportive actions based on the information that the user inputted, data captured from the wearable, and preferences for privacy, which could include an oversimplified interface, grounding and breathing suggestions, gentle

notifications, haptic user feedback on the smartwatch, or access to SOS support. Selected alerts are also sent to the caregiver portal with the permission of the user and is accessible to authorised caregivers or trusted contacts. These support each other so together they form an integrated system of wellbeing support, which integrates and brings together self-monitoring, passive monitoring, supportive intervention and consent-based external support.

2.2 Key Features and Functionalities

EmotiTrack is an integrated approach to wellbeing that includes both active and passive elements. Active features enable users to record their feelings, genre grounding exercises, breathing techniques, previous records and enable the SOS support to go on. Passive features leverage existing body data and algorithms and AI/ML analysis to detect potential stress indicators and deliver support where and when needed. Table 1 provides a summary of the major features, functions and user benefits of these.

Table 1: *Key Features & Functionalities of the Enhanced EmotiTrack System*

Key Feature	Functionality	User Benefit
Dashboard	Provides a main screen that summarizes mood, well-being status, and key functions	Allows users to quickly understand their current well-being status
Mood Tracking	Allows users to record their emotional state and mood history	Helps users become more aware of emotional patterns over time
Live Monitoring	Displays well-being related indicators such as heart rate, activity, and stress level when wearable data is available	Supports continuous awareness of the user's well-being condition
Stress Detection Alerts	Provides alerts when possible stress-related patterns are detected.	Helps users receive support earlier instead of waiting until stress increases
Grounding Exercises	Provides guided grounding activities during stressful moments	Helps users focus and clam themselves using simple support techniques
Breathing Exercises	Provides step-by-step breathing guidance through the mobile app or wearable feedback	Supports self-regulation during stress-related situations
Journal / History & Insights	Stores previous mood entries, activities, and well-being trends	Helps users review long-term patterns and understand emotional changes.
Smartwatch Integration	Connects compatible wearable devices to collect biometric and activity-related data	Reduces the need for manual input during high-stress moments

SOS Button	Allows users to send an emergency alert to trusted contacts	Provides quick access to support during urgent situations
Caregiver Alert / Portal	Allows authorized caregivers to receive selected alerts based on user consent	Supports external assistance while maintaining user privacy
Notifications	Sends reminders, alerts, and well-being prompts	Encourages regular engagement and timely support
Privacy and Consent Settings	Allows users to control what data is shared and with whom	Protects sensitive well-being and biometric information
Adaptive UI	Simplifies the interface during stress-related situations	Reduces cognitive load and makes support tools easier to access

As shown in Table 1, EmotiTrack provides a combination of manual features and proactive support features. This makes this system more useful than a Mood Tracking App as it can be used before, during, and after a stress related situation.

2.3 Technology Integration

To enable the self-proclaimed functions, EmotiTrack combines four key technologies: Artificial Intelligence and Machine Learning, Internet of Things, Cloud Computing and Big Data Analytics. The technologies are chosen because they play a direct role in the system's intended functionality, which is: protecting the health of wearers, communicating with them in real time, intelligently interpreting the data, securely storing sensitive information, and providing long-term insights about health.

Table 2: *Technology Integration in EmotiTrack*

Technology	Role in EmotiTrack	Contribution to the Solution
Artificial Intelligence (AI) & Machine Learning (ML)	Interpretes biometric / behavioural data to identify any possible patterns of stress.	Supports preparation and help for wellbeing - proactive and personalized
Internet of Things (IoT)	Connects wearable devices and smartwatches with the mobile application.	Provides ability to passively collect biometric data such as heartbeat, motion, and activity.
Cloud Computing	Provides backstage processes of synchronization, backup, and information services.	Ensures integrity of the system and multi-user capability.
Big Data Analytics	Performs analysis of wellbeing data from the past and aggregated data.	Provides Like/Trend/Report on wellbeing trends.

As shown in Table 2, the selected technologies work together to make EmotiTrack more proactive and adaptive. AI/ML is used for intelligent stress related pattern detection, IoT is used for data collection using wears, Cloud Computing is used to operate the system in real time and Big Data Analytics is used to gain long term wellbeing insights. These technologies, when combined with one another, enhance the effectiveness of the solution.

2.4 Social Impact

EmotiTrack's contribution to social status is meaningful because it is designed to help students and users who might be experiencing stress, might be feeling overwhelmed by emotions, might have emotional overload, might have anxiety, and/or might have difficulty regulating their emotions. Often individuals may not seek help at first because there is too much to handle, not sure what to do, or don't know how to ask for help. EmotiTrack is a wellbeing app that offers easy to access wellbeing support with the use of a mobile app and/or optional smartwatch integration. Mood tracking, grounding exercises, breathing guidance, notifications and SOS alerts enable users to know their feelings and view tools that can help them when they need it.

This system also enables users to proactively deliver the awareness as a result of their identification of repeated wellbeing patterns in time. EmotiTrack's mechanism of detecting stress-related patterns by the user's wearable system with the help of AI/ML and proactively alerting them to take action before becoming highly stressful is novel. This can assist with an earlier response with calming activities, reduced interface direction and / or available and trusted support options. The system will hence make it easier to form healthy self-regulation habits and help the user to learn to cope with everyday stress on their own.

The consent-based caregiver support is also an important social contribution from EmotiTrack. The caregiver alert function supports trusted contacts to receive only particular alerts with the user's permission. This allows to keep a balance between user safety and privacy and personal control. Support for SDG 3: Good Health and well-being is also embedded in the project, including through raising emotional awareness, implementing safer practices around good digital wellbeing, and making good digital wellbeing support tools more accessible. EmotiTrack shouldn't be used to replace professional mental health care, however. What is its purpose to serve as a supportive wellbeing resource which can be used to help the user to be more aware and easily access services and help as required.

2.5 Future Enhancement Possibilities

Future improvement of EmotiTrack includes integration with the application with University counselling services or student wellbeing services. This would enable users to get formal help in an easier way if they need medical advice and keep the App more focused on giving emotional wellbeing support rather than medical diagnosis. Incorporating more explicit connections to wellbeing supports, emergency contacts and university support based on the user's preferences and consent in the system would also be useful.

An achievable improvement is the increase in wearables that can be compatible. In the future, the following may be supported: additional smartwatches, fitness bands, and health platforms for passive wellbeing monitoring, which can benefit more users. The most important functions of the mobile device, however, like mood tracking, grounding exercises, breathing instructions, and SOS support, should still be offered by the system to a user who doesn't own a wearable device.

The AI/ML can be enhanced incrementally with opt-in historic data too. This would enable the system to give more personalized wellbeing suggestions, depending on past mood inputs from the user, patterns of activities and favourite instruments of wellbeing. Other enhancements could be implementing support for other languages, adding accessibility features like larger text and screen reader support, offering optional audio guidance for calming exercises and providing access to some bare bones support tools offline. All of these improvements will help make EmotiTrack more functional, accessible and valuable in ways that do not compromise the user's privacy and consent.

The entire solution has been explained in detail regarding how EmotiTrack facilitates the users by means of its mobile and wearable capabilities, its technology integration, and the assistance for well-being on a consensual basis.

This is followed by the next section where we have defined the scope of the project.

3.0 Project Scope

Section 2.0 introduced the enhanced EmotiTrack solution and the technologies driving it. Before detailing system requirements and architecture in Section 5.0, this section defines the boundaries of the project — what EmotiTrack will and will not attempt to deliver within this assignment, and the objectives, deliverables, assumptions, and constraints that shape those boundaries. Establishing this scope clearly is what allows the requirements in Section 5.1 to be interpreted consistently by anyone reading this report without prior context.

3.1 Scope Overview

The scope of this project covers the design and prototyping of EmotiTrack as a proactive, passive digital wellbeing support system for university students. The three integrated platforms include a mobile application, a wearable app, and a caregiver web portal with AI/ML-enabled backend architecture. The scope and deliverable for Assignment 2 is a high-fidelity working prototype and one functioning code rather than a fully developed production application.

It must be repeated, as in Section 2.0, that EmotiTrack is a wellbeing support and awareness tool; it is important to distinguish it from a medical diagnostic device and a substitute for professional mental health care and therapy.

3.1.1 Scope Dimensions

To define this scope more precisely, it is useful to consider four dimensions commonly used to bound a system's scope: the people involved in system processing, the people who control the data involved, the amount of data processed, and the cost of system failure.

People involved in system processing: EmotiTrack involves three groups of people. End users are university students who generate mood, biometric, and journal data through everyday use. Caregivers (parents, friends, counsellors, or emergency contacts) are involved only reactively, receiving alerts when a user's SOS is triggered or when explicitly granted visibility into a user's status. System administrators are involved at the infrastructure level (Section 5.3) but do not have routine access to any individual user's personal data.

People who control the data: control over personal data rests primarily with the end user. Users decide what conditions and goals to disclose during onboarding (FR-02), whether to share their location during an SOS event (FR-08), and what caregivers may see (FR-12).

Caregivers control none of the user's data directly; their access is entirely dependent on permissions the user has granted, consistent with the Role-Based Access Control approach described in Section 5.3 and the privacy rules in Section 5.5.

Amount of data involved: the system spans two very different data volumes. Passive biometric monitoring (FR-04) generates a continuous, high-frequency stream of heart rate, breathing, and movement data for as long as a wearable is connected. Account, profile, and settings data (FR-01, FR-02, FR-12), by contrast, is comparatively small and changes infrequently. This distinction is why the architecture in Section 5.3 separates high-throughput stream processing from standard operational databases.

Cost of system failure: unlike most consumer applications, a failure in EmotiTrack does not only cost convenience — a failure in the SOS and caregiver alert pathway (FR-08, FR-09) carries a genuine safety cost, since it is the pathway a user depends on during a real emergency. This is why Table 11 sets a stricter reliability requirement (99.9% uptime) specifically for that pathway, rather than applying a single reliability standard across the whole system. Failures elsewhere in the system, such as a delayed history dashboard (FR-10), carry a much lower cost and are treated accordingly.

3.2 Scope Inclusion

The following features and components are included within the scope of this project:

Table 3: *Scope Inclusion*

Included Feature	Related FR(s)	Description
User registration, authentication & profile personalisation	FR-01, FR-02	Account creation, secure login, and onboarding personalisation based on user conditions and goals.
Smartwatch pairing & passive biometric monitoring	FR-03, FR-04	Bluetooth Low Energy connection to a wearable and continuous background collection of heart rate, breathing, and movement data.
Real-time AI/ML stress detection & alerting	FR-05, FR-06	Real-time classification of user state and an in-app alert when elevated stress is detected.
Grounding & breathing guidance	FR-07	Personalised guided exercises offered in response to detected stress.

SOS emergency trigger & caregiver alert dispatch	FR-08, FR-09	User-activated emergency alert with confirmation step, dispatched to pre-set caregivers.
History & insights dashboard	FR-10	Historical mood/stress trend viewing across selectable time ranges.
Notification management	FR-11	Multi-channel alert delivery via push, SMS, and email.
Profile & privacy settings	FR-12	Central management of caregiver access, notification preferences, and privacy settings.
High-fidelity clickable prototype	—	A 15-screen interactive Figma prototype spanning mobile and wearable interfaces (Section 6.4, 6.5).
One coded key function	—	A working implementation of one function, demonstrated outside the static prototype (Section 6.6).

3.3 Scope Exclusion

In order to ensure the project remains feasible according to the given deadline while maintaining EmotiTrack's unique position of being perceived as a wellness product instead of a medical device, the following items have been excluded from the project's objectives:

Table 4: *Scope Exclusion*

Excluded Item	Reason for Exclusion
Clinical diagnosis or psychiatric assessment	Maintains EmotiTrack's positioning as a wellbeing and awareness tool rather than a medical device.
Therapy, counselling, or medication management integration	Falls outside the scope of a self-directed support and awareness tool.
Direct dispatch to emergency services	The SOS feature notifies pre-set caregivers only; direct dispatch would introduce liability and complexity beyond this project's scope.

Integration with hospital or clinical EHR systems	Would introduce significant compliance and security requirements beyond the assignment's timeframe.
Multi-language support	The prototype is developed and evaluated in English only for this assignment.
Payment, subscription, or monetisation functionality	Not relevant to demonstrating the system's core wellbeing functionality.
A fully deployed, production-ready backend	The architecture (Section 5.3) is designed at a conceptual level; full deployment is beyond this assignment's scope.
Training of a real, production-grade machine learning model	Stress detection is simulated in the prototype rather than powered by a model trained on real biometric datasets.

As Tables 3 and 4 show together, the exclusions largely mirror the non-functional requirements discussion in Section 5.1.2: where any feature that might cause major burdens in security, compliance or clinical liability (e.g., EHR integration or emergency service dispatch) has been excluded in regard to the student prototype of this magnitude.

3.4 Project Overview

With the inclusions and exclusions defined, this subsection sets out the concrete objectives, deliverables, assumptions, and constraints that govern how the team executes within that scope.

3.4.1 Project Objectives

Table 5 sets out the project's five core objectives, each linked to the reason it matters for the overall assignment.

Table 5: *Project Objectives*

#	Objective	Why It Matters
1	Deliver a high-fidelity clickable prototype covering all 15 identified screens across the three core user journeys.	Demonstrates FR-01 to FR-12 (Table 10) in an interactive, testable form.

2	Implement and demonstrate one coded key function representative of the system's core intelligence.	Provides tangible evidence the AI/ML-driven stress detection concept (Section 5.3) is technically feasible.
3	Apply Agile methodology across defined sprints with clearly assigned roles.	Ensures iterative delivery and even distribution of work across the team (Section 4.0).
4	Evaluate the final design against Nielsen's 10 Usability Heuristics.	Validates that the interface remains usable under the high-cognitive-load conditions described in the target persona.
5	Produce a complete, well-linked project report addressing all assignment requirements.	Meets the assessment's documentation standard, incorporating lessons from Assignment 1 feedback.

As Table 5 shows, the objectives are ordered to move from concrete prototype delivery (Objectives 1-2) through process and evaluation (Objectives 3-4) to documentation (Objective 5)—reflecting the same build-then-validate-then-report structure used throughout this report

3.4.2 Deliverables

Table 6 lists the concrete artefacts the team will submit at the end of this assignment, each traceable back to a specific report section.

Table 6: *Project Deliverables*

Deliverable	Description
Clickable Figma prototype	15 interconnected high-fidelity screens spanning Normal Mood Tracking, Stress Alert & Grounding, and SOS & Caregiver Alert journeys, wired with functioning taps, delays, and transitions (Section 6.4).
Coded key function	A working implementation of one selected function (Section 6.6), demonstrating core logic outside of the static prototype.
Storyboards & screen documentation	Three journey storyboards (Section 6.3) and a full screen-by-screen gallery (Section 6.5) mapped to functional requirements.
System requirements documentation	Functional and non-functional requirements, platform justification, and data/privacy rules (Section 5.1, 5.2, 5.5).

Final written report	This document in full, including design analysis, team analysis, and conclusion (Sections 7-9).

3.4.3 Assumption

The following assumptions were made in scoping and designing EmotiTrack, primarily concerning the devices, connectivity, and data available to a real user, since these cannot be fully verified within an academic prototype:

- Users have a smartphone working on the latest version of either iOS/Android and also possess a smartwatch that runs on either WatchOS or Wear OS.
- Few affirmatives that the users always have a good WiFi connection or Bluetooth connection to enable the connection between the mobile app and the smart device.
- Users are proficient in English, as the prototype is designed and tested in English only for this assignment.
- Users are willing to grant the permissions required for passive monitoring (Bluetooth, notifications, and location during an SOS event).
- For the purposes of this prototype, biometric and stress-detection data are simulated rather than sourced from a live, trained ML model or real wearable hardware.
- The target users are university students aged 18 and above, consistent with the persona profiles developed in Assignment 1.

3.4.4 Constraints

The project needs to be accomplished in the twelve-week period mentioned in the assignment timetable (April 30, 2026 – July 12, 2026).

- The group has no funding for paid API services, cloud hosting, or advanced design software. Therefore, all the work is based on free educational tools and free-tier services/solutions (Figma, free cloud service).
- The group consists of five students working on specific segments of the project, which restricts how deep each feature can be developed compared to a professional team.
- The team has no tangible wearable devices for carrying out complete testing from start to end; the use of wearables is being imitated in the prototype, not tested on actual equipment.

- The system is not checked for safety or compliance against GDPR or PDPA (a proper audit that is necessary for a healthcare-related software).
- One feature is functioning (in Section 6.6) while the rest of the solution is demonstrated on the prototype and not via working backend.

Taken together, these objectives, deliverables, assumptions, and constraints define the practical envelope within which EmotiTrack was designed. The following section (4.0 Software Development Methodology) explains how the team organised its process — sprint structure, roles, and tools—to deliver against this scope within the stated constraints

4.0 Software Development Methodology

This section will discuss the methodology of software development followed for EmotiTrack project management. This section will discuss the methodology of choice, rationale for its selection, project planning strategy, sprint planning, Gantt chart, roles and responsibilities of the team members, and tools followed during the software development process. As the EmotiTrack project entails UI/UX Design, integration with wearables, technical architecture, high-fidelity prototype building, and report writing, a systematic methodology was essential.

4.1 Selected Methodology and Rationale

The development approach that was used for EmotiTrack software is Agile-Scrum. The rationale for selecting this approach was due to the nature of the project which involved iterative planning, improvement and collaboration. EmotiTrack was not developed as a full-fledged beta application; rather, it was more important to develop an alpha prototype, architectural structure, storyboard, coding of functionality and usability assessment. Hence, the Agile-Scrum methodology proved to be apt as it enabled the developers to improve the various aspects of the project in small sprints.

The Agile-Scrum methodology also aligns with the nature of the HCI project since user interface design usually involves the need for re-evaluation and enhancement. There was a need for improvement of the EmotiTrack prototype due to the feedback from the lecturer, team consultations, user requirements, and usability rules. Unlike linear methodology that involves only one execution of every step, in Agile-Scrum it was possible to re-evaluate and enhance the project idea, prototype screens, navigation sequence, architecture diagram, and sections of the report during development.

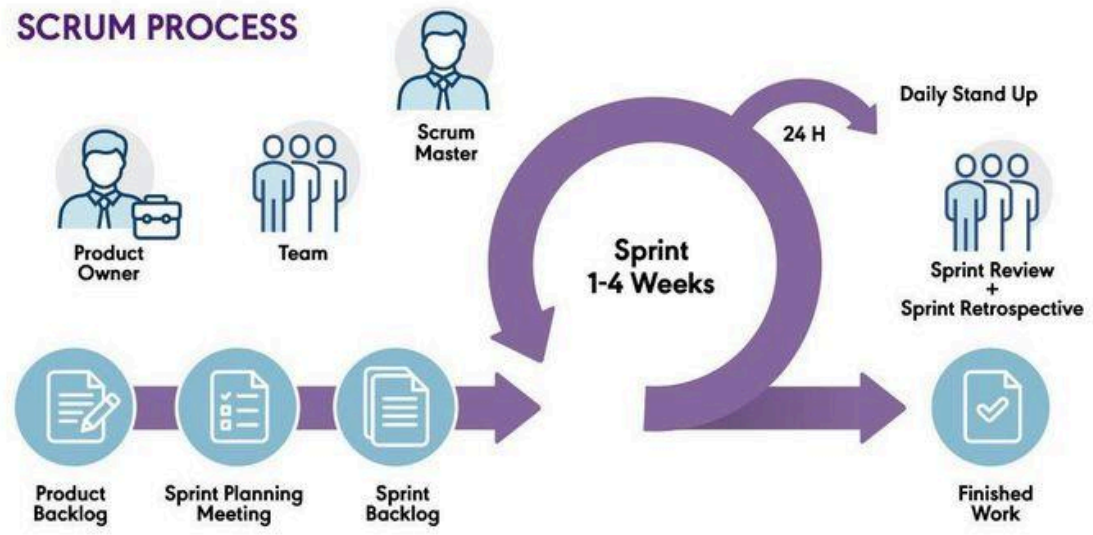


Figure 1: *Scrum Process Used for EmotiTrack Development*

Figure 1 shows the Scrum process adopted for the project management of the entire project. The Scrum process starts with the product backlog in which the core tasks for the project are listed and prioritized. The next step is to select the tasks during the sprint planning session and list them in the sprint backlog. In the sprint, the team works on the selected tasks, evaluates the progress, and performs a review of the completed tasks before proceeding to the next sprint.

4.2 Project Planning and Timeline

The EmotiTrack was planned in accordance with the Assignment 1 and Assignment 2 schedule. Assignment 1 started in Week 1 and was submitted by Week 7, while Assignment 2 started in Week 2 and ended in Week 12. The work was split up into eight sprints in order to plan the project from the initial idea conception to the approval of the executive summary and from there to the final prototype. This approach helped the team divide the load of work.

4.2.1 Sprint Planning

EmotiTrack's sprint planning has been done taking into account the major tasks involved in Assignment 1 and Assignment 2. The team members have briefly reviewed each sprint in order to assess their progress, identify any problems, and modify the next tasks if needed.

Table 7: *Sprint Planning for EmotiTrack*

Sprint 1: Project Initiation, Lecturer Consultation, and Executive Summary
1.1. Form Project Group
1.2. Brainstorm Innovative Project Ideas
1.3. Select The SDGs As The Project Focus
1.4. Define The Initial Concept And Target Users
1.5. Conduct Lecturer Consultation To Discuss The Initial Idea And Receive Early Feedback
1.6. Improve The Project Idea Based On Lecturer Feedback And Team Discussion
1.7. Prepare Assignment 1 Executive Summary
1.8. Submit Executive Summary By Week 3
1.9. Receive Approval To Proceed With The Full Report
1.10. Sprint Review
1.11. Sprint Retrospective
Sprint 2: Problem Definition And User Research
2.1. Sprint Planning
2.2. Define The Problem Statement
2.3. Identify The Target Audience And Proposed Scenario
2.4. Prepare User Research Questions

2.5. Distribute Questionnaire Using Google Forms
2.6. Collect And Analyze User Responses
2.7. Identify User Needs, Pain Points, And Expectations
2.8. Sprint Review
2.9. Sprint Retrospective
Sprint 3: Assignment 1 Requirements And Initial System Design
3.1. Sprint Planning
3.2. Define System Scope And Limitations
3.3. Identify Functional Requirements
3.4. Identify Non-Functional Requirements
3.5. Prepare Data Requirements
3.6. Create Initial Architecture Diagram
3.7. Identify Initial Technologies And Resources Used
3.8. Sprint Review
3.9. Sprint Retrospective
Sprint 4: Assignment 1 Prototype And Report Finalisation
4.1. Sprint Planning
4.2. Create Low-Fidelity Prototype Screens
4.3. Apply Nielsen's 10 Usability Principles To The Initial Prototype
4.4. Explain Application Flows Such As Onboarding, Monitoring, Grounding, SOS, History, Profile, And SmartWatch Interaction
4.5. Finalise Assignment 1 Report Sections

4.6. Check References And Formatting
4.7. Submit Assignment 1 Report In Week 7
4.8. Sprint Review
4.9. Sprint Retrospective
Sprint 5: Assignment 2 Upgrade And Technical Architecture
5.1. Sprint Planning
5.2. Review Assignment 1 And Identify Improvement Areas
5.3. Upgrade The EmotiTrack Concept For Assignment 2
5.4. Define The Enhanced Technology Integration
5.5. Improve The Technical Architecture Diagram
5.6. Explain System Components And Data Flow
5.7. Prepare Platform Choice And Technology Stack Sections
5.8. Sprint Review
5.9. Sprint Retrospective
Sprint 6: UI/UX Design, Storyboard, And Navigation Flow
6.1. Sprint Planning
6.2. Develop The Design Theme And Style Guide
6.3. Finalise Logo, Colour Palette, Typography, And Icons
6.4. Create Storyboards Flows
6.5. Prepare Navigation Flow Diagram
6.7. Sprint Review

6.8. Sprint Retrospective
Sprint 7: High-Fidelity Prototype And Coded Key Function
7.1. Sprint Planning
7.2. Design High-Fidelity Mobile App Screens In Figma
7.3. Design Smartwatch Interface Screens
7.4. Build Clickable Prototype Interactions
7.5. Link Screens According To Storyboard And Navigation Flow
7.6. Select One Coded Key Function
7.7. Implement The Coded Key Function
7.8. Capture Output And Screenshot Evidence
7.9. Sprint Review
7.10. Sprint Retrospective
Sprint 8: Final Documentation and Presentation
8.1. Complete Design Analysis And Nielsen's 10 Usability Evaluation
8.2. Complete Team Analysis And Lessons Learned
8.3. Finalise Report Formatting And References
8.4. Prepare Presentation Slides
8.5. Submit Assignment 2 In Week 12

According to Table 7, the EmotiTrack project consisted of eight sprints for both Assignments 1 and 2. These sprints were helpful for the team to structure the project work gradually, from the start of the project right up to documentation, starting with the initial stage of initiating the project and consulting the lecturer, then user research, design, prototyping, and finally documentation.

4.2.2 Gantt Chart

For the depiction of the entire duration of the project as well as how the eight sprints were allocated from Week 1 to Week 12, the Gantt chart is what was used. The use of the chart will enable you to see all the activities carried out during the project, the members who handled them, and even the major dates for the submission of the various tasks.

A clearer view of the Gantt Chart is available on this link: Gantt Chart- EmotiTrack

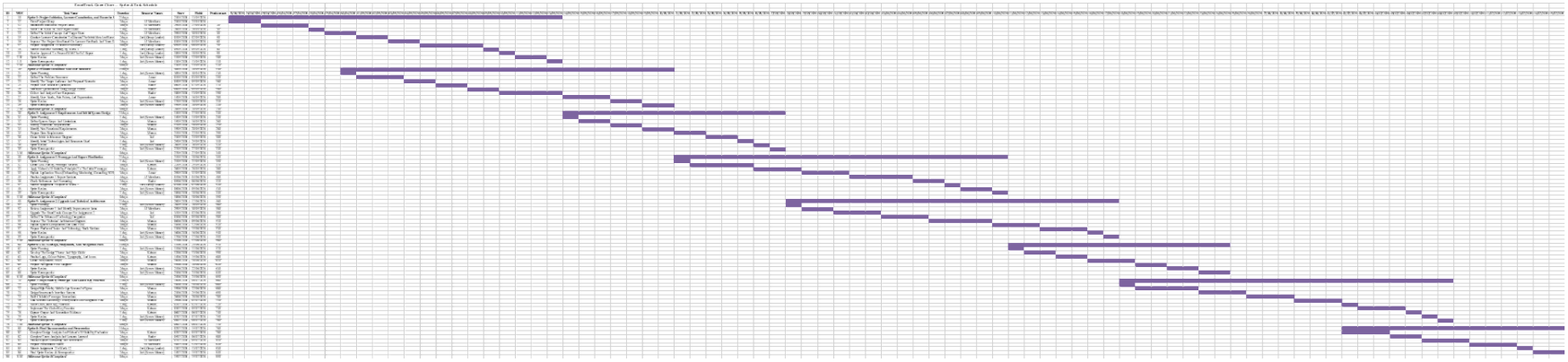


Figure 2: *EmotiTrack Project Gantt Chart*

As seen in Figure 2 above, the project activities were sequenced in a flexible and iterative way using sprints. There was an overlap of tasks since assignment two began even before the first assignment was completed. This enabled the team to start working on refining the concept and developing the high-fidelity prototype simultaneously.

4.3 Team Roles and Responsibilities

Responsibilities of the group were shared in accordance with the major parts of Assignment 2. This enabled the members to distribute tasks among themselves while not excluding the process of checking each other's work. Juri was our leader who controlled the flow of communication and ensured that the end result met the assignment requirements.

The table 8 below shows the task distribution among the team members for Assignment 2

Table 8: *Team Roles and Responsibilities*

Team Member	Group Position	Assigned Tasks
Juri	Group Leader	Executive Summary, 4.0 Software Development Methodology, 5.0 System Requirements and Architecture, 9.0 Conclusion and Future Enhancement
Bader	Team Member	2.0 Proposed Solution, 4.0 Software Development Methodology, 8.0 Team Analysis
Marwa	Team Member	3.0 Project Scope, 5.0 System Requirements and Architecture, 6.0 Design and Implementation
Keitaro	Team Member	6.0 Design and Implementation, 7.0 Design Analysis
Ansar	Team Member	1.0 Introduction, 6.0 Design and Implementation

Even though individual team members had specific segments to work on, the entire assignment was done in collaboration, where group discussions, reviews, and feedback took place. This way, all segments of the report, prototype parts, and presentation material would be congruent with EmotiTrack.

4.4 Tools Used

Below are the tools that have been used to support the processes of communication, documentation, design, prototyping, and project management. This has enabled the group members to collaborate and complete the deliverables within the deadline of the assignment.

Table 9: *Tools Used in EmotiTrack*

Tool	Purpose in the Project
Google Docs	Used for report writing, editing, formatting, and combining team sections.
Google Drive	Used for file sharing, document storage, screenshots, version access.
WhatsApp / Google Meet	Used for team communication, quick updates, discussion, and task coordination
Figma	Used to design the high-fidelity alpha prototype, prototype screens, and clickable interaction flow.
EdrawMax	Used to create and improve diagrams, visual layouts, navigation flow, and supporting visuals.
Google Forms	Used to collect user research responses and understand user needs.
Microsoft Excel / Google Sheets	Used for task distribution, sprint planning, timeline organization, and Gantt chart preparation.
Visual Studio Code	Used to write and test the HTML/CSS/JavaScript-coded key function (breathing and grounding guide)
Online research databases and academic sources	Used to find supporting literature, references, and background information for the report.
Web Browser (Chrome/Edge)	Used to run and demonstrate the coded key function, since it executes client-side without a server.

As can be noted in Table 9 below, the selected tools proved quite useful in both the prototyping process and in the management of the project. Communication and documentation tools helped in the coordination of the report, whereas Figma, EdrawMax, and Visual Studio Code helped in designing and coding EmotiTrack features.

The following section present EmotiTrack system requirements and architectural design

5.0 System Requirements and Architectural

While Section 4.0 illustrates the methodology of Agile-Scrum that has been adopted for developing EmotiTrack, this section, however, deals with EmotiTrack from a product perspective. The focus of this section is on what EmotiTrack needs to do, which includes its functional and non-functional requirements, architecture, platforms and principles applied to the data collected by EmotiTrack. Thus, this section lays a foundation for Section 6.0, which will turn these specifications into the actual interface.

5.1 System Requirements Overview

Functional requirements (FR) describe discrete capabilities the system must provide to the user. Non-functional requirements (NFR) describe the quality attributes — performance, security, reliability — that those capabilities must meet in order to be usable and trustworthy for a wellbeing and safety-critical application. These requirements were derived from the persona profiles, survey findings, and problem definition established in Assignment 1, and they directly shape the architecture described in Section 5.3.

5.1.1 Functional Requirements

Twelve functional requirements were identified, spanning onboarding, passive monitoring, stress intervention, and emergency response.

As Table 10 shows, the requirements follow the user's journey in order — from account creation (FR-01 to FR-03) through passive monitoring and stress response (FR-04 to FR-09) to ongoing insight and control (FR-10 to FR-12). This ordering mirrors the three storyboard journeys presented in Section 6.3, so each functional requirement can be traced directly to a screen a reader can click through in the prototype.

Table 10: *Functional Requirements*

ID	Requirement	Description	Demonstrated In
FR-01	User Registration & Authentication	Users can create an account, log in, and securely authenticate using email/password or biometric login on supported devices.	Onboarding / Login
FR-02	Profile Personalisation	Users select relevant conditions (e.g. anxiety, sensory overload) and a primary wellbeing goal during setup to personalise interventions.	Personalize Profile
FR-03	Smartwatch Pairing & Data Sync	Users can connect a compatible smartwatch (WatchOS/Wear OS) via Bluetooth Low Energy to enable passive biometric collection.	Connect Smartwatch
FR-04	Passive Biometric Monitoring	The system continuously and passively collects heart rate, breathing rate, and movement data from the connected wearable without requiring manual input.	Live Monitoring
FR-05	Real-Time Stress Detection	The AI/ML engine analyses incoming biometric data in real time and classifies the user's state as stable or elevated stress.	AI Analysis / Elevated Stress Detected
FR-06	Stress Alert Notification	When elevated stress is detected, the system notifies the user via an in-app alert describing the detected pattern.	Elevated Stress Detected
FR-07	Grounding & Breathing Guidance	Users can access guided grounding or breathing exercises, personalised to what has been effective for them previously.	Grounding Prompt / Breathing Guide / Session Complete

FR-08	SOS Emergency Trigger	Users can activate an SOS alert from the Home screen, with a confirmation step to prevent accidental activation.	Confirm SOS
FR-09	Caregiver Alert Dispatch	On SOS confirmation, the system notifies pre-set caregivers with the user's status and, if permitted, their location.	SOS Alert Sent
FR-10	History & Insights Dashboard	Users can view historical mood and stress trends, including common triggers, over selectable time ranges (day/week/month).	History & Insights
FR-11	Notification Management	The system delivers alerts and updates via push notification, SMS, or email depending on user and caregiver preferences.	Profile & Settings (Notifications)
FR-12	Profile & Privacy Settings	Users can manage caregiver access, notification preferences, and privacy/data settings from a central settings screen.	Profile & Settings

Each requirement is expanded below to clarify its purpose beyond the table summary:

FR-01 (Account setup & authentication): Before all other functions can be accessed and utilized, one must first be given a chance to set up an account and sign back in after registration. This expression includes the creation of an account with using email and password, verification of credentials before every time one logs in as well as biometry log-in when it is possible.

FR-02 (Profile Personalisation): During onboarding, the user selects relevant conditions they experience (anxiety, panic attacks, autism, sensory overload) and a primary wellbeing goal. This matters because later interventions — particularly which grounding or breathing exercises are suggested — depend on knowing enough about the user's baseline needs from the outset.

FR-03 (Smartwatch Pairing & Data Sync): The user connects a compatible smartwatch over Bluetooth Low Energy. This is what makes passive monitoring possible at all — without a successfully paired device, EmotiTrack has no continuous biometric data source and falls back to manual mood logging only, defeating the app's proactive premise.

FR-04 (Passive Biometric Monitoring): Once connected, the system continuously collects heart rate, breathing rate, and movement data in the background, with no manual input required. This is what most distinguishes EmotiTrack from conventional mood-tracking apps that depend on the user remembering, and being willing, to log how they feel.

FR-05 (Real-Time Stress Detection): The system analyses the incoming biometric stream in real time and classifies the user's state as stable or showing elevated stress. This depends on the AI/ML Engine (Section 5.3), and its accuracy determines whether FR-06/FR-07 trigger appropriately — neither missing genuine stress events nor over-alerting on normal fluctuations.

FR-06 (Notification of Stress): As soon as some level of stress is detected, user gets a notification from the app bugged with a calming message and wording that is easy to understand. It helps to link passive detection happen in relation to the function (FR-05) and the intervention connected with the function (FR-07) that should interrupt and draw user’s attention to what was going on without overwhelming him too much while being in an elevated emotional state.

FR-07 (Grounding & Breathing Guidance): The system offers a choice of guided stress-relief exercises, informed by what has worked for that user previously via the Personalisation Engine. This is the system's primary therapeutic action — everything before it exists to detect the need for this step, and everything after it confirms the step worked.

FR-08 (SOS Emergency Trigger): The user can manually activate an SOS alert from the Home screen, with a mandatory confirmation step. Confirmation exists specifically to prevent accidental activation, since a false SOS has real consequences for both the user and the caregiver who receives it.

FR-09 (Caregiver Alert Dispatch): Once SOS is confirmed, the system notifies pre-set caregivers, including location and status if the user has permitted this. This closes the emergency loop from FR-08 and carries the system's highest reliability expectation, since it's what actually gets help to the user.

FR-10 (History & Insights Dashboard): The user can view historical mood and stress trends over selectable time ranges, including recurring triggers identified by the Analytics Service. This gives the user a reason to engage with EmotiTrack beyond moments of acute stress, turning FR-04's data into something reflective.

FR-11 (Notification Management): The system delivers alerts through push notification, SMS, or email depending on preference. This matters because a single channel can't be relied on in every situation — a caregiver without the app installed still needs to be reachable via SMS during an SOS event.

FR-12 (Profile & Privacy Settings): The user has a central settings area to manage caregiver access, notification preferences, and privacy settings. This gives practical effect to the consent-based control described in Section 5.5 — without it, permissions granted at onboarding could never be reviewed or revoked later.

5.1.2 Non-Functional Requirements

EmotiTrack uses biometric data and geolocation which is sensitive and therefore has non-functional requirements that emphasize the aspects of security, privacy, and reliability, in addition to standard requirements for performance and usability.

The Security, Privacy & Compliance, and Reliability rows carry the most weight in this project, since a failure in any of them (a data leak, or an SOS alert that fails to send) would

undermine the trust the entire application depends on. These are enforced through the encryption, RBAC, and consent mechanisms already detailed in Section 5.3, and inform the data-handling rules in Section 5.5.

Table 11: Non-Functional Requirements

Category	Requirement
Performance	Biometric data must be processed and reflected in the Live Monitoring screen within 2 seconds of receipt, and stress classification must complete within 5 seconds of a detected anomaly.
Security	All data in transit is encrypted using TLS/SSL; all data at rest is encrypted using AES-256. Access to personal data is restricted through Role-Based Access Control (RBAC).
Privacy & Compliance	Users must be able to grant, view, and revoke data-sharing consent (e.g. location sharing with caregivers) at any time, in line with data protection principles such as GDPR/PDPA.
Usability	Core actions (Grounding, SOS) must be reachable within one tap from the Home screen, and interface text must remain simple and legible for users under high cognitive load.
Reliability & Availability	The SOS and caregiver alert pathway must maintain at least 99.9% uptime, since failure in this path directly affects user safety.
Scalability	The backend architecture must support horizontal scaling via cloud compute services to accommodate growth from a pilot group to thousands of concurrent users without redesign.
Compatibility	The mobile application must support current versions of iOS and Android, and the wearable application must support WatchOS and Wear OS.
Maintainability	Backend services follow a microservices architecture so individual services (e.g. Notification Service) can be updated independently without redeploying the entire system.

5.2 Platform Choice

The EmotiTrack platform will primarily be mobile, operating across iOS & Android platforms. This platform was chosen because smartphones are amongst the most widely used and offer the most convenient approach for users to continually interact with the system *(Matos Fialho et al., 2025).* The mobile app allows the users to experience the key functions of EmotiTrack: mood tracking, live monitoring, grounding exercises, breathing exercises,

journal and history, notification settings, SOS, and privacy settings. For EmotiTrack, it is clear that a mobile-first platform would be appropriate since emotional well-being support should be available anywhere, anytime, and particularly when users are experiencing stress they may require quick and easy access to support tools *(Linardon et al., 2019)*.

Wearable devices, in the form of smartwatches with WatchOS and Wear OS capabilities will form the secondary platform. This platform is significant because EmotiTrack is said to offer proactive support by means of passive, or biometric support monitoring. A matching smartwatch can measure various indicators of wellbeing, including heart rate, movement and activity patterns which could alert the system to indicate potential stress patterns *(Long et al., 2022)*. Along with that, smartwatch can trigger fast notifications and haptic feedback to help you be grounded or breathe, with no need to manually open the mobile app. This is helpful for providing low effort interaction, particularly when users are feeling overwhelmed during high-stress times.

EmotiTrack will also have a caregiver portal, accessible on the web as an aid to the use of the platform. This portal is for authorised carers/ or trusted contacts as per the permission of the user. Selected alerts and SOS notifications for vulnerable children, as well as approved wellbeing summaries, can be viewed in a consented manner via the caregiver platform. This platform allows for the caregiver alert feature, and enables the user to have ownership and privacy of information shared *(Martínez-Pérez et al., 2015)*.

Lastly, the backbone of the system will be a cloud-based platform that will link the mobile app, wearables, caregiver portal, databases, and outside services. The cloud platform enables the real time synchronization, safe data storage, transmission of notifications, AI/ML processing, and future scalability *(Islam and Bhuiyan, 2023)*. In sum, all the chosen platforms provide EmotiTrack with the possibility to be part of an interconnected wellbeing support network. The mobile app is the principal user experience, while the user may wear the platform to passively monitor and rapidly intervene as needed and consent-based external support is provided via the caregiver portal, and secure and scalable system operation is through the cloud backend.

5.3 Technical Architecture Diagram

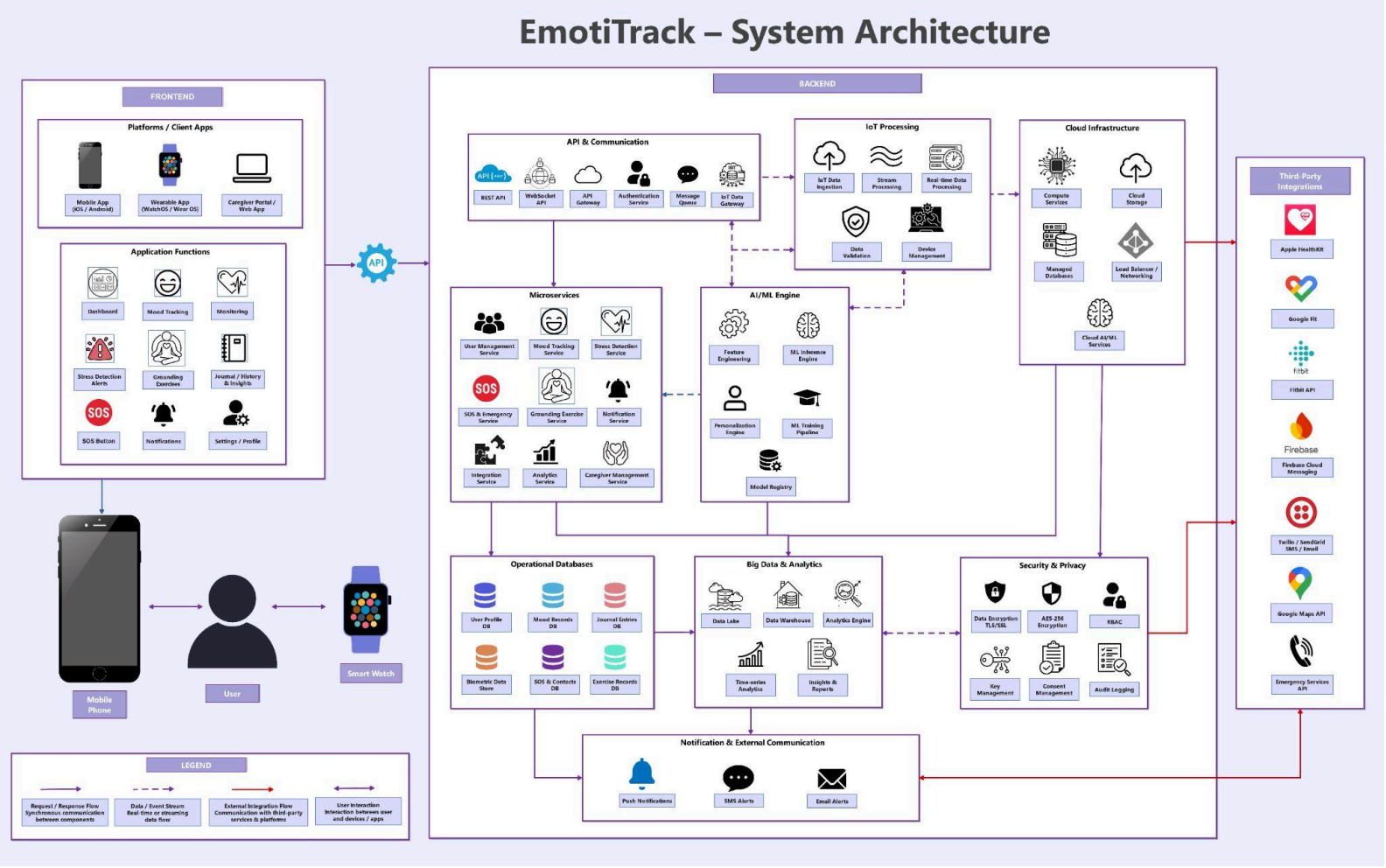


Figure 3: *EmotiTrack Technical Architecture Diagram*

The diagram below illustrates the general system architecture of EmotiTrack and highlights the relationship between the EmotiTrack front end, back end, operational databases, analytics and security and third party integrations. It uses multi-layered architecture design where the applications which interact with the user are divided from its main operations and data management. This separation is helpful with regard to scalability, maintainability, security, and more clearly organizing the system.

The EmotiTrack is also an AI and Machine Learning based solution, including the Internet of Things, Cloud Computing and Big Data Analytics, for delivering of wearable monitoring, potential stress pattern detection, personalised wellbeing recommendations and insights for the longer-term. Data about biometric and activity related parameters are only taken if monitoring is enabled and the consent of the user has been obtained. System then invades authorized data and gives proper assistance along with privacy, access control, security protection measures.

Frontend Layer

The frontend face of EmotiTrack is created of 3 applications that are used by the user and different devices: a mobile application, a wearable application and a caregiver portal. A mobile app, which is compatible with Android and iOS, is the main app that end users will use. It offers everything from a dashboard to mood tracking, monitoring, alerts regarding the stress, grounding and breathing exercises, journal and history records, notifications, SOS support, and privacy settings.

The app is for the wearable devices will run on the compatible platform of smartwatches such as watchOS and Wear OS. It enables people to access critical wellbeing data, be alerted and receive selected support functions from their smartwatch. The caregiver portal will be a web based interface, through which approved caregivers or trusted onlookers can get chosen alerts and view authorized data, in accordance with the user's consent.

Its interface is simple, easy to access and has been user friendly and intuitive in design. Under stressful circumstances, users may lack the ability to use complex interfaces. Because of this, EmotiTrack uses a more simplified and adaptive interface to minimize the cognitive load, and help to make key support elements more accessible.

API & Communication Layer

Its main role is that it acts as an interface between the front-end applications and the back-end services, facilitating secure and efficient communication. The REST service provides for the usual request-response interactions: user authentication, gathering data, updating users, and changing settings. The WebSocket API enables real-time, two-way communication between EmotiTrack and the application, thus delivering monitoring updates, notifications and alerts without users having to continue to refresh the system. The API Gateway is the primary purpose for the request to be sent to the services as all the requests are transformed and validated and will be rate-limited at the API Gateway before the appropriate services.

The Authentication Service authenticates users, manages login sessions and security tokens, and provides with multi factor authentication. The Message Queue also facilitates the sharing of information between the services in the back end so that e.g. sending notifications and generating analytical reports can be performed without disrupting the use of the system. Wearable data such as heart rate, movement and activity data is sent to the IoT Data Gateway, which forwards the data to the specific processing elements for checks and analysis.

Backend Layer

On the back end are 5 integrated subsystems containing user requests, information that is authorized based on biometric and behavioural data, the wellbeing recommendations, stores, and alerts.

The microservices provide the main business logic of EmotiTrack. The User Management Service is responsible for user's registration to system, user profile, preferences, and user account settings. Mood Tracking Service is in charge of managing mood entries, mood history, and mood related summaries. The Stress Detection Service is used to check processed wearable data for possible stress-related patterns and raise appropriate alerts. The Grounding Exercise Service will oversee grounding and breathing exercises, which will include instructions, timers, recommendations and completion records.

The SOS and Emergency Service provides the Activation of SOS, trusted contact notifications and emergency contact information. The Notification Service sends push notifications, SMS and email alerts integrated via a communication provider. The Caregiver Management Service manages the access authorisations and permissions that are granted to users and authorised caregivers. The Analytics Service analyzes data in the past to create wellbeing trends, summaries and reports. An Integration Service manages the connectivity

with third-party platforms, data transformation, service communication management, and error management.

AI and Machine Learning Integration

EmotiTrack embodies fundamental technologies such as Artificial Intelligence and Machine Learning. They allow the system the ability to perform analysis on both authorised biometric, behavioural and user-reported data, and to identify any potential patterns that could be linked to stress, offering tailored wellbeing support. EmotiTrack is not intended to diagnose mental health disorders. Instead, it signals when the indicators more or less differ from that used by the person, in order to detect indicators of meaningful difference with the user who could require a supportive intervention.

Features of the features are derived from raw features like the heart-rate variability, the pattern of movements, the activity, the mood, etc. in a way that they become meaningful for the system that is able to analyse them. The ML Inference Engine utilizes learned models on these features to generate pattern estimates of stress and confidence values. The Personalisation Engine tailors alerts and support suggestions based on the previous patterns, preferences and selected settings by the user.

The ML Training Pipeline is used to help improve the models in a progressive manner on the basis of consent faced data. The Model Registry contains model versions that have been approved, and facilitates updates/revocation of model when necessary. Combined, these parts enable EmotiTrack to offer proactive and context-aware wellbeing assistance without the need for users to have to report each stressful circumstance.

Internet of Things Integration

Internet of Things (IoT) technology allows for EmotiTrack to be integrated with compatible wearable devices and smartwatches. The wearable when monitoring is on, can gather wellbeing information like heart rate, activity pattern, movement etc, which is recorded when consent is given by the user. This way, the data are sent via Bluetooth Low Energy to the IoT Data Gateway that pushes the data to relevant processing backends.

The IoT Data Ingestion module reads and archives data flows with a timestamp. Stream Processing takes raw sensor data and transforms it into meaningful metrics versus Real-time Data Processing analyses raw sensor data to detect meaningful changes and/or unusual variations in the pattern of the user's real-time interactions. Data Validation validates data,

handling missing or corrupted data and quality data readings. With the Device Management features available, wearables can be paired, connected, disconnected, and compatible with devices.

The importance of IoT integration to EmotiTrack is that they enable to passively monitor wellbeing without users continually entering data. This is useful if it's a stressful time and the user isn't able to open the app or record their condition manually. But the capabilities of the mobile are present and available even when not connected to a wearable and the wearable monitoring feature is not desired.

Cloud Computing Integration

Cloud Computing delivers the scalable underlying infrastructure that enables EmotiTrack's backend services, data storage, notifications and AI/ML processing. Compute Services are used for the back-end microservices and performing model inference as needed. In doing so, the system can internally deal with several users and incoming wearable, application data without being reliant on a single local device.

Cloud Storage offers scalable storage for system assets, user generated data, approved records or backup data. Managed Database Services include the operational databases and can include such features as automatic backup, replication, encryption and access-control. Networking and Load Balancing are used to spread the load on the available instances of services to guarantee stable performance and prevent any service from becoming overloaded.

Future development of Cloud AI/ML Services may include support for the following: Model Training, Model Management, Heavy Compute-Intensive Inference. The cloud environment also provides for the availability of the system, recovery of data, and future expansion from a small pilot group to a larger group of users. As such, by utilizing Cloud Computing, EmotiTrack can function more effectively and seamlessly, ramping up its deployment capabilities as the system evolves.

Databases and Big Data Analytics

EmotiTrack operates on several databases to store a particular type of system information in each. User Profile Database: User details, user preferences and consent settings are stored here. A Journal Entries Database contains the journal content entered by the user and the Mood Records Database contains the self-reported mood entry and related data and time stamps. Authorised wearable data that is essential for monitoring and analysis is managed by

the Biometric Data Store. The SOS and Contacts Database is used to track trusted-contact information and SOS event records, and the Exercise Records Database is used to hold SOS exercise history and marking exercise completion.

The Big Data and Analytics subsystem enables the analysis of historical data that are based on consent. The Data Lake keeps the raw or lightly processed data in a controlled environment and the Data Ware house has the capability of organizing the structured historical data for analysis. The Analytics Engine and Time-Series Analytics modules detect patterns in mood recordings, activity amount and trends, and allow you to check the biometric data and exercise usage over a period of time.

The Insights and Reports allow users to view analytical results and summaries by using dashboard. For instance, the system could indicate periods of stress or fluctuations in self-reported wellbeing which are common following engagement in support activities. The purpose of these results is to gain wellbeing data-based insights not medical conclusions. Access to and protection of data, data retention and privacy controls are implemented throughout the analytics process.

Security and Privacy

A security and privacy controls are involved across the system architecture, especially related to the work of EmotiTrack, as it deals with sensitive data regarding the wellbeing of others and also handles biometric data. Data can be encrypted while moving through the frontend applications and backend services and external platforms, through TLS encryption. Information that's stored is protected using AES-256 encryption technology, minimizing the dangers involved with unauthorized access if information is exposed.

Role Based Access Control lets users access their own information and for caregivers/trusted contacts to only view the information authorised by the user. Consent Management enables users to determine which data are collected, how the information is used and gives the ability to tag selected alerts for a particular individual. Users may also change or withdraw their consent at any time, if and when they wish. Audit Logging contains all the necessary information to ensure that access to sensitive information, and any important security-related activity is monitored, to ensure accountability and future investigation if necessitated. The system uses some encryption keys which are protected by Key Management. These measures collectively serve to facilitate safe data management, user autonomy and data privacy throughout EmotiTrack.

Third-Party Integration

EmotiTrack is designed to integrate certain third party services for wearables to provide location-based support, connections, and notifications. Information about users' health and activity from some of the wearables that they have authorised Apple's HealthKit and Google fit to access, as well as the fitbit API. Firebase Cloud Messaging can be used for mobile push notifications, SMS and email alerts can be used if activated with Twilio and Sendgrid. When invoked by the user, location information may be shared via the use of the Google Maps API with an authorised contact when the SOS function is activated or to enable user to identify support services that are close to their location. Emergency support integration can also supply you with relevant contact details or links to support solutions. All data that a user gives to third-party platforms are controlled by their consent and should be limited to the amount of data needed for a chosen function.

Data Flow and System Integration

EmotiTrack has a clear data flow, from the front-end applications to backend services, wearable devices, operational databases to the external communication providers. Whenever the user inserts a mood or starts a grounding or breathing activity, a secure request gets passed from the frontend application and to the backend service, via API Gateway. If wearable monitoring is activated and the user consented to it, the biometric and activity-related data will be transferred via BLE to the IoT Data Gateway. The IoT Processing components validate, organize and deliver authorized data to respective services. The ML Inference Engine keeps an eye on all the processed indicators and user-interaction patterns to find out the indicators that could be indicative of stress related patterns. The Stress Detection Service supports the Notification Service to provide an alert, wellbeing suggestion or simplified help via the mobile app when support is needed. Notices are delivered via SMS or email via an external provider, and only delivered to carers as authorised by the user.

Relevant records are maintained in the proper operational databases such as mood entry, completion of exercises, biometric information, SOS events etc. The Big Data and Analytics subsystem periodically processes the historical data—with the user's consent—to generate long term trends and wellbeing data, which in turn are presented using the dashboard and insights section. Security and encryption are implemented from the full data flow, as well as access control and consent-management.

Technology Integration Summary

The table 12 below gives a summary of the latest IT technologies incorporated within EmotiTrack together with their respective uses, strengths and effects within the system.

Table 12: *Technology Integration Summary for EmotiTrack*

Technology	Role in EmotiTrack	Key Capabilities	Impact on System
Artificial Intelligence (AI) & Machine Learning (ML)	Enables the detection of stress-related patterns and customised interventions to improve well-being.	Data processing from biometrics and behaviorals; machine learning for detecting patterns of stress; personalisation of recommendations based on user history; training and maintenance of models in the registry.	Supports proactive and adaptive assistance by interpreting user trends to make recommendations like "grounding exercises" or alerts, simplified interface responses, etc.
Internet of Things (IoT)	Provides the ability to passively collect biometric data from wearable and smartwatch technologies.	Collect continuous heart rate, movement and activity data; Bluetooth/BLE connectivity; IoT Data Gateway to ingest data; stream processing to process data in real time; device management.	Does not require manual input from the user to monitor wellbeing indicators which is beneficial during periods of high stress where users may not be actively opening EmotiTrack.
Cloud Computing	Delivers scalable Infrastructure for back end processing, storage, sync and AI/ML support.	Providing compute services to back-end microservices; cloud storage services for secure data and backups; managed cloud database services; load balancer and networking services; cloud AI/ML Services.	Increases availability, reliability, scalability and performance, while enabling multiple users, real-time communication and secure data processing.
Big Data Analytics	Facilitates the ability to conduct analysis of patterns and trends of emotional wellbeing over time and effectiveness of interventions.	Data lake for raw data store, data warehouse for structured historical data, analytics engine to do trend analysis, time-series analytics, to generate insights and reports.	Provides insightful information about the mood of an individual, stress patterns, and biometric patterns.

5.3.2 System Components

The section mentioned, 5.3 provided a descriptive explanation about EmotiTrack's architecture. The Table 13 has summarized the same architecture into a single reference framework. This table gives the information about each level including its specific element and functionality.

Table 13: *System Components Summary*

Layer	Component	Function
Frontend	Mobile Application (iOS/Android)	Primary user interface: dashboard, mood tracking, monitoring, grounding, SOS, settings.
Frontend	Wearable Application (WatchOS/Wear OS)	On-wrist access to core functions and passive biometric sensing.
Frontend	Caregiver Portal (Web)	Web-based access for caregivers to view consented alerts and wellbeing summaries.
API & Communication	API Gateway	Single entry point for frontend requests; handles routing, rate limiting, and validation.
API & Communication	Authentication Service	Manages logins, session tokens, and multi-factor authentication.
API & Communication	IoT Data Gateway	Receives biometric data streams from wearables via Bluetooth Low Energy.
Backend Microservices	Stress Detection Service	Runs real-time analysis of processed biometric data to detect stress patterns.
Backend Microservices	Grounding Exercise Service	Suggests, tracks, and logs grounding/breathing exercises.
Backend Microservices	SOS & Emergency Service	Handles SOS activation, confirmation, and caregiver notification.

Backend Microservices	Caregiver Management Service	Manages caregiver permissions and access controls.
AI/ML Engine	ML Inference Engine	Applies trained models to produce real-time stress-level predictions.
AI/ML Engine	Personalisation Engine	Tailors recommendations and alert thresholds to the individual user's baseline.
IoT Processing	Stream Processing	Converts raw sensor data into usable real-time metrics (e.g. heart rate variability).
Cloud Infrastructure	Compute Services / Cloud Storage	Runs microservices and AI/ML models; provides scalable, backed-up storage.
Databases	Mood Records / SOS & Contacts / Exercise Records DB	Store per-user operational data for immediate access and later analysis.
Big Data & Analytics	Analytics Engine / Data Warehouse	Processes aggregated historical data to surface long-term wellbeing trends.

5.3.3 Data Flow

Building on the "Data Flow and System Integration" description already given in Section 5.3, this subsection presents the same flow as a discrete, numbered sequence — useful for tracing exactly what happens, and in what order, from the moment biometric data is generated to the moment a caregiver is alerted.

1. **Passive collection** — The connected smartwatch continuously collects heart rate, breathing rate, and movement data and transmits it via Bluetooth Low Energy to the IoT Data Gateway.
2. **Ingestion & processing** — The IoT Data Ingestion module timestamps the incoming stream; Stream Processing converts raw readings into usable real-time metrics (e.g. heart rate variability).

3. **Stress analysis** — Feature Engineering and the ML Inference Engine analyse these metrics against the user's personal baseline (via the Personalisation Engine) to classify the current state as stable or elevated stress.
4. **Alert generation** — If elevated stress is detected, the Stress Detection Service raises an alert, which is passed to the Notification Service.
5. **Multi-channel delivery** — The Notification Service delivers the alert to the mobile app as an in-app notification and, where relevant, via SMS/email (Twilio/Sendgrid) and to the Caregiver Portal, subject to the user's consent settings.
6. **User response** — The user follows a suggested grounding/breathing exercise (Grounding Exercise Service) or, in an emergency, manually triggers SOS (SOS & Emergency Service).
7. **Persistent storage** — Every reading, log, and interaction is written to the relevant operational database (Mood Records, Exercise Records, SOS & Contacts) for immediate access and future reference.
8. **Long-term analytics** — The Big Data & Analytics subsystem periodically processes historical data from the Data Lake/Data Warehouse to generate trend insights, surfaced back to the user through the History & Insights dashboard (FR-10).
9. **Security enforcement throughout** — At every step above, TLS/SSL encrypts data in transit, AES-256 encrypts data at rest, and RBAC together with the user's consent settings govern exactly who can access what, at each stage of the flow.

This sequence demonstrates that data flow in EmotiTrack is not a single straight line but two parallel tracks — the passive biometric stream (steps 1-4) and the user-driven interaction path (step 6) — that converge at the Notification Service and are both ultimately captured in the same storage and analytics layer (steps 7-8).

5.4 Technology Stack

EmotiTrack's technology stack was chosen to enable real-time processing of biometric data, wearable compatibility, detection of stress phenomena using AI/ML, cloud scalability, protection of data, and the analysis of long-term wellbeing. EmotionTrack also involves sensitive emotional well-being and biometric data, so technologies chosen for this project should be reliable, private, responsive and integrate mobile, wearable, web and cloud applications. The next tables provide a summary of the proposed technology stack for each of the architectural layers and describe the role and rationale of the technologies chosen.

Table 14 shows the front-end technologies employed for the front end of EmotiTrack that will interface with the user, including the mobile application, caregiver portal, the wearable interface, and the UI/UX prototype design.

Table 14: *Frontend Layer Technology Stack*

FRONTEND LAYER			
Layer / Component	**Selected Technology**	**Purpose in EmotiTrack**	**Justification**
Mobile App (iOS & Android)	Flutter	Mobile app that works across different platforms for tracking mood and visualizing stress patterns, as well as grounding activities	It is possible to develop a single codebase for iOS and Android with Flutter and have a good user experience at the same time. Performance is satisfactory for real-time data visualization and responsiveness in mental health apps.
Web Portal (Caregiver)	React.js	Interface to monitor the well-being of users via the web and get alerts	React.js is a framework that uses components for building responsive applications. Real-time updates can be easily provided through WebSockets which are supported by React.js ecosystem.
Wearable Support	WatchOS & Wear OS	Natively supported watch gestures and rapid stress alert notifications	The native framework for wearable devices will give optimal performance and smooth sensor integration. Watch OS and Wear OS allow light weight applications with quick notifications and SOS alerts.
UI/UX Design Tool	Figma	Prototyping and User Interface Design for All Platforms	Figma is an excellent choice when it comes to collaboration and rapid prototyping, allowing you to improve design iteratively by incorporating feedback from users and testing usability.

Overall, the frontend stack is conducive to EmotiTrack's goals of delivering a consistent, accessible and responsive experience across the mobile, web and wearable. The system can be used by end users and caregivers using Flutter and React.js, and high fidelity prototype designing and usability testing can be done with Figma.

The table below lists the API and communication technologies used for connecting the frontend applications with the backend services. The technologies are necessary since EmotiTrack needs both data exchanges and notifications.

Table 15: *API and Communication Layer Technology Stack*

API & COMMUNICATION LAYER			
Layer / Component	**Selected Technology**	**Purpose in EmotiTrack**	**Justification**
API Architecture	REST API	Communication protocol that allows communication between front-end applications and back-end systems	REST API offers a stateless and scalable architecture that can work perfectly on the web and mobile clients.
Real-time Communication	WebSocket API	Live alerts on stress and notifications to caregivers using real-time data streaming	WebSocket provides two-way communication that is critical in pushing real-time alerts to both users and their caregivers without having to poll continuously.
API Gateway	Google Cloud API Gateway	Management of APIs requests, Authentication, and Rate Limiting in Centralized manner	The API Gateway is the one place where all the requests are processed, which leads to centralized management of the security, requests, and traffic control.
Message Queue	Cloud Pub/Sub (Google Cloud)	Notifications and data pipeline event processing using asynchronous messages	Through Pub/Sub, services can be decoupled such that notification and data processing operations can be done asynchronously.

The API and Communication Stack ensures the provision of a secure and responsive interface among the user, carer, wearable devices, and backend services. RESTful API allows for usual request-response processing, whereas WebSocket and Pub/Sub API allows for real-time tracking and notification.

Table 16 gives the list of backend technologies used for the implementation of system functionality in EmotiTrack application such as User Management, Mood Tracking, Stress Detection, SOS, Notifications, Analytics, and Caregiver Management.

Table 16: *Backend Layer Technology Stack*

BACKEND LAYER			
Layer / Component	**Selected Technology**	**Purpose in EmotiTrack**	**Justification**
Server Framework	Node.js with Express.js	Application server on the back which performs the request processing, keeps track of the business logic and coordinates microservices	Node.js is non-blocking, event-driven, which is perfect for processing multiple concurrent requests by many users. Express.js is one of the lightweight framework that provides ease in the development of API and inclusion of different middleware with it.
Microservices	Node.js Microservices	Modular backend services including User Management, Mood Tracking, Stress Detection, SOS & emergency, Grounding Exercises, user Notifications, Integration, user Analytics and Caregiver Management.	With microservices architecture, one can independently code, deploy, and scale each service. This increases system resilience – failure of one system will not bring down any other system.

Backend architecture uses modular services in such a way that every major service can be developed, tested and scaled independently of other services in the system.

The table 17 below gives details on the database technologies that store various types of EmotiTrack data such as users' profiles, mood logs, journals, biometrics streams, SOS contacts, and historical analytics.

Table 17: *Database Layer Technology Stack*

DATABASE LAYER			
Layer / Component	**Selected Technology**	**Purpose in EmotiTrack**	**Justification**
User Profiles & Application Data	Firebase Firetore	Profile storage, mood log, SOS contact list, and application setting storage	Firestore is a NoSQL document database with features such as real-time synchronization, auto-scaling, and inherent security. The schema used by Firestore is flexible.
Journal & Wellbeing Records	MongoDB	Storing journal entries and flexible well-being records	The document-oriented nature of MongoDB enables different ways of storing journal entries. The horizontal scaling capability of MongoDB can manage the growing volume of user-generated data.
Biometric Data	Time-series Database / Cloud Bigtable	Biometric data storage from wearable devices that operate on high frequencies (heart rate, HRV, motion, and activity levels)	The Time Series database is specifically designed for the storage and query of time-stamped data points.
Historical Analytics & Reports	BigQuery (Google Cloud)	Data Warehouse for storing and analyzing wellbeing information for a long period of time	BigQuery offers fast SQL querying capabilities that help analyze big datasets and generate reports about trends of user wellbeing. It integrates well with Google Cloud AI platform.

There are different approaches to data storage in the database stack because EmotiTrack works with various data types. For example, Firestore is ideal for storing app records and syncing data; MongoDB supports flexible journal and wellbeing records, whereas time series databases can be used for biometrics trend

Table 18 illustrates the cloud infrastructure technologies that are proposed to support EmotiTrack with respect to hosting, backend deployment, storage, database management, and scalability.

Table 18: *Cloud Infrastructure Technology Stack*

CLOUD INFRASTRUCTURE			
Layer / Component	**Selected Technology**	**Purpose in EmotiTrack**	**Justification**
Cloud Provider	Google Cloud Platform	Support with different components of the whole EmotiTrack application which includes hosting, computing, storage requirements and managed services.	Google Cloud has comprehensive applications deployment, data storage, machine learning and analytics solutions. The simplicity, speed and ease of integration allow them to leverage a single service.
Compute Services	Cloud Functions or App Engine	When the backend service and scheduled task are executed in a serverless manner.	With serverless compute, there is no infrastructure management overhead. Cloud Functions are used for event-driven processing (such as sending a stress detection alert if biometric data is streamed in), and App Engine is used for continuous services (which are continuously active).
Storage Services	Cloud Storage	Attachments of user-generated content, such as journal entries, profile photos, and exercise videos, are stored.	Cloud Storage offers secure, scalable, object storage that includes the features of encryption and access control.
Managed Databases	Cloud SQL or Firestore	Expertly operated relational or NoSQL database services that have auto backups and HA support.	Managed databases eliminate operational costs and provide data durability and availability.

The set of cloud infrastructure blows all the measures needed for scalability, accessibility and processing security on the back-end. A use of Google Cloud together with Firebase fits with the architecture since it is already using Firebase Cloud Messaging, Google Maps API, Google Fit and AI/ML in the cloud

Table 19 shows the AI/ML pattern technologies supporting stress and personalization, model training, and model management.

Table 19: *AI/ML Layer Technology Stack*

AI / ML LAYER			
Layer / Component	**Selected Technology**	**Purpose in EmotiTrack**	**Justification**
ML Frameworks	TensorFlow or Scikit-Learn	Good results were achieved for development and training of machine learning models for stress pattern detection.Stress pattern detection was done and good results achieved with Machine Learning models.	TensorFlow is a complete library for developing neural networks and deep learning models, while scikit-learn provides simpler and more interpretable algorithms for stress detection, using physiological characteristics. They both have been shown to exist and are well-used in health-related fields.
Cloud ML Platform	Google Cloud AI / Vertex AI	Services of machine learning, accessible via the cloud, for model training, hyperparameter tuning, and inference.	Vertex AI aims to give customers managed services for the full ML life cycle—preparing, training and deploying data models. It cuts the complexity of ML operations and aids in quick experimentation.
Model Registry	Model Registry (Vertex AI)	Version control and management for trained ML models	Model Registry is used to trace back versions, performance and deployment details of your model. This will guarantee the reproducibility and allow rolling back to previous models.

By using their AI/ML capabilities, the EmotiTrack tool can analyse biometric and PS indicators and detect potential stress patterns. These technologies are designed to aid in recommendations and suggestions for wellbeing and personal measures, but not medical diagnoses, clinical evaluation or mental health treatment by a healthcare provider.

Table 20 shows the integration technologies that were found in the smartwatches and wearable health platform to collect and process biometric information.

Table 20: *IoT and Wearable Integration Technology Stack*

IoT & WEARABLE INTEGRATION			
Layer / Component	**Selected Technology**	**Purpose in EmotiTrack**	**Justification**
Wearable Communication Protocol	Bluetooth Low Energy (BLE)	Mobile to mobile and mobile to smartwatch wireless communication.	BLE is a low-power wireless technology that is ideal for continuous wearable wireless communication. This is the default method of communication between a smartphone and smartwatch.
Health Data Integration	Apple HealthKit (iOS) & Google Fit (Android)	Seamless integration with existing health systems for access to health data from wearables and apps	HealthKit and Google Fit are both standardized APIs that make it easier to access biometric information from diverse wearable devices and health applications. This allows EmotiTrack to function with a variety of wearable brands, without needing to customize them on a per-device basis.
Wearable APIs	Fitbit API	FitBit accessible biometric data on wearable technologies	Fitbit API allows for integration with all Fitbit devices, allowing for all to be supported and access to high quality biometric data.
IoT Data Gateway	IoT Data Gateway with Cloud Pub/Sub	Centralized ingestion of information from wearable devices, and a processing centralized.	IoT Core gives secure connectivity to devices and data ingestion at scale. Pub/Sub can be used for async processing of an incoming stream of biometric data.

Stream Processing	Apache Kafka or Google Cloud Dataflow	Field based, real-time processing of continuous flow of biometric data	By enabling real-time analysis of incoming biometric data, stream processing can help to detect stress patterns and generate alerts as soon as they happen, before more data has been gathered and processed using batch processing methods.

Empowering healthier societies relies on the smart blending of the IoT and wearable with the right integration stack, which is a key part of EmotiTrack's proactive approach to supporting better health and well being. The system can stream in data from the relevant wearable components, such as BLE, HealthKit, Google Fit or Fitbit API, and can handle biometric events in real time with the help of Pub/Sub and stream processing.

Table 21 presents an explanation of security & privacy technologies for safeguarding sensitive user data and controlling access based on consent.

Table 21: *Security and Privacy Technology Stack*

SECURITY & PRIVACY			
Layer / Component	**Selected Technology**	**Purpose in EmotiTrack**	**Justification**
Authentication	OAuth 2.0 & JWT.	At the user authentication and authorization, ensure security.	OAuth 2.0 offers industry-standard authentication allowing a secure sign in and integration with third parties. JWT (JSON Web Tokens) provide stateless authentication for better scalability.

Data Encryption (In Transit)	TLS/SSL	All data transmitted between clients, servers and the cloud is encrypted.	By leveraging TLS/SSL, sensitive wellbeing data is secured in transit and can not be breached. All API endpoints are secured using TLS 1.2 or superior and utilizing HTTPS protocol.
Data Encryption (At Rest)	AES-256 Encryption	Protection of sensitive data in databases and cloud storage.Data encryption in databases and cloud storage.	AES-256 is a robust encryption method that secures user information even in the event of the compromise of storage systems.AES-256 is a robust encryption standard that secures the user's data even should the storage systems be compromised.
Access Control	Role-Based Access Control (RBAC)	Granular permissions on who can view certain data and functionalities	That users are able to access their own data, caregivers have rights only to that assigned user's data, and administrators have suitable privileges.
Consent Management	Consent Management System	Monitoring and compliance with the principle of user consent of collection and processing of data	A consent management system helps users put into practice privacy laws and uphold their preferences for data utilization.
Monitoring & Logging	Audit Logging & Google Cloud Logging	All system activities are comprehensively logged, for security monitoring and compliance.	Audit logs can be used to help identify unauthorised attempts at login and track the behaviour of a system for compliance auditing.

the security stack that's required since EmotiTrack involves information relating to emotional wellbeing, biometric and SOS. Users are empowered to control their data and caregivers have only granted access to information; authentication, consent management, encryption, role-based and audit logging mechanisms help ensure this.

Table 22 outlines external services utilized for notifications, alerts, location sharing and crisis support information.

Table 22: *Notification and External Services Technology Stack*

NOTIFICATION & EXTERNAL SERVICES			
Layer / Component	**Selected Technology**	**Purpose in EmotiTrack**	**Justification**
Push Notifications	Firebase Cloud Messaging (FCM)	Real time SMS notifications to mobile phones for stress alerts & reminders.	FCM delivers dependable scalable push notifications to the iOS and Android platforms. It easily integrates with Firebase's Backend services
SMS Alerts	Twilio	Notifications for emergencies and critical stress events via SMS	Twilio guarantees SMS delivery during emergencies, so users won't miss alerts while the application is not in use.
Email Alerts	SendGrid	Emails from mood summary, insights and caregiver reports.	SendGrid can also deliver emails on a scalable level with templates and tracking, which is ideal for sending out periodic wellbeing reports and insights.
Location Services	Google Maps API	Accessing SOS features and setting the emergency context based on location. Accessing SOS features/setting SOS context from location knowledge.	Google Maps API can be used for safe sharing of locations in emergency scenarios to give context to emergency responders.
Crisis Support Resources	Emergency Services API	Supporting links to crisis/hotlines and mental health services	Emoji integration with services APIs allows EmotiTrack to connect the users with professional support resources during an emergency.

EmotiTrack's real-time support functions can be stacked on the notification and external services stack. -mobile alerting is provided by Firebase Cloud Messaging, SMS and email via Twilio, SendGrid, SOS location sharing via Google Maps API and integration with emergency service and providing access to emergency service support resources when necessary.

Overall, the chosen tech stack enables EmotiTrack's primary technical goals by bringing together active communication services, security measures, databases, AI/ML processing, cloud infrastructure, IoT wearable data collection, and frontend applications. The stack is also aligned with the four new IT technologies chosen for the project: Artificial Intelligence with the Machine Learning, Internet of Things with the Cloud computing and Big Data Analytics. This makes EmotiTrack a powerful, scalable, secure and proactive wellbeing support system, and not a single application to be installed on your mobile devices.

5.5 Data Requirements and Privacy Rules

Having defined what data the Databases and Big Data Analytics subsystem stores (Section 5.3) and what security mechanisms protect it, this section sets out data requirements from a privacy and governance perspective — what is collected, how sensitive it is, and what rule governs its handling. This matters for a wellbeing application in particular: EmotiTrack is a support and awareness tool, not a medical device, so its data-handling rules are deliberately conservative around consent and retention.

Table 23: *Data Categories and Privacy Rules*

Data Category	Examples	Sensitivity	Privacy Rule
Biometric data	Heart rate, breathing rate, movement/activity streams	**High**	Encrypted at rest (AES-256) and in transit (TLS/SSL); retained per user-configurable history window only.
Mood & journal entries	Self-reported mood logs, journal text, exercise outcomes	**High**	Stored in the Mood Records / Journal Entries databases; accessible only to the user unless explicitly shared.
Location data	Device location shared only during an SOS event	**High**	Collected only on explicit SOS confirmation (FR-08); never tracked passively; shared only with the user's designated caregivers.
Account & profile data	Name, email, authentication credentials, condition/goal selections	**Medium**	Stored in the User Profile Database; passwords hashed, never stored in plaintext.

Caregiver & contact data	Caregiver names, contact details, permission settings	**Medium**	Access governed by RBAC; caregivers can view only the information the user has explicitly authorised.
Usage & analytics data	Aggregated, anonymised trend data (e.g. weekly stress averages)	**Low**	Used for the Big Data Analytics subsystem; anonymised before being used for model training or reporting.

The clearest example of EmotiTrack's privacy-by-design approach is location data: rather than tracking location continuously, EmotiTrack only ever collects it at the moment of an explicit SOS confirmation. This directly reflects the consent-management principle described in Section 5.3, and ensures the most sensitive data category is also the most tightly scoped.

Together, these platform, component, and data-governance decisions complete the requirements foundation for EmotiTrack, before Section 6.0 turns to how this architecture was translated into a usable interface.

This section outlined the system requirements, platform selection, technical architecture, technical setup and data privacy issues deciding EmotiTrack's technical approach. The following section explains how these elements were translated into the system’s UI/UX design, prototype, navigation flow, and coded key function.

6.0 Design and Implementation

This section will describe the design and implementation of the EmotiTrack prototype. The purpose of this part is to transform the idea described in the project proposal to a particular visualized version understandable by the user. Since the application is primarily intended for students to track their mental wellbeing, mood, stress levels, and provide emergency assistance, the prototype has been designed in a calm, minimalist style with an emphasis on usability in mind.

The user interface and experience (UI/UX), application graphic design, and navigation panels were prototyped using a high fidelity clickable prototype of the mobile application and smartwatch interface. The navigation between different types of user interface (UI) was designed logically and intuitively for the users to understand the UI structure on the first sight. In addition, the prototype also includes a coded key functionality representing one of the primary functions of the full fledge application which would be further developed after the prototype was completed.

6.1 UI/UX Design Overview

The design of UI/UX of the application is focused on creating an easy, accessible and comforting experience for the user while keeping in mind its purpose in tracking the user's mood, detecting distress and providing appropriate assistance through the SOS feature. It achieves this by prioritizing large buttons, muted colors and overall accessibility .The UI/UX aims to allow users to perform basic functions seamlessly and achieve core objectives like mood tracking or getting help breathing. All of this is done to increase the likelihood of the user regularly engaging with the application and using it for wellbeing maintenance and emergency help.

The UI has been designed to be very simple and intuitive to keep the user focused on their primary needs in this application: understanding their emotions, tracking them, and seeking help if necessary. Buttons for most of these functions (Mood tracker, Grounding, and SOS) are prominently displayed on every screen, and the language is kept very straightforward to prevent the user from getting lost or confused. The app is designed to respond to the most urgent mental health issues that students face daily, making it a reliable tool for both tracking their wellbeing and receiving immediate assistance.

6.2 Design Theme and Style Guide

The design concept was inspired with the themes of tranquility, emotional support, and safety. The prototype uses a soft visual language to appear more approachable and less intrusive. Rounded buttons, cards, icons, and ample spacing dominate the interface to convey a sense of calmness.

The style guide below was applied to maintain consistency across all elements in the prototype. The guide includes specific colours, fonts, and styles for UI components such as buttons and icons. Consistency helps the users navigate the application faster while building trust in the product.

6.2.1 Logo

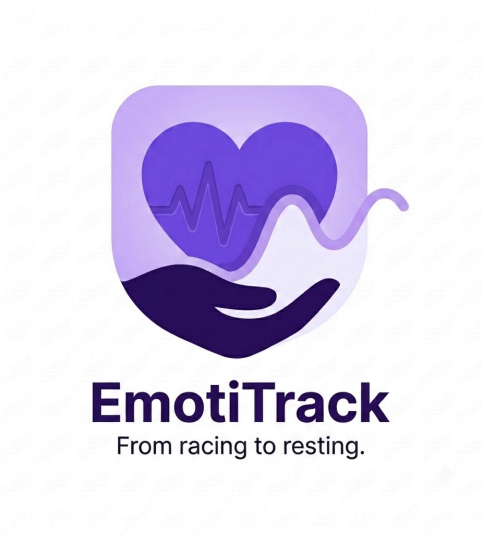


Figure 4: *EmotiTrack Logo*

EmotiTrack's logo utilizes the fundamentals of emotional consciousness, compassion, and equilibrium. The visual identity of the emblem is characterized by smooth lines and NON-SHARP shapes implying cheerfulness and friendliness. Because the application is aimed at mood tracking and the well-being promotion through emotional management, the brand image must be non-threatening and non-medical in nature. The logo also expresses a sense of compassion and support to bring the idea of psychological assistance to the users of the application.

The final mark builds on this principle through two combined elements: a hand gently cradling a heart, and a heartbeat line that runs through the heart and gradually smooths into a

calm wave. The cradling hand was chosen specifically so the logo reads as "being cared for," rather than simply "being monitored" — an important distinction for an application whose core function is passive biometric tracking during moments of stress. The pulse-to-wave line shows a jagged pattern at its start which denotes the raw stress signal picked up by EmotiTrack, but ends with a smooth, wave formation of the stress signal at the right side of the heart, hence showing that the app calms the user down. In this way, the logo goes beyond simply signifying the brand; it visually depicts the whole function of EmotiTrack in one continuous line: EmotiTrack's function is to detect stress, manage the user, and bring him back to being calm.

The combination of purple and lavender colors in the logo of the app ties in well with the theme described in 6.2.2.

The EmotiTrack logo is paired with the tagline "From racing to resting", which mirrors the pulse-to-wave motion in the mark itself and is used alongside the logo on the splash screen. The logo is applied across the splash, onboarding, login, and profile screens to increase recognition and strengthen the branding of the application throughout the user's journey.

6.2.2 Colour Palette

We have chosen purple and lavender as the dominant colours for EmotiTrack because of the concepts it aims to convey to the users. Firstly the app is intended to address the emotional wellbeing of the individuals, and purple and lavender are associated with tranquility. Secondly, white and grey shades are used as background colours for the interface elements. The colours green, orange, and red represent varying levels of emergencies and emotions. In general, I can say that the author's choice of colours is coherent with the concepts they wanted to communicate through the app and the target audience they intended to address. The students who use the app on a daily basis and face numerous adverse situations need a tool to help them cope with their emotions and effectively manage their stress levels.

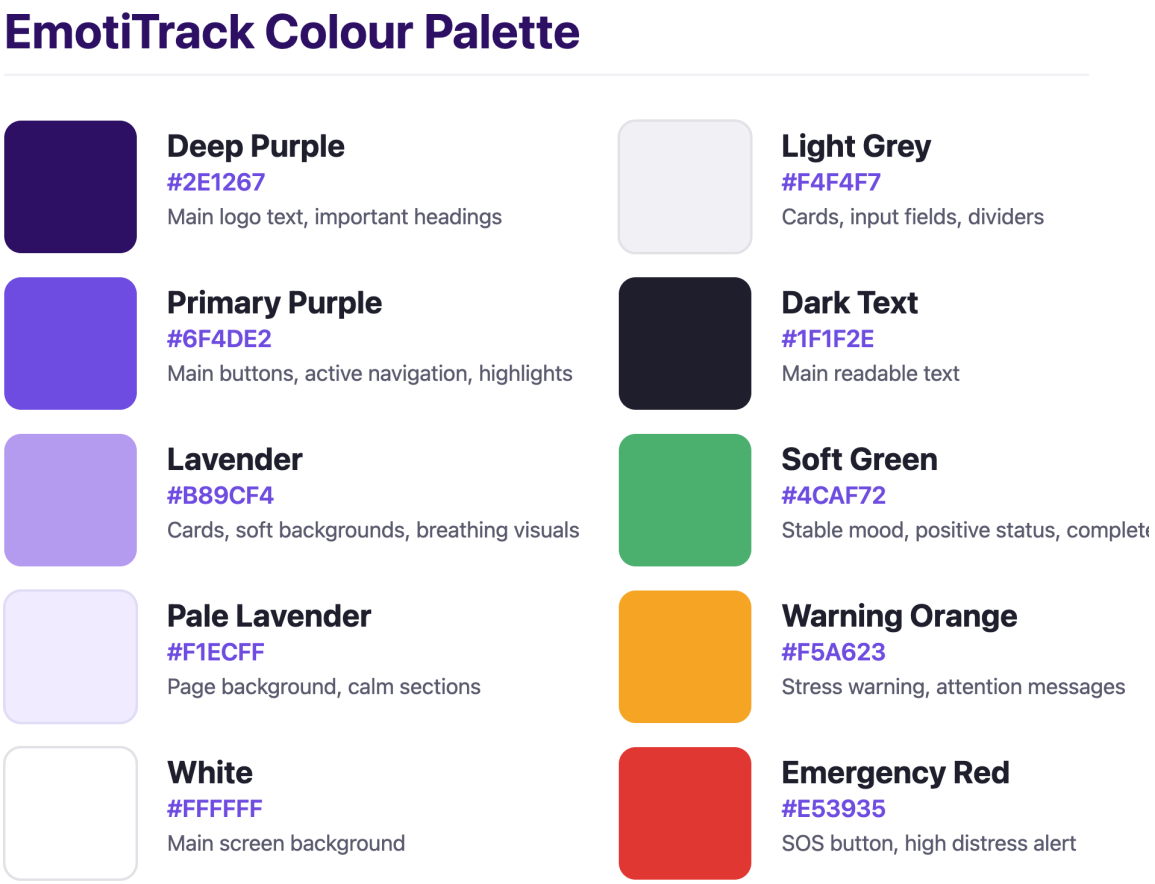


Figure 5: *EmotiTrack colors Palette*

The colors were used consistently throughout all the prototype screens. For instance, purple was used in the main screen for EmotiTrack while green was used to indicate that the user was stable, orange was a warning sign of stress increase and red was the emergency (SOS). This would be helpful to ensure that colors mean the same thing throughout the application so as to have consistency and make it easy for users to understand the severity of each situation based on the color.

6.2.3 Typography and Icons

The colors were used consistently throughout all the prototype screens. For instance, purple was used in the main screen for EmotiTrack while green was used to indicate that the user was stable, orange was a warning sign of stress increase and red was the emergency (SOS). This would be helpful to ensure that colors mean the same thing throughout the application so as to have consistency and make it easy for users to understand the severity of each situation based on the color.The typography and icons in the EmotiTrack are created to ensure the simplicity of the interface, its readability, and the emotional aspect of the application. As the

application focuses on tracking moods, stress levels, grounding exercises and an SOS feature, it is essential to make the text as simple and understandable to the users as possible. Icons were created to complement the text and make the interface more intuitive.

Typography

The prototype uses a rounded sans-serif font style that is commonly used in modern apps and websites such as Google, Medium and Inter, Poppins, SF Pro Display. It allows the interface to look aesthetically pleasing and modern while remaining highly readable on digital screens. On the prototype, the headings are created using a bolder version of the font size while the body uses an italicized and a smaller version of the same font.

Icons

Icons are used throughout EmotiTrack to help users understand features without reading too much text. The icons follow a simple rounded style to match the calm and friendly design theme. Each icon has a clear meaning and is placed near related labels or buttons.

6.3 Storyboard

The storyboard shows the sequence of scenes that a typical user may experience when using the EmotiTrack application, and how the user might interact with the system in each scene. It shows the app's reactions to the user's emotional state, when it senses that the person is stressed, it responds in a timely manner and brings the user to the calm and safe state.

The advantages of the storyboard over a series of individual screens is that the storyboard explains the entire user experience and the decision making process at each step. It shines a light on the relationships of the various features and how they intertwine and work together so that a user can get customy support without much effort.

The storyboard is also used for sharing the design idea with the function of the particular application. It provides a representation of the proposed user experience prior to implementation, and validates that the solution meets project goals to support emotional wellbeing through proactive monitoring and intervention.

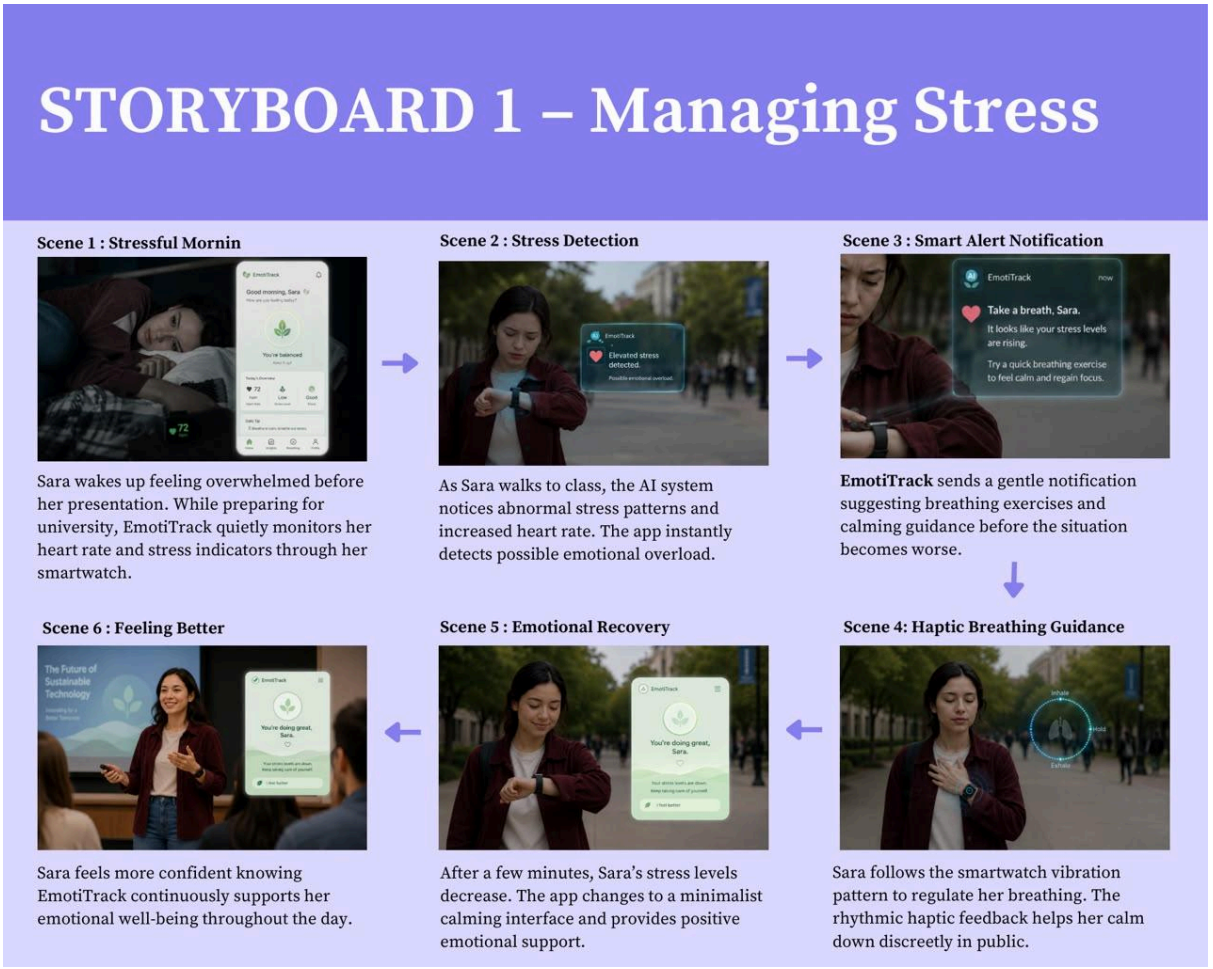


Figure 6: *STORYBOARD - Managing Stress*

The storyboard starts with a user during a normal day, noticing signs of stress. EmotiTrack shows the heightened state of stress via smartwatch monitoring, sends a soothing message, and will take the user through a grounding exercise with its haptic (touch) feedback that is around breathing. At the end of the exercise, the emotional state of the user is improved, highlighting how the application has been able to offer proactive and continuous emotional support in the user journey.

6.4 Clickable Prototype

This section documents how the storyboard journeys defined in Section 6.3 were translated into a clickable, high-fidelity prototype using Figma. Where the storyboard tables describe intended behaviour in words, the Figma prototype makes that behaviour testable: a reader or evaluator can click through the same 15 screens in the same order the storyboard describes, and confirm that the interface actually supports each journey.

6.4.1 Figma Prototype Overview

The Figma file is organised into five functional groups — Onboarding, Home & Monitoring, Grounding & Breathing, SOS, and History & Profile — with a corresponding row of smartwatch screens placed beneath the main canvas. This is the group of categories on the basis of the work performed by the screens in the application instead of referring to the three journeys belonging to the storyboards. In fact, several screens (for example, Home and Monitoring) are utilized in different options outlined in Section 6.3. All frames in every category are numbered and titled clearly (e.g. “Home Dashboard”, “Live Monitoring”, etc.) allowing a reviewer to find a particular screen mentioned in Tables 6.3.1-6.3.3 without applying any alternative methods in searching. Figure 7 below depicts the general layout of the canvas that shows the placement of five functional categories and the row with smartwatches shown for easy navigation.

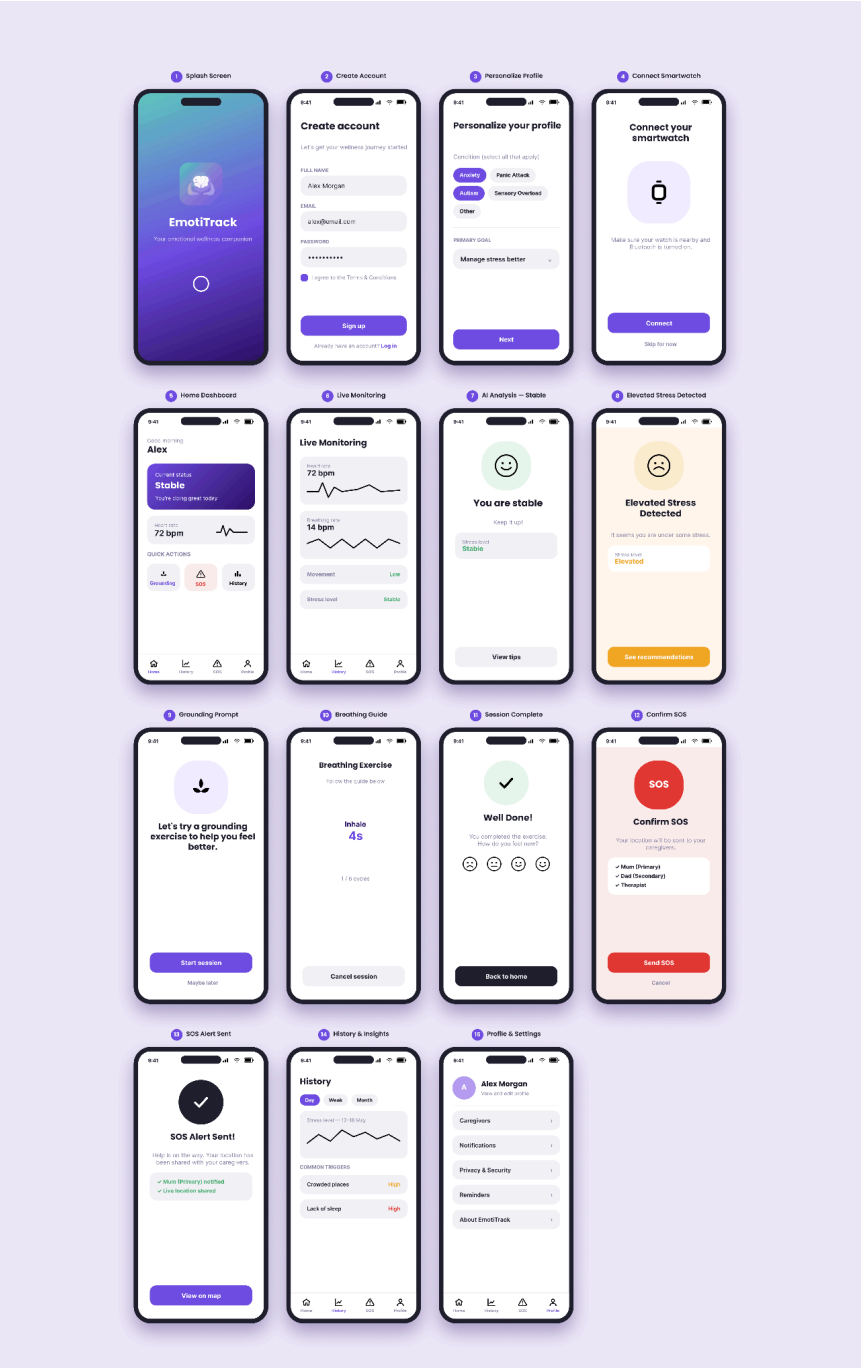


Figure 7: Figma Canvas Organisation by Screen Group

The visual design system established in Section 6.2 — the purple and lavender colour palette, rounded sans-serif typography, and rounded iconography — was implemented as reusable Figma components (buttons, cards, alert banners, and navigation bars) rather than one-off elements per screen. This ensures the colour-coded severity system (green for stable, orange for stress warning, red for SOS) renders identically across all screens, which is essential

given that users are expected to interpret these colours instantly and without reading text, particularly during high-stress moments.

6.4.2 Prototype Interaction Flow

Table 24 maps each screen transition to its Figma trigger type and animation style. This is the detail that turns 15 static screens into a functioning clickable prototype: each row specifies exactly what a user action (a tap, or the passage of time) is set up to do inside Figma's prototyping mode.

Table 24: *Prototype Interaction Flow Mapping*

Journey	Screen Transition	Figma Trigger	Animation Style	Notes
Normal Mood Tracking	Splash → Onboarding/Login → Home	On tap / After delay	Fade	Entry
Normal Mood Tracking	Home → Live Monitoring	On tap	Slide (right)	Core
Normal Mood Tracking	Live Monitoring → Stability Confirmation	After delay	Dissolve	Feedback
Stress Alert & Grounding	Home → Stress Alert Popup	After delay (simulated detection)	Smart animate	Overlay
Stress Alert & Grounding	Popup → Suggested Activity	On tap	Slide (up)	Core
Stress Alert & Grounding	Suggested Activity → Exercise Selection	On tap	Slide (right)	Choice
Stress Alert & Grounding	Exercise Selection → Breathing/Grounding	On tap	Smart animate	Core

Stress Alert & Grounding	Exercise → Completion → Home	After delay	Dissolve	Exit
SOS & Caregiver Alert	Home/Emergency → SOS Trigger	On tap	Smart animate	Overlay
SOS & Caregiver Alert	SOS Trigger → Confirmation	On tap	Slide (up)	Safeguard
SOS & Caregiver Alert	Confirmation → Dispatch → Alert Confirmation	On tap / After delay	Fade	Exit

As Table 24 shows, two trigger types dominate the prototype: 'On tap', used for deliberate user actions such as confirming an SOS alert, and 'After delay', used to simulate system processes that would run automatically in the real application, such as biometric analysis or alert dispatch. 'Smart animate' transitions are used specifically where an element (for example, an alert banner) needs to appear to move or resize between screens, reinforcing the sense that the interface is responding to the user in real time rather than simply swapping static frames.

With the interaction flow now defined, the following sections (6.5 Prototype Screens and 6.6 Coded Key Function) present the resulting screens and the one function selected for full code implementation.

6.5 Prototype Screens

The subsequent paragraph describes the high fidelity screens made on Figma by using the same five functions that were mentioned in Section 6.4.1: Onboarding, Home and Monitoring, Grounding and Breathing, SOS, and History and Profile. Each picture represents the mobile screens in one category, then there follows a table, which associates every mobile screen to the particular function that it represents. Thus, the series of screens presented in this subsection help meet the assignment requirement of making at least 15 high fidelity screens (Table 3, Table 6), covering the entire user journey created in the storyboard (Section 6.3).

6.5.1 Onboarding Screens

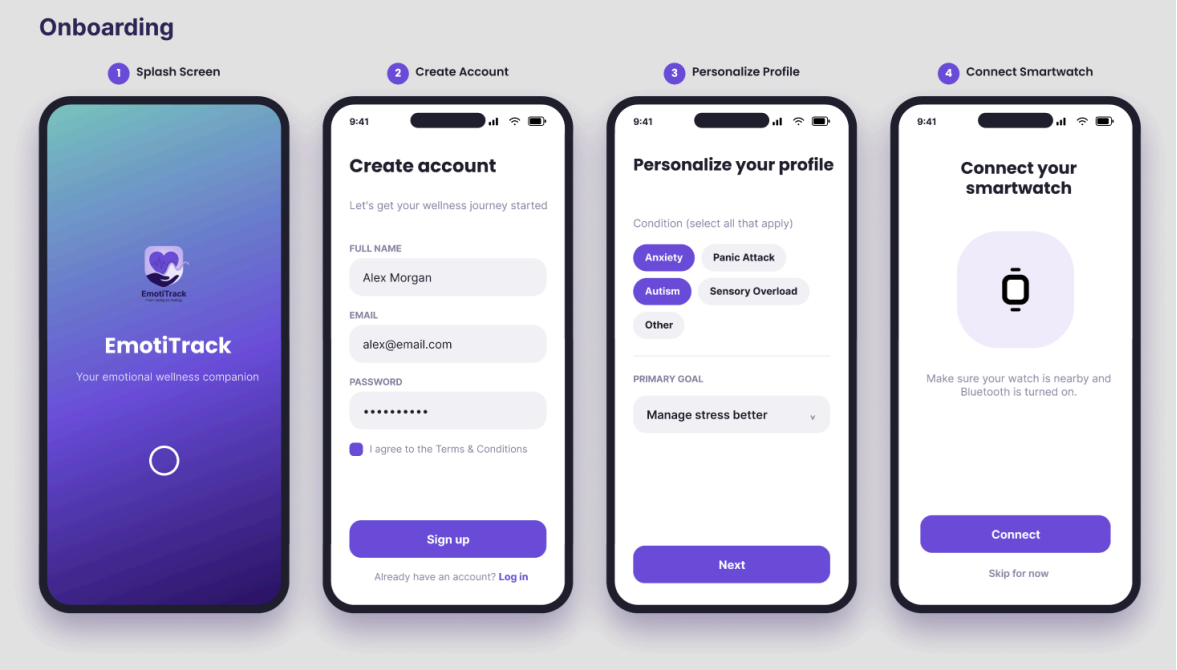


Figure 8: *Onboarding Screens*

Screen	Related FR
Splash Screen	—
Create Account	FR-01
Personalize Profile	FR-02
Connect Smartwatch	FR-03

Account registration, personalized goal/condition selection, and smartwatch connection are all included in the onboarding group that falls under FR-01 to FR-03 (see Table 10). These screens provide the minimum amount of information required by the system prior to implementing any monitoring or intervention.

6.5.2 Home and Monitoring Screens

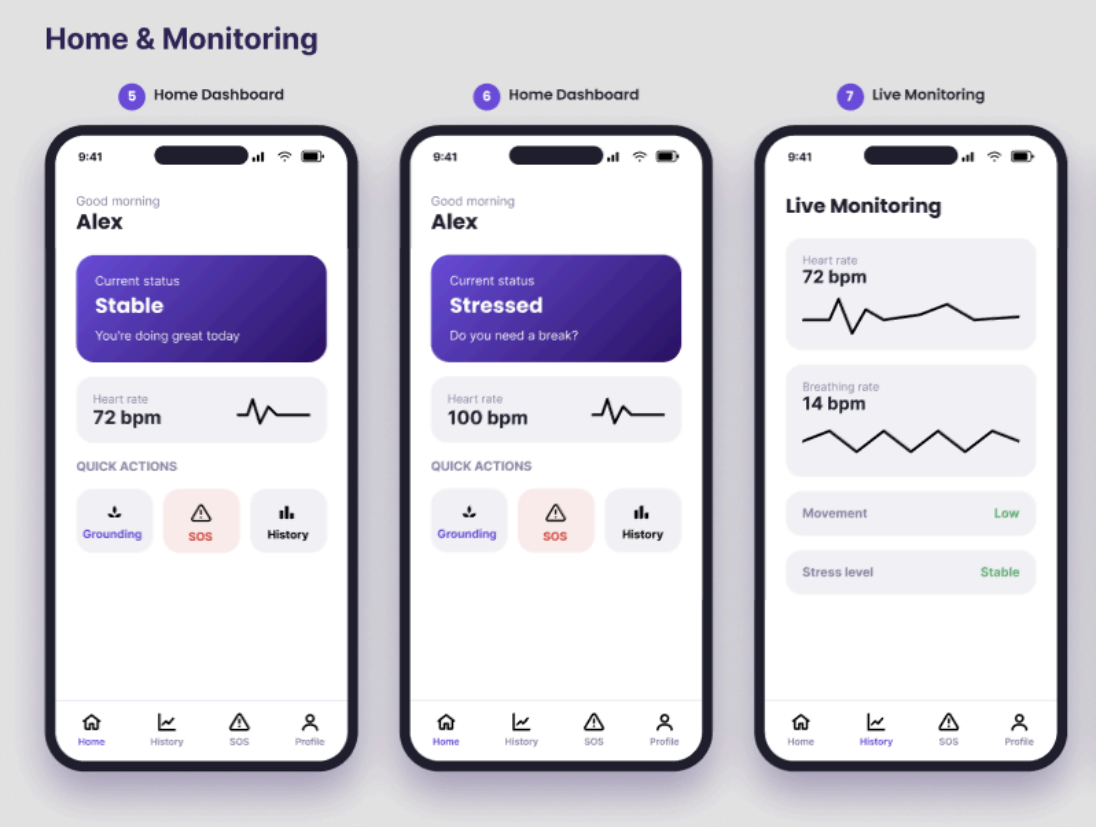


Figure 9: *Home and Monitoring*

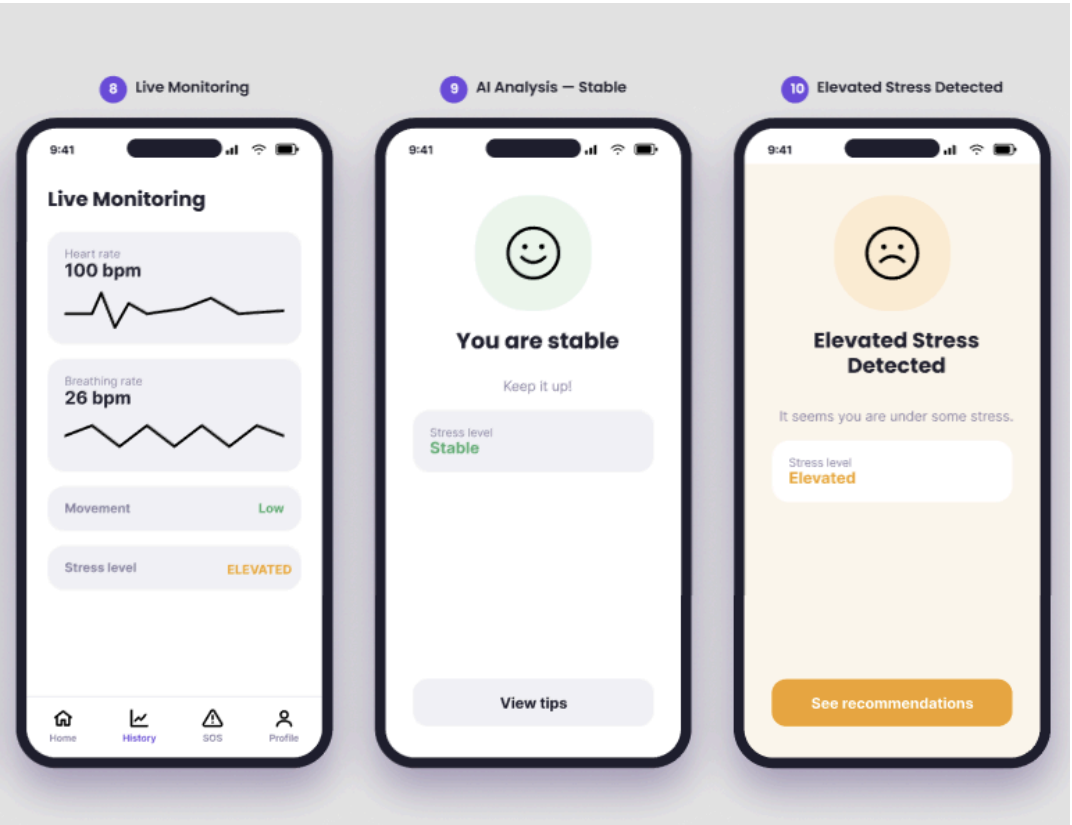


Figure 10: *Home and Monitoring*

Screen	Related FR
Home Dashboard – Stable	FR-10
Home Dashboard – Stressed	FR-06
Live Monitoring (Stable)	FR-04
Live Monitoring (Elevated)	FR-04, FR-05
AI Analysis – Stable	FR-05
Elevated Stress Detected	FR-05, FR-06

This group demonstrates the passive monitoring and real-time stress detection pathway (FR-04 to FR-06). The two Home Dashboard states show how the interface visually distinguishes a stable reading from a stressed one, while the Live Monitoring and AI Analysis screens make the system's biometric processing visible to the user, in line with the "system status visible" heuristic discussed in Section 7.1.

6.5.3 Grounding & Breathing Screens

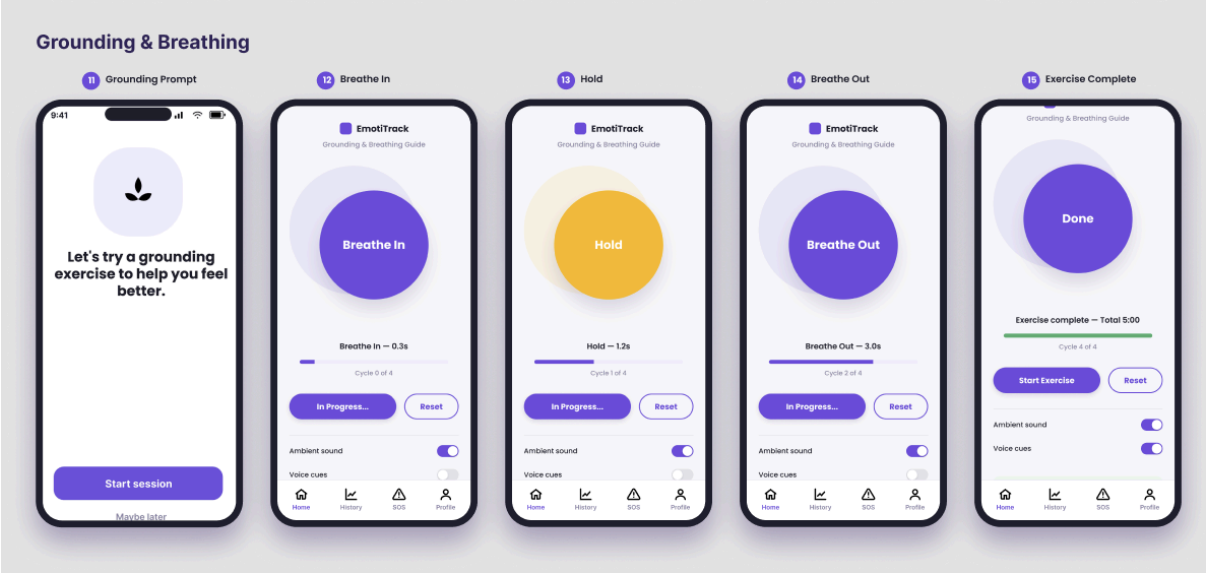


Figure 11: *Grounding & Breathing Screens*

Screen	Related FR
Grounding Prompt	FR-06, FR-07
Breathe In	FR-07
Hold	FR-07
Breathe Out	FR-07
Exercise Complete	FR-07

These screens demonstrate FR-07, the system's primary therapeutic action. The sequence mirrors the coded key function described in Section 6.6, guiding the user through the inhale, hold, and exhale phases before confirming completion.

6.5.4 SOS Emergency Screens

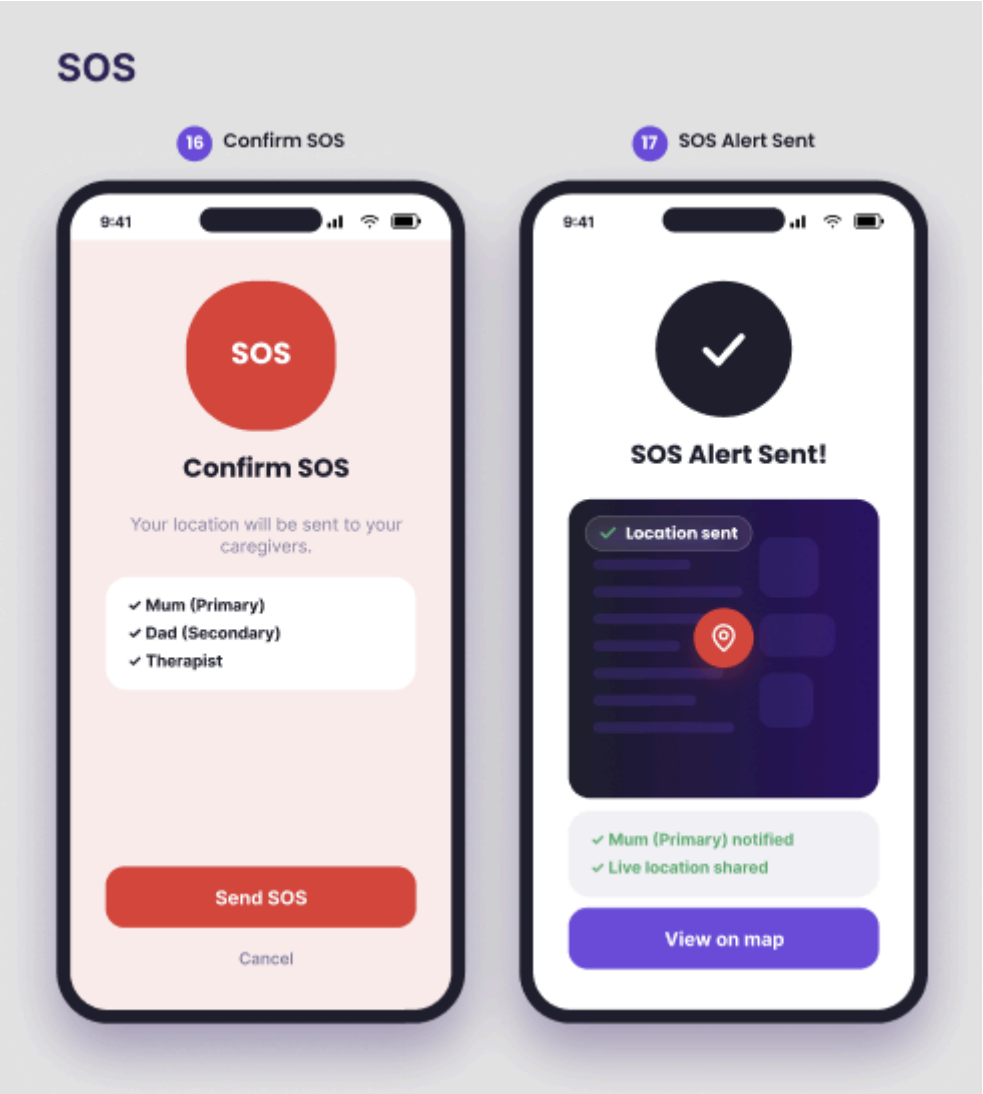


Figure 12: *SOS Screens*

Screen	Related FR
Confirm SOS	FR-08
SOS Alert Sent	FR-09

The Confirm SOS screen demonstrates the mandatory confirmation step required by FR-08 to prevent accidental activation, while the SOS Alert Sent screen confirms dispatch to pre-set caregivers (FR-09), including the map view showing shared location.

6.5.5 History & Profile Screens

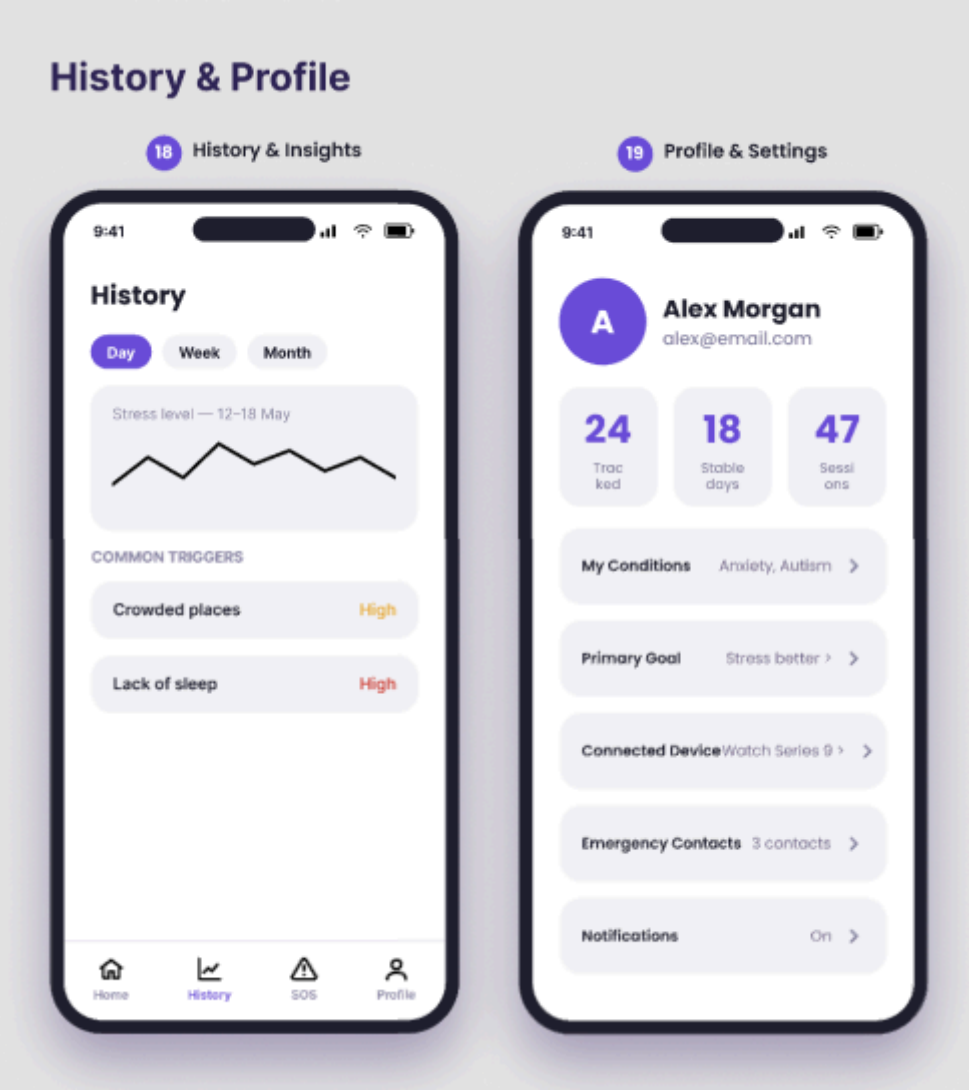


Figure 13: *History & Profile Screens*

Screen	Related FR
History & Insights	FR-10
Profile & Settings	FR-11, FR-12

The History screen demonstrates FR-10, giving the user visibility into mood and stress trends over time. The Profile & Settings screen demonstrates FR-11 and FR-12, showing caregiver access controls, notification preferences, and privacy settings in one central location.

6.5.6 Smartwatch Screens

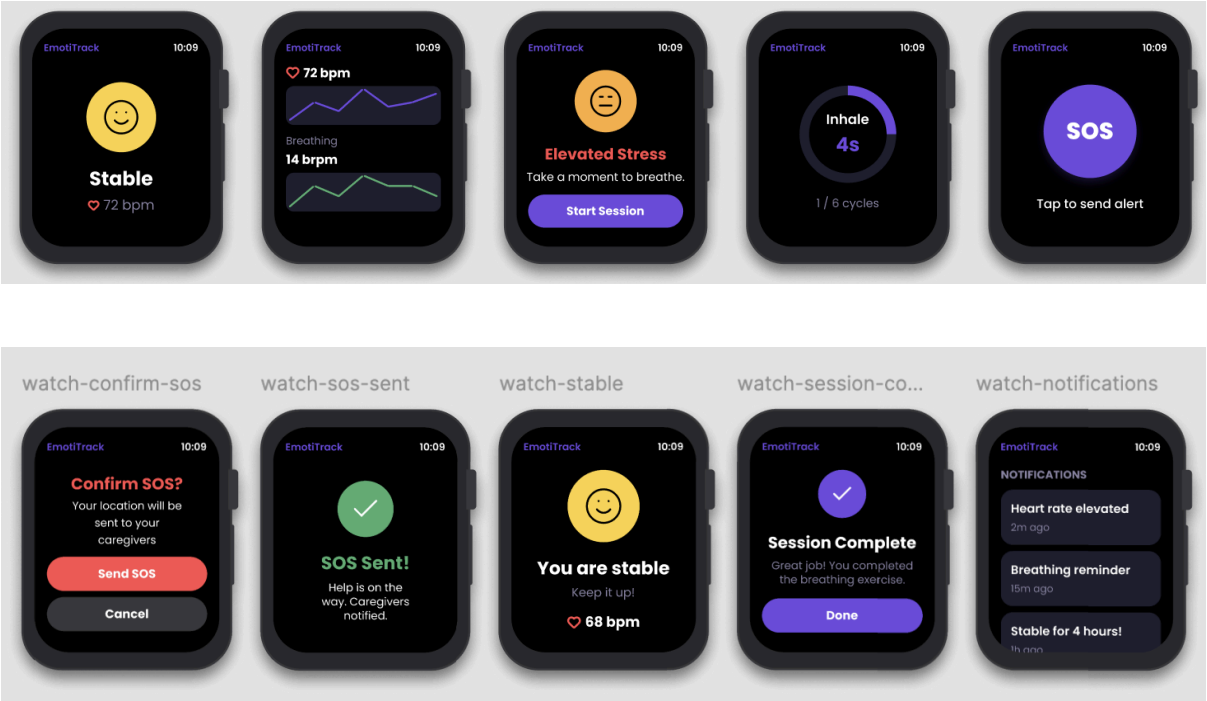


Figure 14: *Smartwatch Companion Screens*

Screen	Group	Related FR
Stable (72 bpm)	Home & Monitoring	FR-04, FR-10
Live Monitoring (HR + Breathing graph)	Home & Monitoring	FR-04
Elevated Stress	Home & Monitoring	FR-05, FR-06
You are stable (68 bpm)	Home & Monitoring	FR-05, FR-10
Notifications	Home & Monitoring	FR-06, FR-11
Inhale 4s (breathing circle)	Grounding & Breathing	FR-07
Session Complete	Grounding & Breathing	FR-07
SOS (Tap to send alert)	SOS	FR-08
Confirm SOS?	SOS	FR-08
SOS Sent!	SOS	FR-09

The smartwatch row mirrors the core mobile functions — stability status, live monitoring, stress alerts, grounding/breathing guidance, and SOS confirmation — in a wrist-optimised format, supporting the low-effort interaction described in Section 5.2 and the Smartwatch Integration feature in Table 1.

6.6 Coded Key Function

Alongside the Figma prototype, one function of EmotiTrack was fully coded and demonstrated outside the static prototype, in line with Objective 2. This coded function gives tangible evidence that one of EmotiTrack's core proactive-support features can genuinely work, rather than only being described in the architecture in Section 5.3.

6.6.1 Selected Function

The process that was chosen for the coding implementation is referred to as the guided breathing exercise, which goes hand-in-hand with FR-07 referenced in section 5.1.1. The coding of this process has been done using HTML, CSS, and JavaScript which means that it is now live on the web and running on web browsers. The process allows the user to go through all the phases of the grounding cycle: the inhaling phase, the holding phase, and the exhaling phase and goes through four different cycles, with a countdown clock, a progress bar, and a completion indicator after the completion of all cycles.

6.6.2 Reason for Selection

This function was chosen because it represents the system's primary therapeutic action, the step that everything earlier in the stress-response flow exists to lead into, and everything after it depends on having worked. As Section 6.3.2 explains, once a stress-related pattern is identified, the value of EmotiTrack lies entirely in whether the user can be guided through a calming exercise that is easy to follow and does not add to their distress. Coding this function, rather than one of the account or history-related features, gives the clearest demonstration that the "proactive support" and "grounding and breathing support" claims made in Sections 2.0 and 2.2 are technically achievable within the scope of this assignment.

It also follows with the visual and audio design decisions described in Section 6.2, since the same color palette, rounded shapes, and calm tone that guide the prototype's static screens had to be reproduced in working code rather than only in a design file. For these reasons, the group judged it the function best able to represent both the intelligence and the intended user experience of EmotiTrack in one coded deliverable.

6.6.3 Implementation Description

The coded function was implemented as a standalone web prototype in HTML, CSS and JavaScript for this assignment. This way the team showed the behaviour of the function to the audience in a visual, interactive and audible way within the time frame. Flutter would be the mobile equivalent and Node.js/Express the back end application depending on the backend in the complete EmotiTrack system as proposed in Section 5.4. The breathing exercise would be conducted via the Grounding Exercise Service in Section 5.3.2 and not be a standalone page.

The breathing exercise is set to a prescribed pattern: four seconds in four seconds out, and six seconds out. Note that this is repeated 4 times (cycles) to make four complete sets. Each phase is timed by a JavaScript subroutine and details of the time remaining and the instruction now being performed are updated at all times on the screen. The breathing indicator will increase and decrease in size and color over time in a crescent using CSS Transitions and by means of both visual and audible cues, the user will know roughly what he/she is currently in. The exercise is ended automatically after the fourth Cycle.

The audio feedback does not use prefabricated sound files but is made completely live via Web Audio API. When the phase of breathing changes, the rhythm is played with a short chime. When there is interaction with buttons, the rhythm is played with a make-up click sound (to verify). During active rhythm, an optional ambient tone is played. Users will have the option to turn on & off these sounds with a toggle switch. With an optional voice-cue setting, you instruct the computer's built-in Speech Synthesis API to speak each phase of the breath.

This function shows the Breathing Exercises feature that is described in Table 1. The same guidance may also be provided with vibration by the smartwatch in the complete system, under the ‘Smartwatch Integration' in the same table. The present coded function is not associated with a database or external API as it models the exercise of breathing on its own. Similarly, if this were the full architecture, the time at which the exercise began and if it was completed or not would be recorded in the Exercise Records Database as outlined in Section 5.3.3.

6.6.4 Output / Screenshot Evidence

The following screenshots were captured while running the coded breathing and grounding function in a web browser, showing each stage of the exercise as described in Section 6.6.3.

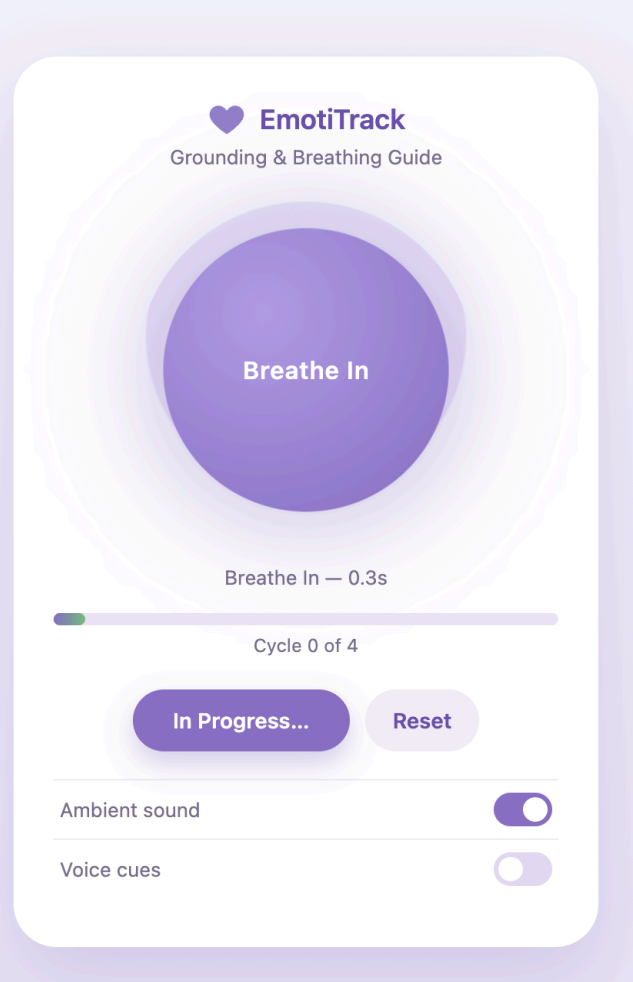


Figure 15: *Breath in Cycle*

This screenshot demonstrates the visual state of the function during the inhale phase, confirming that the breathing circle expands and the phase label updates correctly, as described in Section 6.6.3.

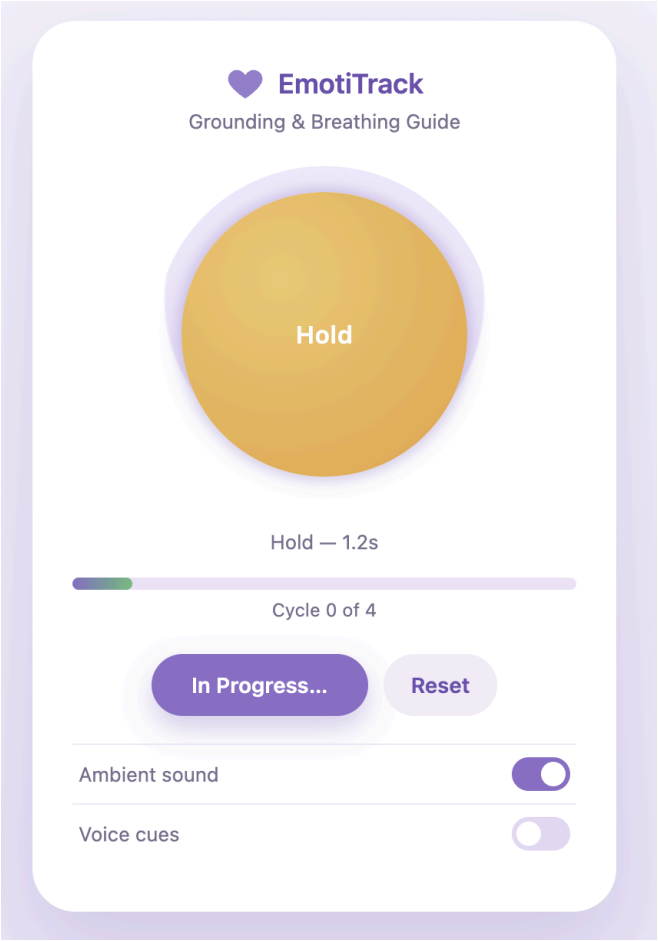


Figure 16: *Hold Cycle*

This screenshot shows the circle holding at its expanded size with the color shifting to reflect the hold phase, illustrating the phase-change logic and progress tracking described in Section 6.6.3.

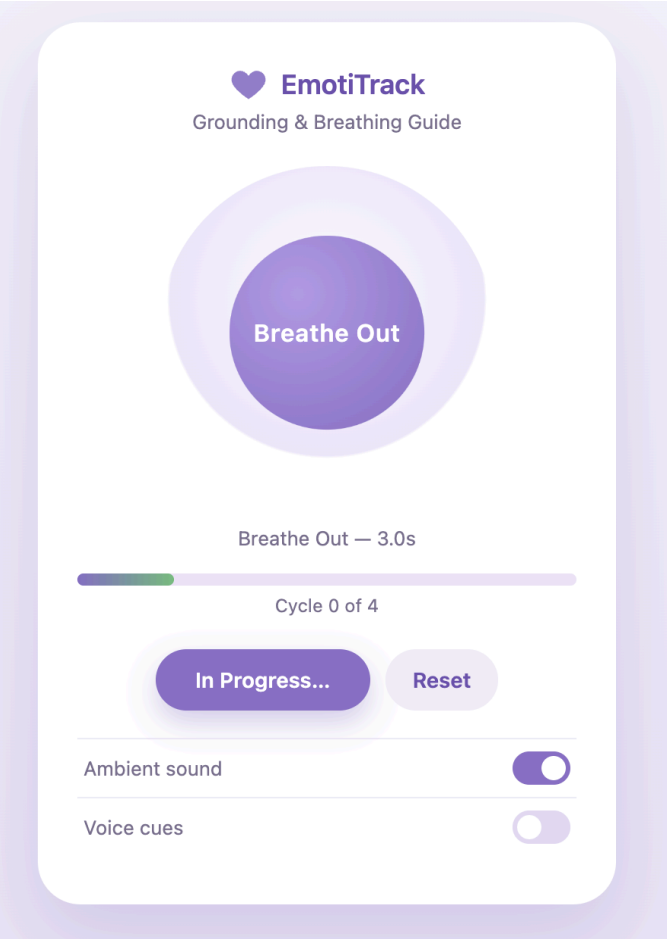


Figure 17: *Breathe Out Cycle*

This screenshot demonstrates the circle shrinking back down during the exhale phase, confirming that all three phases of the breathing cycle are functioning as intended.

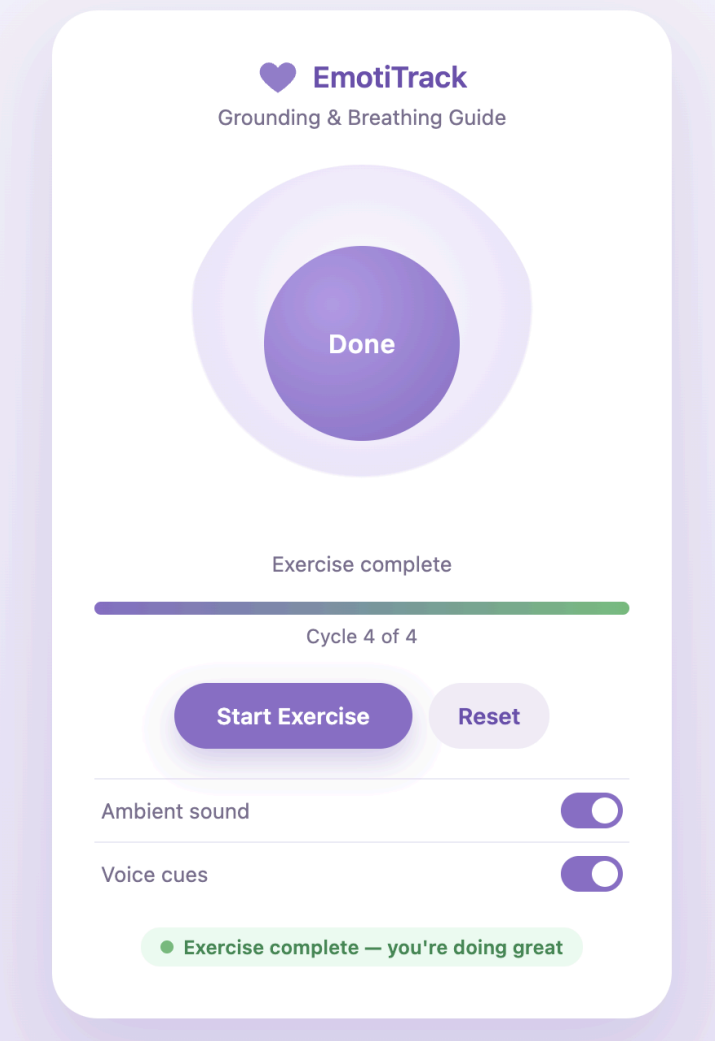


Figure 18: *Exercise Completion State*

This screenshot shows the function's completion state after four full cycles, confirming that the cycle-counting logic and completion trigger described in Section 6.6.3 work correctly.

6.7 Navigation Flow

The EmotiTrack application's navigation was built to be simple and direct, with the idea of giving those who want to use the application the one-click access to the main wellbeing features. On the Home Dashboard, users can easily navigate to monitoring, grounding/breathe, SOS, and history with just a few taps, clinic settings, and smartwatch settings. We first show the full navigation structure in Figure 19, and then six examples of important user journeys which are presented for each type of interaction to show a representative process.

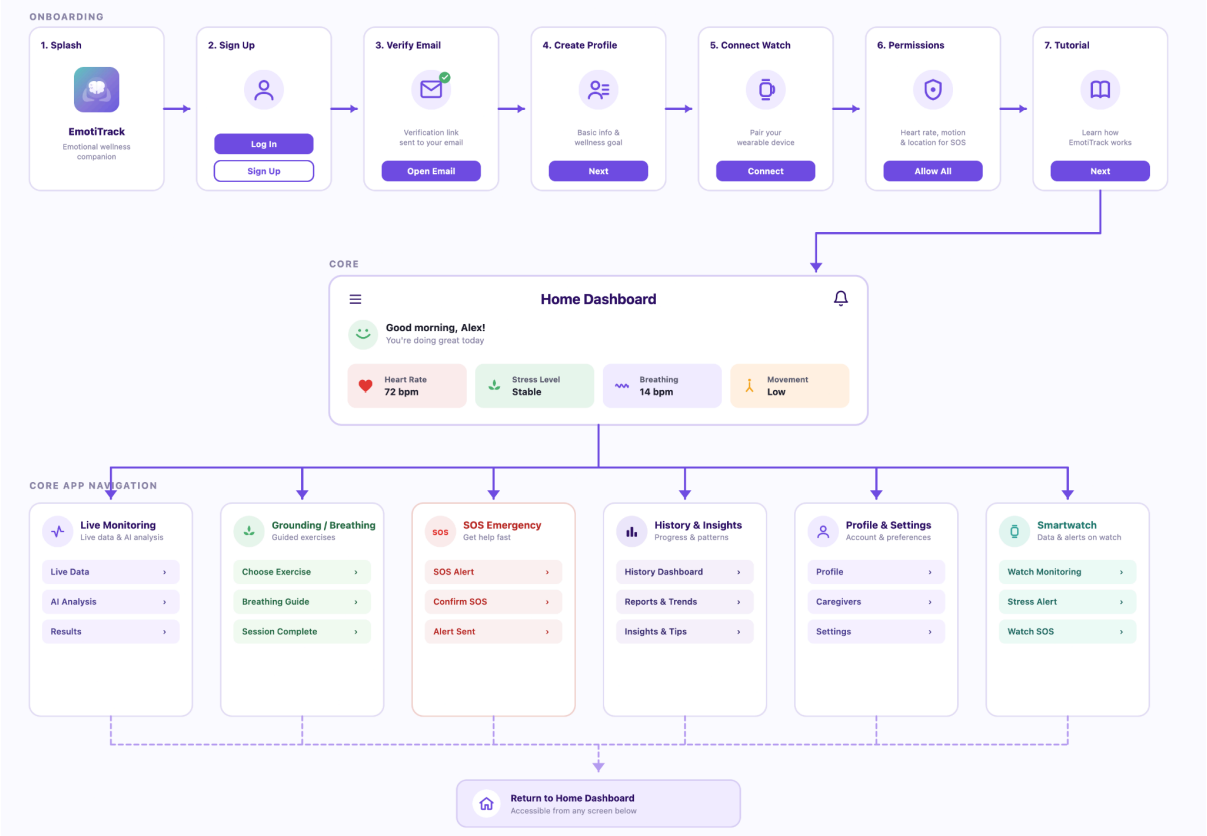


Figure 19: *Overall Navigation Flow*

Figure 19 is the main screens and features of EmotiTrack connected. For new users, the Home Dashboard is only the destination after the recently introduced "onboarding sequence". The main features of the application can be accessed from the dashboard where you can go back to the Home screen in case you need. This is a structure that ensures consistent navigation and a minimum of hoops to jump through in accessing key support tools.

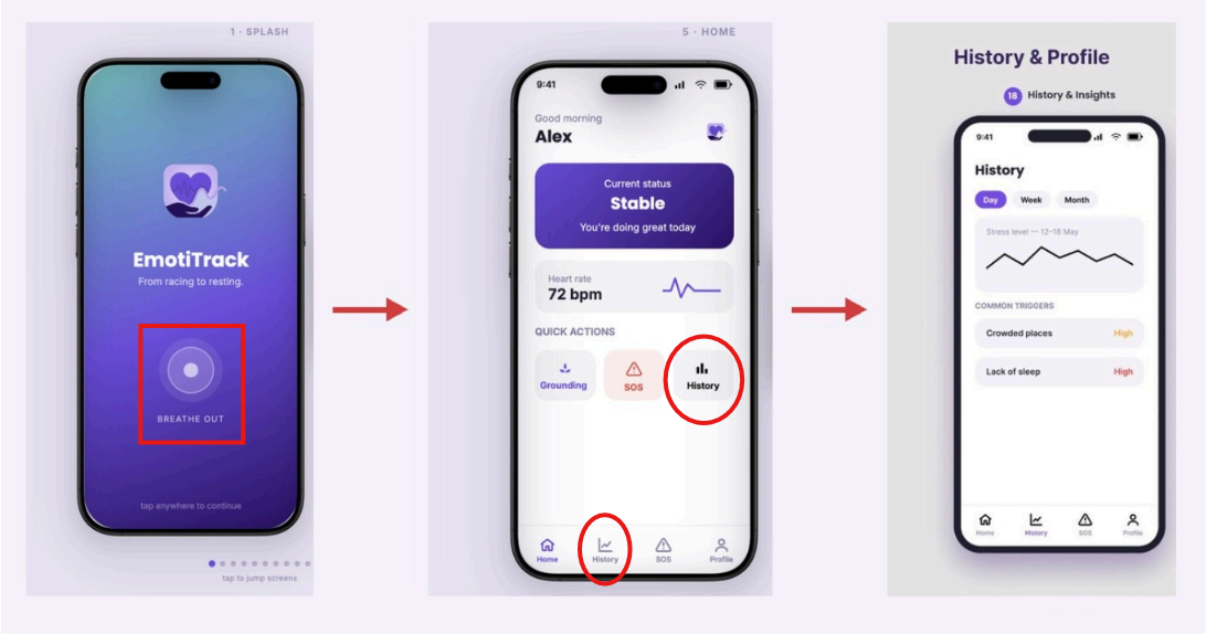


Figure 20: *Onboarding and History Flow*

Figure 20 explains the steps for creating an account when installing EmotiTrack for the first time, selecting a profile, adding a smartwatch, and getting to the Home Dashboard. The user can choose to view the History button and previous wellbeing records and patterns on the dashboard. The highlighted buttons explain what needs to be done to navigate between the screens that are displayed.

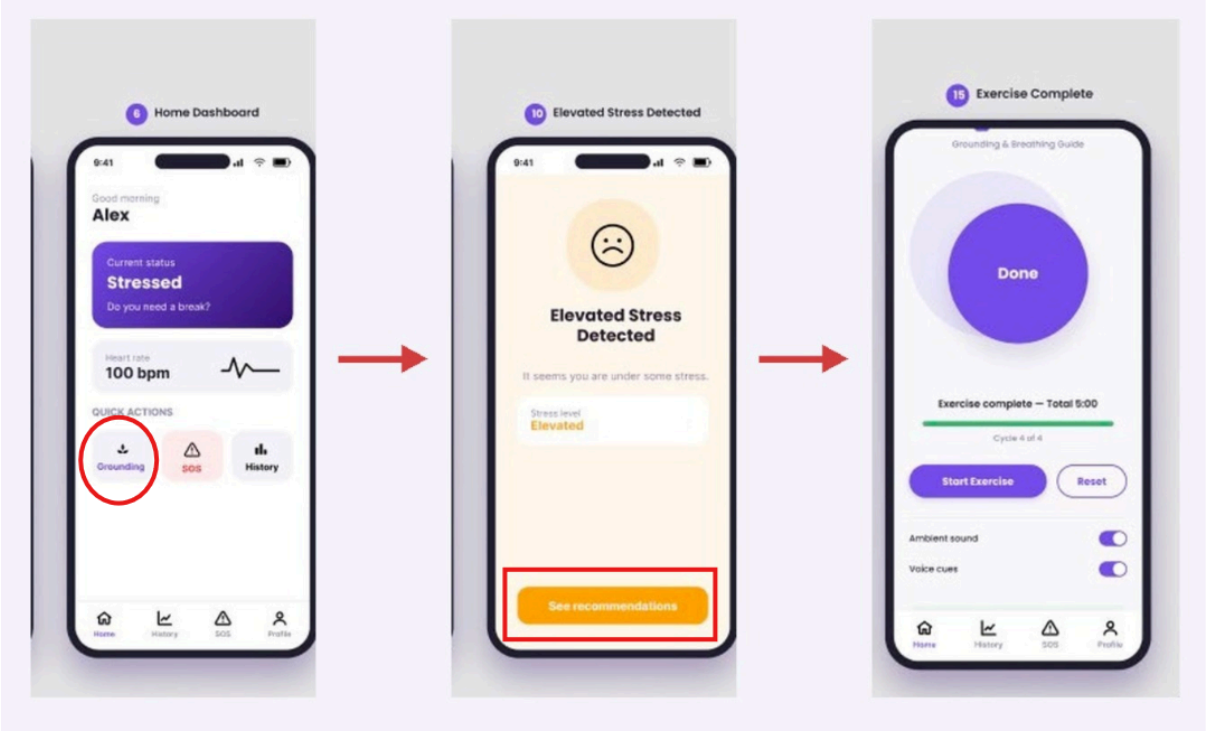


Figure 21: *Stress and Grounding Flow*

A possible pattern of the support flow when a stress related pattern is identified is shown in figure 21. The user is able to get to the Grounding function on the Home Dashboard, and see the suggestion for the next ground, then choose to do a guided grounding or breathing movement. At the end of the exercise, the interface is clearly marked as completed, and the user can then redo the exercise or go back to another section of the app.

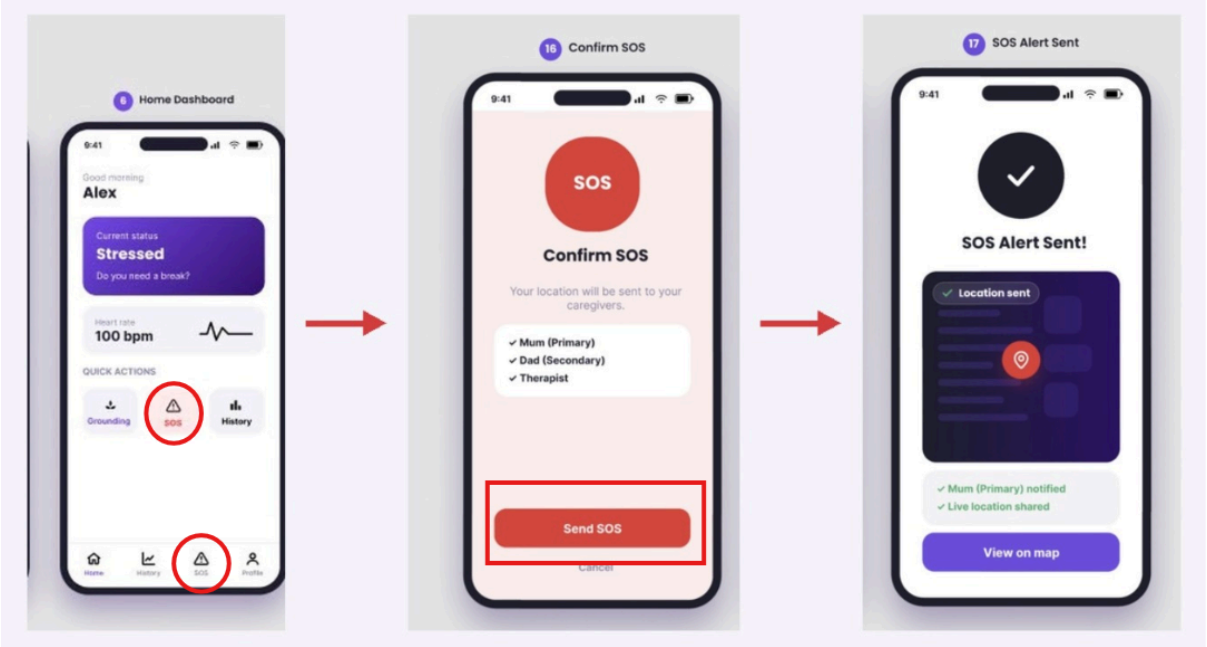


Figure 22: *SOS Emergency Flow*

The user when activated SOS function from the Home Dashboard as shown in figure 22. Once the user clicks on SOS, it takes him to a screen of confirmation where he is shown with who is the authorized contact who will be alerted. An alert will only be sent as soon as the user has chosen the Send SOS button, and then again in order to confirm the notification and the allowed location information has been sent.

The three detailed flows were chosen as typical user journeys showing the key ways of engaging with EmotiTrack: when the system is first used by a user, and they access their own records; when they wish to use EmotiTrack for wellbeing support during a stress responding situation; when they need urgent consent based support. They are not meant to demonstrate ALL possible navigation paths. The rest of the routes, those such as Live monitoring, Profile and Settings and Smartwatch functions etc. are displayed in the overall navigation structure of Figure 19. These overview and detailed flows give a clear understanding of the full flow of an application and what users do in important scenarios.

6.8 Visual, Audio and API-Based Features

Visual Techniques

The interface uses a small set of custom icons which includes a leaf-shaped logo built directly in SVG, consistent with the calm, non-clinical way as described in Section 6.2.1. The breathing circle itself is animated using CSS transitions, smoothly expanding during the inhale phase, holding its size during the hold phase, and contracting during the exhale phase.It gives the user a visual rhythm to follow without needing to read the on-screen text. The color scheme follows the palette in Section 6.2.2: purple and lavender tones to represent calm which is the default state of the interface. A warmer tone marks the hold phase, and green is used to signal successful completion, keeping the same color-coded logic used elsewhere in the prototype for stable, warning, and emergency states. A progress bar and a cycle counter ("Cycle 2 of 4") give the user a continuous sense of how much of the exercise remains, addressing the design goal in Section 6.1 of keeping users oriented without requiring sustained concentration.

Visual Functions:

- **The breathing circle's animation states:**

CSS

```
.breath-circle{
  width:120px;
  height:120px;
  border-radius:50%;
  background:radial-gradient(circle at 35% 30%, #b79bea,
var(--primary));
  box-shadow:0 0 0 0 rgba(139,111,201,0.4);
  transition:transform 4s ease-in-out, box-shadow 4s ease-in-out,
background 0.6s ease;
}
.breath-circle.inhale{
  transform:scale(1.55);
  box-shadow:0 0 40px 10px rgba(139,111,201,0.35);
}
.breath-circle.hold{
  transform:scale(1.55);
  background:radial-gradient(circle at 35% 30%, #f0c96b,
```

```
var(--accent-warn));
}
.breath-circle.exhale{
  transform:scale(1);
  box-shadow:0 0 0 0 rgba(139,111,201,0.2);
}
```

- **JavaScript driving the phase changes (updates the circle, label, and triggers audio together):**

Javascript

```
function startPhase(){
  const phase = PHASES[phaseIndex];
  phaseTimeLeft = phase.duration;

  breathCircle.className = 'breath-circle ' + phase.name;
  phaseLabel.textContent = phase.label;
  playPhaseChime(phase.name);
  speak(phase.label);
  ...
}
```

- **Progress bar update logic:**

CSS

```
.progress-fill{
  height:100%;
  width:0%;
  background:linear-gradient(90deg, var(--primary),
var(--accent-stable));
  border-radius:6px;
  transition:width 0.2s linear;
}
```

Javascript

```
const totalDuration = PHASES.reduce((a,p)=>a+p.duration,0) *
```

```
TOTAL_CYCLES;
const elapsed = (cycle * PHASES.reduce((a,p)=>a+p.duration,0))
                +
PHASES.slice(0,phaseIndex).reduce((a,p)=>a+p.duration,0)
                + (phase.duration - phaseTimeLeft);
progressFill.style.width = Math.min(100,
(elapsed/totalDuration)*100) + '%';
```

Audio Techniques

The function coded in this way produces sounds through the browser instead of relying on pre-existing sound recordings. There is an audible sound played each time a button like "Start Exercise" or "Reset" is clicked confirming that the command entered by the user has been received. A bell is rung on every occasion that the phase changes, with the inhale being different from the hold and exhale in sounds; hence, the user would be able to perform the exercise through sound alone if desired. The user is also served a steady tone during the exercise as well as a sound that indicates a successful completion of the 4 cycles. All sounds can be turned off with the use of the toggle switches present on the screen.

Audio Functions:

- **Generating tones (used for clicks and chimes):**

Javascript

```
function playTone(freq, duration, type='sine', vol=0.15){
  if(!soundOn) return;
  const osc = audioCtx.createOscillator();
  const gain = audioCtx.createGain();
  osc.type = type;
  osc.frequency.value = freq;
  gain.gain.setValueAtTime(vol, audioCtx.currentTime);
  gain.gain.exponentialRampToValueAtTime(0.001,
audioCtx.currentTime + duration);
  osc.connect(gain).connect(audioCtx.destination);
  osc.start();
  osc.stop(audioCtx.currentTime + duration);
}
```

- **Button click sound:**

Javascript

```
function playCompletionChime(){
  [523.25, 659.25, 783.99].forEach((f,i)=>{
    setTimeout(()=>playTone(f, 0.6, 'sine', 0.12), i*180);
  });
}
```

- **Phase-change chime (different pitch per breathing phase):**

Javascript

```
function playPhaseChime(phase){
  if(phase === 'inhale') playTone(523.25, 0.5, 'sine', 0.12);   //
C5
  if(phase === 'hold')   playTone(659.25, 0.5, 'sine', 0.10);   //
E5
  if(phase === 'exhale') playTone(392.00, 0.6, 'sine', 0.12);   //
G4
}
```

- **Completion chime:**

```
function playCompletionChime(){
  [523.25, 659.25, 783.99].forEach((f,i)=>{
    setTimeout(()=>playTone(f, 0.6, 'sine', 0.12), i*180);
  });
}
```

- **Ambient background tone:**

```
function startAmbient(){
  if(!soundOn || ambientNodes) return;
  const osc1 = audioCtx.createOscillator();
  const osc2 = audioCtx.createOscillator();
  const gain = audioCtx.createGain();
  osc1.type = 'sine'; osc1.frequency.value = 174;
  osc2.type = 'sine'; osc2.frequency.value = 220;
  gain.gain.value = 0.025;
  osc1.connect(gain); osc2.connect(gain);
  gain.connect(audioCtx.destination);
  osc1.start(); osc2.start();
  ambientNodes = {osc1, osc2, gain};
}
```

- **Voice cues using Web Speech API:**

```
function speak(text){
  if(!voiceOn) return;
  if('speechSynthesis' in window){
    const utter = new SpeechSynthesisUtterance(text);
    utter.rate = 0.9;
    utter.pitch = 1.0;
    speechSynthesis.speak(utter);
  }
}
```

API-Based Features

The programmed function utilizes two native APIs from web browsers for a lightweight model devoid of any dependencies instead of using the external APIs mentioned in the initial brief, like OpenGL, Lottie, or an outside AI chatbot API. For example, the Web Audio API is responsible for generating the previously mentioned clicking sounds, the sound of the phase change, ambient sound, and the completing sound. The Web Speech API, namely its Speech Synthesis interface, is employed to provide the sound breathing cues while transforming the phase name into audible speech inside the browser. It is worth noting that the abovementioned two API technologies were favored in difference to the originally chosen techniques since there is no need to have any outside accounts and access to the network for these APIs.

In general, this section showcased the design and realization process of EmotiTrack, its visual style, storyboard, clickable prototype, the prototype screens, the key function coded and the flow of navigation. The following section evaluates the final design using usability principles and discusses its strengths, limitations, alternatives, and key design decisions.

7.0 Design Analysis

The EmotiTrack prototype aims to give students an easy, supportive, and comfortable user experience to track their emotional state. Consistency, accessibility, usability and ease of navigation have been taken into account throughout the whole design process. The prototype combines mood tracking, live monitoring, grounding exercises, SOS emergency support, history tracking, and profile management into one integrated application. This section analyzes the design based on Nielsen's 10 Usability Heuristics, explains the pros and cons of the design, and explains other concepts that were once proposed during the design process and why they were rejected.This section examines the design through Nielsen's 10 Usability Heuristics, elucidates the strengths and weaknesses of the design, and explains alternative ideas that were considered during design and why they were discarded.

7.1 Nielsen's 10 Usability Principles Evaluation

An Evaluation of the 10 Usability Principles in the context of Nielsen's 10 Principles.

1. **The system status is visible.It is visible whether the system is up or down.**

EmotiTrack is an application that continually provides the user with updates on the activities occurring. While live monitoring, the user can see their heart rate, breathing rate, movement and stress level. The breathing exercise also includes progress indicators like ‘Breathe In’, ‘Hold’ and ‘Breathe Out’, to the user so they can see what stage of the exercise they are at. If an SOS is sent, the person will be immediately made aware that help is coming by appearing on the confirmation screen.

2. **Match between the System and the real world**

The application employs familiar words and symbols that will be understood by the user. Common terms like Heart Rate, Stress Level, Grounding, SOS and History are quite straightforward and don't need much explanation. The icons, for example the heart, leaf, warning symbol and profile icon, are naturally associated with their functions, so that the user interface is easy for first time users to grasp.

3. **The user has control and freedom over the system.**

The use of the user's interactions is under their control. Enabling the connection of the smartwatch can be omitted in case a wearable device is not available during onboarding. The user can cancel breathing exercises or SOS actions before confirmation to prevent unexpected

actions. Users can also use navigation to go back to the Home Dashboard from any major feature.

4. **Consistency and Standards**

The use of the same purple colour palette, rounded buttons, typography, icon style and navigation layout throughout the prototype helps to ensure consistency. Primary actions are constantly available as large coloured buttons and navigation icons stay in the same area on a number of screens. This consistency reduces the learning curve and helps users recognise familiar interface elements quickly.

5. **Error Prevention**

There are a few things that help to minimize user errors. The SOS function needs to be confirmed before caregivers are alerted to an SOS message, which prevents unintentional alerts. When creating an account, it asks the user to confirm his/her email address, minimizing incorrect account registration. Permission requests also are consolidated to make it easy for the user to see what access is being requested.

6. **Recognition instead of Recall**

Important functions are always visible and users don't need to remember complicated actions. The Home Dashboard includes easy access buttons for Grounding, SOS and History. The icons for navigation are displayed on the bottom of almost every screen, so they can identify a function without having to memorize where it is located in the menus.

7. **Flexibility and efficiency of use**

The prototype is usable for new and experienced users. It has onboarding and tutorials for new users and monitoring features for returning users on the dashboard. Smartwatch integration also increases more efficiency by enabling users to get alerts of stress and start breathing exercises directly from a smartwatch without opening the app.

8. **Aesthetic and Minimalist Design**

The UI/UX is simple and clean. Each screen addresses just what you need to do the task and thus reduces your distraction level. The soft use of purple hues, white backgrounds, rounded cards, and ample spacing ensure a serene visual aesthetic, consistent with the app's mental health-focused mission.

9. **Facilitate Users to Identify, Analyze and Correct Errors**

The application is clear and conveys ideas about the state of the system and results. High stress is included in a separate results screen that includes recommendations instead of technical information. The SOS workflow requires confirmation prior to sending alerts, and successful actions are followed up with confirmation messages to make users aware of the results of actions.

10. **Help and Documentation**

EmotiTrack is built to be intuitive but further instructions are available via onboarding tutorials and explanations when it is first set up. Exercises include grounding and breathing one with step-by-step instructions so user can understand how to use the application without any external documentation.

7.2 Strengths of the Final Design

The Final Design's strengths are listed below.The following are the strengths of the Final Design.

There are some benefits of the last EmotiTrack design, with respect to the usability and user experience. The interface adheres to a uniform look and feels, uses a soothing purple colour palette, rounded elements and legible typography, making the application entryway for students. The dashboard gives quick access to the most critical features of the application, thereby cutting the number of steps for performing the common tasks.

One of the other benefits is that they have a variety of wellbeing features built into this one platform. Users can track their health, conduct breathing exercises, view grounding exercises, track emotional history, handle emergency contacts, and activate SOS alarms with ease and without having to switch applications. The integration of smartwatch technology also enhances accessibility, allowing for real-time monitoring and swift access to emergencies.

7.3 Weaknesses and Limitations

Even though the prototype has some good qualities, it has some drawbacks. The design is principally about showing the interaction of the users, not a working system. The functionalities like AI stress analysis, wearables data collection, caregiver notifications and location sharing are depicted conceptually and would require external APIs and back-end infrastructure in the real development process.

Furthermore, the prototype has not yet been used in an extensive manner with actual users. Students could be involved in formal usability testing to highlight opportunities for improvement in the interface, accessibility issues and workflow optimisations. There are also limited personalization options in the current design, which may be enhanced for future versions.

7.4 Alternative Designs Considered

Various design features were analyzed and the best one was chosen for the prototype.

One of the first ideas the team had was to use a dark interface, as it helps to minimize eye strain and can be aesthetically pleasing. The dark theme, however, seemed too sterile and lacked the relaxing and supportive tone that was needed for a mental wellbeing app.

Another option was to have a dashboard with multiple health metrics at once. This method did give more information, but resulted in a crowded and overwhelming interface. The team chose, however, a simplified dashboard which focuses on only the most essential data.

The other option was to create a side navigation menu to contain all features. This made the dashboards less cluttered, but meant that there were more steps to get to common functions like Grounding and SOS. The final design, however, moves these functions to the Home Dashboard, where they're more readily accessible.

7.5 Design Decision Justification

The final EmotiTrack design was chosen because it offers the greatest degree of simplicity, usability and functionality. The interface is consistent with usability principles, it is not too complex and it lets user navigate quickly. The calming colour palette and the minimalistic design also emphasizes the objective of the application for emotional health.

The navigation was designed to be dashboard-centred as it minimises effort for the user while ensuring key functions are accessible. Functionalities like Grounding, Live Monitoring and SOS are readily available and are essential during stressful moments. The integration of the Smartwatch makes it even more convenient, providing alerts and support without the need to use the mobile application.

Finally, the end prototype effectively demonstrates the potential of EmotiTrack to offer an accessible, supportive, and effective emotional wellbeing tool for university students, while also presenting opportunities for further development and improvement, including enhanced AI capabilities, cloud integration, and customised wellbeing recommendations.

Overall, the design analysis assessed the usability of EmotiTrack, its strengths and weaknesses, alternate designs considered and important design decisions made. This section considers the team's experiences and challenges, successes and failures, and learning together in the course of the project.

8.0 Team Analysis

This section assesses how well the team has cooperated and worked in developing EmotiTrack. It addresses the sharing of responsibilities, the management of communication and the response of the team to challenges faced in the preparation of the report, technical architecture and the prototype, and in giving the presentation. Members were divided into sections, but important decisions and final products were discussed together to avoid conflicts within the project.

8.1 Team Dynamics

The team operated in a collaborative organizational model with each member assigned particular parts of the project and also performing joint operations. Primarily, communication was done via apps such as WhatsApp, Google Meet and shared online documents. These tools enabled members to update, consult on design, share file and view finished work.

Juri she is the group leader, providing the basis for communication, reviewing progress and see that the report and prototype were not only valid but met the requirements of the assignment. The members gave inputs as assigned to their respective sections like proposed solution, project scope, system architecture, UI/UX design, prototype coding, design analysis and documentation. Group discussions were significant especially when choices impacted multiple sections such as selecting system features, technology, navigation flow, and prototype consistency.

8.1.1 Team Strengths

A great thing about the team was the diversity of the talents being put forward. The writing, technical planning, system architecture, UI/UX design, prototype, and design evaluation were needed within the project. This break-up of activities gave each member the chance to work on a successful portion of the project, whilst also enabling them to work together towards the full picture.

The team also showed great adaptability for when improvements were necessary. Initial concept of EmotiTrack was strengthened through feedback from lecturer, internal review to show that the technology integration is stronger and report structure is improved. When inconsistencies were present, members were willing to revise their sections. The additional benefits of all documents sharing a single source and creating a unified document to review the project made it easier to accommodate individual work.

The other strengths were the team's capacity to integrate approximately the various project parts. The system requirements, architecture, prototype screens, storyboard, and coded key function were related to the proposed features. This helped a uniform direction in both the technical and designing aspects of EmotiTrack.

8.1.2 Team Weaknesses

The biggest difficulty encountered by the team was to get everyone's work done at different times and times. Because multiple chapters were written simultaneously, there was some variation in terminology, formatting of chapters, names of features and technical explanations. To this end, further checking was carried out to see that the names of the different components, and the projects were consistent throughout the report.

Another difficulty was the time management as prototype making, report, diagrams, coding, and presentation were overlapping. Several of the tasks were more time consuming than first anticipated, resulting in a higher workload up to the last submission deadline. Valuable for fast updates on information, but in-depth technical/design discussions sometimes easier to deal with in meetings or by reviewing documents.

However, the weaknesses made evident that in order to accomplish the project earlier integration, clarity of internal deadline and more frequent reviewing of shared work would be important.

8.2 Lessons Learned

The team realized that good communication, consistency with the terminology and regular check of progress are key in a group project. While members worked on separate tasks, all shared review was needed to make sure that there was correlation and cohesion between the system requirements, architecture, prototype, and report.

The project also highlighted the need for setting internal deadlines prior to the final submission deadline. This meant a higher amount of test and editorial time was dedicated to formatting and rectifying any inconsistencies. In summary, the team learnt about user centred design, accessibility, prototyping, technical planning, privacy and collaborative project management.

9.0 Conclusion

The EmotiTrack project suggested a system for emotional wellbeing support system which includes connectivity by using mobile interaction, wearables for monitoring, personal support tools and caregiver connectivity based on a user's consent. This system was developed to overcome the weakness of wellbeing apps that simply prompt the user to open the app and choose some support in potentially stressful moments. EmotiTrack, with its active and passive modes of wellbeing assistance, including the mood tracker, grounding and breathing exercises, stress related alerts, SOS support, interface's adaptive elements, and historical insights, revolves around the wellbeing of everyone.

The project also highlighted the application of Artificial Intelligence and Machine Learning, Internet of Things, Cloud Computing and Big Data Analytics in a multi-layered system architecture. They enable processing of wearables data, potential stress patterns detection, real-time alerts, data security, and data history analysis. Security/privacy has been kept in mind throughout the design, such as user consent, encryption, controlled access to caregivers, and audit logging.

A high-fidelity alpha prototype, storyboard, navigation flow, technical architecture and coded breathing-exercise function were developed and serve to demonstrate the proposed system. The design was also assessed as per Nielsen's usability principles to gain insights into the strengths and limitations of the design. The current project is not a full operational application, but it does give us a good basis for further development and testing.

EmotiTrack concludes by offering a practical and user-centred way to providing digital support to emotional wellbeing. Future development include wider wearableness, integration with University wellbeing services, expand accessibility, multi-lingual, and more personalised recommendations using consent-based historical data. These enhancements have the potential to make the system more useful without compromising user privacy and they can remain within the user's control and keep them safe.

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Appendix

Appendix A: Gantt Chart—EmotiTrack

Appendix B: System Architecture-EmotiTrack

Appendix C: The Prototype Link in Figma

Appendix D: Coded Key Function Link

Appendix E: Students Declaration Form

Appendix F: Project Flies