**IEEE CS Bangalore Chapter Internship and Mentorship Program - 2025**

**Duration: 1st April 2025 to 30th September 2025**

**Monthly Progress Report Template**

**Project ID: P18**

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**Title of the Project: Digital Phenotyping for Early Detection of Student**

**Stress**

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Digital Phenotyping for Early Detection of Student Stress

Monthly Report – June

# Executive Summary of Progress

June marked a major milestone in our project lifecycle, as we successfully transitioned from active development into full-scale testing and analysis. All the core components of our cross-platform app and admin dashboard are now complete and have been internally validated. With most technical challenges addressed in May, June focused on system refinement, user engagement monitoring, model validation, and initiating the research article draft that encapsulates our work.

Our app—StressSense—is now in its stable release (v1.0). It incorporates all planned modules: passive data tracking (GPS, accelerometer), active data inputs (chatbot surveys), wearable integration (Fitbit/HealthKit), and a backend powered by Firebase. We rolled out this version to the final cohort of pilot users and achieved high rates of retention and daily app interaction.

The testing phase involved monitoring app performance across multiple dimensions—sensor data completeness, survey response rates, anomaly detection, battery consumption, and user feedback. We also began in-depth statistical analyses comparing system-predicted stress scores against user-reported values from validated surveys (PSS, DASS-21). This provided early insights into model accuracy, engagement patterns, and temporal trends in stress behavior.

Alongside technical work, we dedicated a significant portion of June to preparing our research article. Sections covering background, methodology, and system design have been drafted. Figures such as data collection timelines, feature flow diagrams, and early analytics are being prepared for inclusion. This article will be the culminating academic artifact for our internship.

# 1. Problem Definition

The central issue our project addresses is the early identification of stress in university students using their smartphones. Academic stress often builds up silently and affects students' performance and mental health. Traditional methods such as paper-based surveys are reactive and infrequent. Our approach allows for continuous, passive, and privacy-conscious monitoring using the sensors already present in students' devices. The goal is to identify stress patterns as they emerge, enabling intervention before the situation worsens. Our app not only tracks physical movement and location but also introduces active input like mood check-ins through a chatbot to create a hybrid sensing framework. In May, we further refined our definition by understanding how passive data like reduced mobility or changes in sleep timing may be early signs of stress.

# 2. Literature Review

Existing research supports the use of digital phenotyping in stress detection through smartphone-based sensors and wearable data. Key studies like StudentLife and mindLAMP demonstrate the feasibility of such systems, showing how data like sleep duration, physical activity, and social patterns correlate with psychological states. June’s literature exploration focused on multimodal sensor fusion techniques, the role of active user inputs in improving model accuracy, and ethical data handling frameworks compliant with HIPAA and GDPR. We also reviewed methodologies used for model evaluation and stress-score calibration.

# 3. Existing System

# Most existing mobile health apps focus either on wellness (e.g., meditation, journaling) or data collection without active feedback. Systems like mindLAMP provide a foundation but are often research-centric and lack actionable feedback loops. Our comparative evaluation revealed that commercial tools either restrict sensor access or depend on manual input, limiting their efficacy. Our system fills this gap by providing real-time feedback and combining both passive and active data collection in a privacy-conscious manner.

# 4. Proposed System

We proposed a hybrid stress detection framework based on a cross-platform mobile app built with Flutter and a Firebase backend. The app continuously collects accelerometer, GPS, and wearable sensor data. Additionally, users are prompted with mood check-ins through a chatbot. This data is aggregated and passed through a machine learning model to infer stress levels. The app provides feedback in the form of alerts, tips, and self-help suggestions. The backend handles secure data transmission, logging, and analytics through Firebase Cloud Functions and Firestore.

# 5. Knowledge Gained – Tools, Technology, Courses etc.

This month, the team deepened its expertise in:

* Firebase Cloud Functions and Firestore indexing.
* OAuth 2.0 integration for Fitbit and HealthKit.
* Time-series data processing and feature extraction.
* Python statistical libraries for inferential analysis (scipy, seaborn, pandas).
* GDPR and HIPAA-compliant mobile app design.
* Scientific writing and research methodology.
* These learnings were both technical and procedural, including managing user studies and interpreting survey-based psychological instruments like DASS-21.

# 6. Architectural Framework

The final architecture includes:

* Frontend: Flutter mobile app with modules for sensor data capture, user onboarding, chatbot interaction, and notifications.
* Backend: Firebase services (Authentication, Firestore, Cloud Functions) for data ingestion, preprocessing, and user state management.
* Wearable Integration Layer: API modules for Fitbit and HealthKit.
* Monitoring Layer: Anomaly detection routines that flag broken sensors or user inactivity.
* ML Pipeline: Feature extraction in Python and a trained SVM model predicting stress states.
* Dashboard: Admin panel for viewing cohort trends and exporting CSV data.

# 7. Project Implementation

Key deliverables completed in June:

* Final deployment of StressSense v1.0 to all participants.
* Completed onboarding for all users with full sensor and chatbot engagement.
* Monitored real-time logs for failures and improved performance of data sync.
* Ran full-scale tests on stress prediction algorithms using live user data.
* Implemented usability improvements (battery optimization, notification handling).
* Achieved stable data flow from internal and external sensors with >90% consistency.

# 8. Results

* App Retention: 88% user retention over the 30-day test period.
* Survey Adherence: Over 70% completion rate for PSS and DASS-21.
* Sensor Data Completeness: 92% for internal sensors, 80% for wearables.
* Model Accuracy: Correlation coefficient of 0.63 between app-predicted stress scores and user self-reports.
* Behavioral Insights: Stress spikes correlated with late-night phone activity and reduced physical movement during academic stress periods.
* Technical Stability: 99.1% system uptime.

# 9. Conclusion and Future Work

We have completed the primary development and testing of the StressSense system. All functional modules are now live and validated. The data collected has proven useful for both behavioral analysis and stress prediction. Going forward, we will concentrate on finalizing the research article and preparing for submission to academic venues. We also plan to release an internal whitepaper summarizing deployment challenges, technical lessons, and ethical considerations. The internship will conclude with the successful submission of our research paper.

# 10. Research Article Preparation

Progress on the research paper includes:

* Drafted Abstract, Introduction, and Methodology.
* Collected and visualized all relevant data for Results and Discussion.
* Started composing Discussion and Limitations sections.
* Finalizing plots: time-series comparisons, heatmaps of engagement, confusion matrix for model performance.
* Shared draft among team members for collaborative editing.

Signature of the Mentor

Date: 14th June 2025