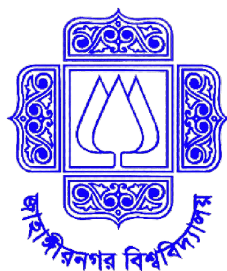# StudyPlus: A Flutter-Based Study Tracking Application with Firebase Integration and AI-Powered Recommendations

by

Md. Enamul Hoque
Examination Roll: 233228

A Project Report submitted to the
Institute of Information Technology
in partial fulfillment of the requirements for the degree of
Professional Masters in Information Technology

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September 2025

DECLARATION

I hereby declare that this thesis is based on the results found by ourselves. Materials of work found by other researcher are mentioned by reference. This thesis, neither in whole nor in part, has been previously submitted for any degree.

—————————————

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CERTIFICATE

The project titled "StudyPlus: A Flutter-Based Study Tracking Application with Firebase Integration and AI-Powered Recommendations" submitted by Md. Enamul Hoque, ID: 233228, Session: Fall 2023, has been accepted as satisfactory in partial fulfilment of the requirement for the degree of Professional Master's in Information Technology on the 11th of October 2025.

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ACKNOWLEDGEMENTS

ABSTRACT

This paper describes the design and architecture of StudyPlus, a mobile application designed to help students manage their study more effectively by providing structured tracking, goal setting and intelligent recommendation capabilities. Developed with Flutter, Firebase, the user-authentication powered and study-session tracking enabled app possesses goal-setting functionality and a data-based visual analytics dashboard. Meanwhile, an AI-based recommendation system that will be included as part of the Gemini API offers personalized guidance for students on how they should handle their study time, balance subjects and improve productivity. Related works in the domain have proposed study management tools that however not offer personalized functionalities and do not include any form of real time support to suggest methods for improving study habits. AI is not used by such systems to tailor to the individual needs of learners, which restricts their potential impact in terms of user productivity. The current project attempts to overcome such shortcomings by offering the support of a modular and scalable architecture that is capable of providing personalized advice and visual feedback on students' study habits. Intelligent recommendation engine is integrated, making learning more efficient and you more effective. Evaluation suggests that StudyPlus is a dependable efficient tool for students, as usability testing verifies the core competencies and performance testing reveals fast response time. According to user feedback, users appreciate the app's clean layout and that AI-powered recommendations keep students engaged in learning. StudyPlus provides a more complete experience than current alternatives, with integrated real-time analytics and personalised AI-driven study recommendations that improve the ability of students to organise and motivate themselves to learn. The project can be accessed via its public GitHub repository: [https://github.com/iamtariqul/StudyPlus].

Keywords: Study Habit, Cross Platform, Flutter-based Applications, Privacy and Scalability.

LIST OF ABBREVIATIONS

GPS	Global Positioning System
API	Application Programming Interface
BaaS	Backend as a Service
CSS	Cascading Style Sheets
DB	Database
JWT	JSON Web Token
RLS	Row-Level Security
SQL	Structured Query Language
UI/UX	User Interface / User Experience
VPS	Virtual Private Server
PostGIS	PostgreSQL for Geographic Information Systems
SSO	Single Sign-On
HTTP	HyperText Transfer Protocol
HTTPS	HyperText Transfer Protocol Secure
SSL	Secure Sockets Layer
GPS	Global Positioning System
JSON	JavaScript Object Notation
TLS	Transport Layer Security
IDE	Integrated Development Environment
CRUD	Create, Read, Update, Delete

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CHAPTER I

Introduction

1.1 Overview

There's been an oceanic shift in the way students have started learning over the last few years, and that has also been coupled with the rise of mobile devices and digital tools. Old-school HubSpot tactics like handwriting notes and reading paperback books are being complemented by, or even fully replaced with digital options. Times to plan, manage and make the most of your learning if you want to learn effectively, then you need to learn when managing time it's time for new experiences and learning tasks on sessions manages how much time you spend in learning tracks what's up learn atleast 1 hour per week check by online reports signs teacher monitoring. It's easy to understand why so many students struggle with monitoring the time dedicated to studies and their behaviour, when you have so much on your plate. The increasing demand for personalized, on-the-fly study pattern recommendations has opened up a new space for study-tracker apps.

Digital tools for study tracking are in that case indispensable to increase productivity of students. These apps help users keep track of their studies, goal-set and give them a progress check. But while there are plenty of study trackers out there, very few can manage to offer personalized recommendations and incorporate the likes of advanced technologies like artificial intelligence (AI) for enhanced user engagement on time as well as improve user experience. (Sharma Rani, 2020) Furthermore there are applications that students can use to schedule their study time and monitor their progress with practice tests but they lack data driven resources with real-time information as well as Personalized success strategies (Buchanan, 2019). This is why students frequently misinterpret it when they try to determine how to customize their study schedules.

1.2 Background and Motivation

There is a growing demand to provide students with a resource or tool that will empower them to have more control over their learning by studying better and smarter. In this fast-paced academic atmosphere of the 21 century, students carry the weight of a number of demands whether it is on their part to excel academically or personally. More Challenging School Academic Programs More challenging school programs require more time management resources to help students make the most of their study time. However, students have the same challenges of effectively organizing study time today as they always had; too often are they still relying on outdated tools such as paper planners and one-size-fits all digital solutions which do not provide them with any feedback to shape their study behavior. But these traditional methods of learning do not offer pupils the kind of feedback they need to become better learners, causing them stress, forcing poor time management upon them, and subsequently under-performance in terms of grades.

One of the most common problems in contemporary education is the lack of personalized guidance regarding efficient study strategies. Most existing study apps are more designed for time tracking, and scheduling tasks as opposed to proposed personalized hints and adaptive feedback. Many students lack comes down to not knowing when and how they will be most productive, and end up caught in the web of bad study habits.! Research has shown that most students don't actually know when they're at their peak study time, and your energy to focus will fizzle. Energy ebbs and flows for today or work. Significance of Studying Patterns The study of Almalki and Jin (2021) highlighted the importance individual study patterns has on how this information may significantly increase a student's focus and productivity. Existing applications do not address this particular need, so that they are still far from fully leveraging the potential of AI and advanced data analytics to provide actionable feedback on a student's F2F study activity.

1.3 Objectives

1. Create a mobile app on the fly to help with session tracking, recommendations based on AI and for goal setting.

2. Developed in flutter and firebase (real time sync). Fill the gaps in current study aids, don't get real-time updates, do not receive recommendations tailored to specific needs and not have meaningful analytics.

3. The students will track their study sessions, time their recordings, select topics and evaluate how effective they are.

4. Track session time and productivity. Deliver stats and suggestions based on performance analysis in real time, for more efficient studies. Leverage actionable insights and real-time analytics to enhance study time quality.

5. Have students set and break down academic goals (daily, weekly, long-term) into smaller parts.

1.4 Project Outline

The thesis structure is as follows: Chapter 1 contains the general introduction to the problem of research, including background, problem statement, objectives and research questions. It indicates in broad terms what will be covered as well as the importance of the study and structure of the remainder of the thesis. Chapter 2 consists of the full literature review, including existing location tracking technology, location-sharing applications, privacy and security issues in location sharing, and platforms (like Vercel) involved in hosting web applications. Related work in the domain is also presented in this chapter, which further includes case studies and researches on location tracking systems. This Study's Methodology The method used in this study is described as follows: (1) Research Development In chapter three, the researcher will describe how the research was developed and outline: the design approach chosen, chapter 3.1; technologies used which include frontend technology, backend technology and geolocation API integration which are explained further to a later section in this paragraph., chapter 3.2; and system designing through using Use Case Diagram shows in next section in later of paragraph., Chapter 3.3 software architectural pattern used for developing this research output. It also details the ethical issues relating to data and privacy. Chapter 4 describes the system architecture and implementation, including user interface design, integration with geolocation and mapping services, real-time location sharing support and deployment on Vercel. Chapter 5 then examines the system's performance, showcasing results from usability and user feedback analysis as well as comparisons with other location tracking technologies. This section also presents the system's pros and cons including its effects on privacy, security, etc. Lastly, Chapter 6 concludes with the summary of the thesis by discussing the results, its contribution and recommendations for further work: possible extensions to the system and how it may be improved in terms of privacy.

CHAPTER II

Literature Review

2.1 Related Work

2.1.1 Introduction to Study Tracking Applications

Now today, as education is going digital with every learning process that's taking place online, various study tracking apps are being developed to assist students in staying organized. Tracking their study and helping them to get concentrated again on their studies while revving up efficiency. With the demand for effective time management, setting goals and using data insights to achieve better academic outcomes for students on the rise, they have grown tremendously in recent years. Study tracking apps may be generally referred to as digital tools that help students organize their studies by recording how much they study and analyzing the effectiveness of their studying methods. These tools have evolved dramatically since their early iterations as mere time-keepers to today's AI-driven systems and companion-based analysis that offer personalized feedback and intricate metrics for enhancing the user's learning journey. At first, those apps were quite primitive and delivered only essential set of functions enabling to log the time, create a kind of to-do or checklist as well as schedule tasks and events. They had their limits, offering little more than logging study hours or simply nudging students to stick to their schedules and deadlines so that they could stay productive. This means that, for example, the first time-tracking apps like Toggl or Focus Booster allowed students to record how much time they spent on specific tasks. Therefore, they were able to monitor their progress on various tasks which helped them keep a flow rate.

However, as students needs became more complicated, these tools expanded from being simply time tracking and logging. With booming mobile technology, and with the development of more personalized learning techniques in recent years, todays

study-tracker apps are chocked-full of features designed to help students become more efficient and successful learners. These features 14 could be monitoring the focus micro-subtask level interpretation (Gradilla et al.,2020) may be from memory to input, measures on productivity and order of tasks in the subject for user (García et al.,2021). The gamesification was built off the back of time tracking, with apps like Forest making it easy for students to actually stay focused on studying and getting rewarded for staying in the zone rather than looking wandering around. And these aspects have turned study tracking into more than just a way of keeping up with what we are doing, but into choosing learning and time management as a lifestyle.

Features such as goal setting, and analytic dashboards added new ways to use study tracking apps. Now students could set their own goals — say, a certain number of hours to study in a day, or to achieve a particular grade in the class — and follow progress on those goals instantly. This development was fuelled by the realisation that (A) receiving clear goals and direct feedback about how well these are met, is crucial to keep up motivation, and (B) for enhancing learning effectiveness (Johnson et al., 2022). Many study tracker apps, including MyStudyLife and Habitica, also come equipped with a goals feature to help students plan both short-term and long-term goals to keep them organized and motivated.

2.1.2 Existing Study Tracking Solutions

Study trackers are the holy grail when it comes to college students these days, because what's better than knowing you're on top of your time management and being able to track your study habits. Over time, there have also been a number of study-tracker apps that surface with its set of features best suited for making focus, productivity and time management. Normally, these applications allow students to log the time they spend studying and also set academic goals and find ways how their progress can be targeted to achieve those goals. However, despite the diversity of those studying trackers, only a handful are to offer personal advice or data-aided insights they might use to learn and grow KW:study better?4These challenge still remain mostly unfilled.

The most simple project tracking apps will not do much more than this logging. A few (widely used) apps include Toggl and Clockify which allows you to manually start/stop a timer to see how much time is spent on various activities including hours studying. These are mostly apps that will accurately track exactly how much time a student is spending on what kinds of activities. But they don't offer the instruments to measure how well you are studying or to help get better when you are proving

not productive. The restricted focus of these apps to support students by looking at detail such as personal feedback and live recommendations is limited in that it is confined by monitoring (Schultz et al., 2020).

But with more streamlined features desired, many of the study tracking apps have expanded into new productivity management and goal setting tools. Apps like Forest and Focus Booster gamified the idea of using time. In one of them, called Forest, students can "plant" a virtual plant as they work (it dies if the user leaves the app or becomes distracted). This game-esque technique encourages users to focus at their desks and help visualize productivity. Challenge Although this increase in motivation perhaps led to empowerment of students, it still does not cover the need for more profound insights into one's own self-regulation or real-time intervention within the study behavior block/dissect study behavior patterns (Miller & Thong, 2021)

2.1.3 Digital Tools for Productivity Management

Task management has been reported to be the problem in the educational domain where students have difficulty managing their time, multiple deadlines and finding a balance between personal life and education in near-real educations. For the past few days, productivity management digital apps have been top on the students' favorite lists where they get a variety of functions to do such as planning out their time, but their to-dos and how much they progressed. These sorts of tools are loaded with all manner of bells and whistles such as to-do lists, reminders, time tracking, calendar management — and other ways to help students make better use of their hours and juggle the demands on their academics. The trend towards productivity tools in education and technology as a whole also reflects the way we increasingly rely on digital products to get more done, untangle unnecessary complexities, and guide our goal-focused actions. Apps for students These apps can really feed a student in all ways, from planning and organizing to focus at study and more things.

When productivity management tools first emerged, they were relatively little more than what was placed before them—a known list of things to do along with a means to set reminders and deadlines and manage the list. Among the best minimal apps for students, simple productivity apps like Todoist and Microsoft To Do are perfect to keep a track of daily to-dos and just about every academic assignments. They are based on the idea that task management, and some self-imposed structure for a student's workload is needed (putting all those crucial deadlines in one place so students know what they need to do). For example, allows to decompose a task

starting with bringing each of its constituent tasks down to their specific steps and building them back up, prioritize their order which makes goals clickable for scaffolding plans and as well reduces the cognitive load of having effort of memory for many goals that need to be remembered (Zimmerman et al., 2020). Though helpful in organizing daily activities, all these instruments are referring to taskmanagement and they do not provide any immediate feedback or hints on how to increase user's productivity by interpreting his behaviour.

2.1.4 Role of Artificial Intelligence in Education

AI Revolution In Education: How Measured Is Artificial Intelligence? It is not an easy task to overstate the influence of artificial intelligence (AI) in education. Powered in part by big data and algorithms, AI could lead to a much greater level of personalisation in learning, improved learning outcomes and productivity gains for teaching and administration. Education uses of AI The computer science christopher edison, director of the artificial intelligence lab at stanford university in california adaptive learning is one longterm application.:There are many areas in which ai can be applied to education, such as smart content, virtual facilitators and personalized content delivery. These novel technologies, they say, solve some of the ugliest and most persistent problems in education: How to tailor learning opportunities for each child, how to provide all students with at least as much feedback as an attentive tutor provides (and thus not just a teacher's pet), and how to ensure that young humans spend their time in school doing the thing that is most productive for them to do.

One of the best-known uses in education is adaptive learning, where AI personalises both the pace and level of content for each learner, based on their current understanding. This is especially helpful when you have students working at varying paces, a necessity due to the range of ability and knowledge of language experience. For one, platforms like Knewton and DreamBox use artificial intelligence to see how a student responds to the materials and then adjust the lessons accordingly. Adaptive learning platforms allow students to engage with content at an appropriate level of challenge (neither too difficult nor too easy) as part of personalized learning experiences, and may have a substantial impact on learning (Baker Siemens, 2021). As adaptive learning tools help learners progress to proficiency, the teachers themselves can become aware of which knowledge gaps they have and how to adjust their own approach towards each learner.

Another important development in education technology is the Integrated learning systems (ILS) which use both AI and the principle of tutoringIntelligent tutoring sys-

tems, CMU CSILE as AI tools Learning for knowledge work; another AI/CS system is Soar. Tutors, who represent individualised face-to-face tutoring offer personalised attention and support to students. Cognitive tutor system can deliver content, ask question and assess answer and provide feedback, typically NLP used to interact like a conversation. Through interactive systems, students receive immediate feedback after they perform solving problems practicing a subject matter in more conceptual manner depth.

2.2   Gaps in Current Research and Solutions

But learning tech has some fundamental problems present in research and solutions alike available today that are impeding progress in the disbursement of study tracking apps and AI-driven learning tools, even though these technologies have advanced. While there is a plethora of study apps available, many do not have the essential pieces— personalized recommendations, instant adjustability and in-depth analysis. There are apps in existence that force you to manage your time or be more organized, or even applications that collect data — but their training system isn't as robust as it could be. Although there is also an ability to focus or not pay attention because actionability, and the personalized recommendations based on a task to individual study history (Zimmerman et al., 2020).

One enormous gap is the personalized recommendation system that can adapt to each student's constantly shifting study habits. Some applications do rely on AI-based mechanisms, but the usage is generally confined to basic task scheduling or topic recommendations based off of prior work. There are still no other more intelligent AI solutions for real-time data which can provide specific recommendations like: how much a user should study, how long the meditation break should be, or what methods are the best ones to get the most out of your time spent studying. Knewton and DreamBox are adaptive learning systems that leverage AI in the classroom, but limit the work to just course content, not the full range of learning activity, as is desired for optimizing study behavior as a gap (Baker Siemens, 2021). Research by Tan et al. (2021) has further argued that AI can not only be used to recommend study schedule but to adapt in real time during the study, giving an effective and focused direction.

CHAPTER III

System Analysis and Design

3.1 Introduction

With StudyPlus, the study app has been created and developed at the forefront of innovation to what can be achieved through AI integration and live data synchronization for perfecting your studying routine. In this chapter we revisit our StudyPlus system analysis and design -a description of its most rudimentary aspects, architecture, as well as the technologies that allowed it to be implemented. Purpose The aim with this chapter is to, in a concrete fashion, describe system requirements (functional and non-functional) as well as showing how we have approached specifying, designing and developing of the system.

Study Session Control was developed to address the issues that students encounter when trying to control their study habits; be it time management, focus maintenance or even academic achievement. With personalized study reminders, live observation statistics and bautifulized progress bars according you your work, you will have everything in place for a perfect day! So as demand grows for effective, data-based study support, the app is trying to do all of these genres It's an all-in-one study bay maximizes your time and energy by providing AI-driven insights that'll pinpoint where you can improve with a goal to set goals according to them so you can track your progress This round-up has put together everything from its cross-platform capabilities and simplistic design in a nice compact delivery.

3.2 System Requirements

The characteristics of StudyPlus features were accurately articulated to enable StudyPlus to be able to meet user interests in a natural and smooth manner. These

requirements are categorized as functional and non-functional requirements. By Functional I mean what the app has to do and what must be in it, and also by non-functional is not included functionality but how the app should perform and what level of quality (in terms of technical execution) would help ensure that user satisfaction will receive its highest score.

3.2.1 Functional Requirements

StudyPlus' essential functions are developed to respond to the needs of students, offering complete tracking and controlling solutions to their study activity. These include:

1. User Authentication: Users should log sign up, in and out of the app securely. We will do this using Firebase Auth with students being able to sign up either through their email or via social logins like Google or Facebook. The billing-type mechanism also ensures that the users' data is protected, and shared only with appropriate users.

2. Real-time session tracking: When studying, students will be able to track their study session in real time. Start the session/pause the session/stop the session. You can tag each session with the subject, method of study, duration and focus/productivity. The data will be stored and synchronized in Firebase Realtime Database.

3. Goal Setting: the optional setting of study goals by the user based on time, number of sessions or portion of study due. Progress will be visually tracked using RYG progress bars and students will be prompted to keep on pace. The app will also allow students to edit their goals as they transition from one kind of studying to another.

4. AI Suggestions - Based on reliability data gathered during study sessions, the app will give AI suggestions to uplift your way of studying. The AI will also suggest when would be optimal time for studying and taking breaks, how user should study, based on the latter's focus ratings and productivity pattern. These points of view will be changing according to the study behavior of the user.

5. Analytics and Monitoring: The app will include a monitoring dashboard so that the users can see how much they have studied. These will be charts showing

time spent studying by subject, focus/productivity trends over time, and tangible progress made relative to academic goals. These visualisations will enable students to become aware of their study habit and record that information for even studier habits later on.

6. Real-Time Sync The app needs to be able to sync the study data he's doing on the devices – A student is supposed to continue from where he stops his study, goal and progress should be in sync no matter which device of phone, tab or computer he is using. It would do this as the Firebase Cloud Firestore would handle all data and syncing.

7. Notifications and Reminders: The System notifications and reminders will queue up such as time to study, next study period, goal completed or take a break from studies etc. These reminders will encourage learners to keep up with their studies and practice.

3.2.2   Non-Functional Requirements

Aside from functional requirements, StudyPlus has several non-functional requirements, to ensure a user-friendly and high-performing interface:

1. Real Time Performance: Application should be real time in performance as much as is practicable and reasonable. With the live tracking and sharing of information there is no problem doing this with multiple users at once without degradation in performance. And it will be achieved with Flutter's power optimized rendering engine, and Firebase's scalable cloud infrastructure.

2. Scaling to large data set size: In this task, you will need to store a theoretically limitless amount of data, like study sessions or user added entries. Google's Firebase real-time database and cloud functions are built-in to automatically scale the app so that it can sustain new users growth without needing to be written over.

   Security: As StudyPlus will store personal and study habits-related data, Users will authenticate securely using Firebase Authentication, data will be encrypted at transit and at rest. For all security things (like role-based access control or just to use your own data from firebase's db) the app will follow currently accepted best practices.

3. Both iOS and Android: The app has to be both for the students, so everyone is able to use it no matter of preference. For this, the app will be developed in flutter which is a framework that provides a set of tools to develop a codebase that can run on various platforms while maintaining performance and usability.

4. Usability: The design of app should be user friendly so that the students can access and use the tools without problems. The app UI will follow the material design, keep the UX clean and clear. It will be tested with real end-users for usability and user experience.

5. Reliability: A study instrument needs to be reliable, in terms of down time and failure. It should also be resilient without being vulnerable to system outages (such as losing internet connectivity) and ensure no data is lost or corrupted during transient failures. To ensure stability, the app will also keep undergoing tests for application bugs and boundary cases.

   Localisation: The app should work for students from anywhere in the world, with any level of language ability on board. We can use this to scale StudyPlus further in the international market.

3.2.3   System Architecture

The system architecture for StudyPlus was constructed to have modularity, scailability and interchangeability of the components. The structure of the application is based on client–server architecture with Flutter in the role of a client-side mobile app and Firebase providing backend services. The architecture is stratified in to three layers: the presentation layer, the application logic layer and the data management layer.

It's a user interface layer which provides simple and easy navigation for the users with responsive design layout, visual elements and attractive look and feel optimized to enhance user experience. The logic layer contains application logic concerned with authenticating, tracking study sessions, managing goals and processing analytics. The layer also incorporates AI-based recommendation services, so that the system can give learners personalized study insights. And grunt layer manages the data saved in Firebase Realtime Database and it's storage system for storing and receiving data via Firebase. This allows one to synchronize study-time sessions, goals and results in real time on all devices without increasing the complexity or destroying some aspects of efficiency. In this way, the system balances the usage between usability and reliability

with respect to the extensibility along these lines of architecture which is suitable for academic environments and can be adapted to future improvements.

3.3   Security Considerations

Because StudyPlus stores sensitive personal information, such as user credentials, study progress and lifestyle preferences; security was taken into account as an essential criterion for system design throughout the development. Users are securely authenticated through Firebase Authentication, which includes best practices like stored encrypted passwords, email verification and session management. Integration All client application to backend services traffic is transmitted over HTTPS as means to encrypt data and protect from eavesdropping and tampering.

Apart from secure transmission, Firebase was also used to safeguard data within its database by enacting role-based access controls and formalizing rules. Every user can read and edit only their data, thus avoiding inter-user information leakage. Data validation rules also ensures that the inputs provided are in proper formats, thereby preventing insertions of malicious codes through e.g. SQL injection attacks or corrupting the database. Further, password reset and account recovery facilities are included to provide user security and convenience.

CHAPTER IV

Implementation

4.1 Overview of the System

The last phase is the realization that converts the abstracted design (in its previous phase) into a real application environment. The system image introduced, based on theoretical concepts presented in chapters three and four was evolved using appropriate tools and technologies to working modules. StudyPlus mobile app was implemented with Flutter cross platform framework, and supported by Authentication, Database and Analytics of Firebase. This stage consists of setting up the development environment, integrating Firebase services with Flutter and partial implementation of all major modules (authorizing the user, tracking the study session, managing goal list, displaying data analytics charts or AI-powered recommendations). Additionally, addresses the modularity and scalability; components work individually but in conjunction with others to create part of the whole user system. Furthermore, we closely considered not only the functionality but also the usability and efficiency of our system and validated and debugged the implementation iteratively. Such systematic development has helped to transform StudyPlus from a design idea grounded in theoretical model to a functioning service providing students with the means to support their learning.

4.2 Development Environment Setup

The above set up on development environment is crucial to circumvent any hiccups in adopting StudyPlus. Given that we wanted our app to work on the greatest number of platforms; so, we decided our main framework would be Flutter in order to get high native performance on Android and iOS in a single codebase. The structure was created by installing Flutter SDK, configuring Dart programming language and

building Android Studio as an IDE. Android Studio was chosen because of a wide support for Flutter plugins, debugging tools and device emulators which made it very convenient for deployment during the development.

Backend infrastructure was established with Firebase alongside Flutter. We use Firebase the cloud services like handling user authentication, real-time database and app analysis service are heavily invoked in StudyPlus. The flutter projects on the Firebase console have links that describe how to integrate these services. That also involved constructing Android and iOS configuration files to support application for both.

Code was managed and versioned using Git to facilitate collaboration, and the project was hosted on GitHub to follow its changes. This implied sanity development, rollback, clear history along the the project. The overall architecture was self-contained and enabled modular coding, testing and deployment of each application's modules.

4.2.1 Tools and Technologies Used

1. Flutter SDK- Cross platform framework to craft native mobile apps with single code base.

2. Dart Programming Language - The main programming language used for developing the application in Flutter.

3. Android Studio – Integrated Development Environment (IDE) with Flutter plugins, emulators, and debuggers.

4. Firebase Authentication - The service for a user to sign in /sign up securely and accessing their account using email, password and third part providers.

5. Firebase Realtime Database- A cloud hosted NoSQL database to store study sessions, user goals and relevant data in real time.

6. Firebase Analytics – A tool used to monitor the user's actions in the app, record app usage and performance data.

7. Git — Version control easy to use system in order to keep source and changes under a controlled environment.

8. Device Emulators / Physical Devices: For testing the app on Android/iOS.

4.3 Firebase Setup and Integration

All data concerning the study was stored and maintained in the Firebase Real-time Database. For instance, goals set by the users were kept in structured JSON nodes which included: subject (biology), goal value (120 minutes), and a time frame (weekly). Each record of a goal also has some meta such as createdAt, startDate, endDate, currentProgress and isActive meaning if is true or false. By the use of such an architecture, the system was able to plot process with potential reminders and notifications at end-user convenience.

StudySessions were stored in the database with duration, method [eg, Reading], focusRating, productivityRating, startTime and endTime. For instance, a session could be logged with 5 star focus rating and 4 productivity rating so that the system can have big data minimums for metrics, and maintain AI suggestions. This structured output was valuable for the uniformity of the response, ease of querying and making it possible for us to accurately report study patterns in the analytics dashboard.

With this setup Firebase was no longer just the repository of all, it also became the gateway for authentication, goal city and session management. The real-time syncing of the feature meant that you'd always see your most recent totals on whatever platform you were on. This deep integration of Firebase in StudyPlus was a great contributor to the app's reliability, scalability and success.

4.4 User Authentication Implementation

The research system StudyPlus was developed using a closely coupled architecture that could leverage Firebase Authentication to administer secure user identities. The two operations that were supported as part of the authentication flow, back then, were sign-up and then later sign-in and all these operations were performed using Firebase Realtime Database to save and retrieve user profiles and preferences.

Figure 4.1: Login screen of StudyPlus.

Figure 4.2: Sign-up page of StudyPlus.

When people signed up, they would create an account with an email address and password. Registration resulted in firebase produced user profile that stored to the database. It also included sensitive information such as the user's ID, email address, full name and the academic levels that they are reading at, as well as when a user created an account and last used it. Default settings (notification, theme mode and default study) were also predefined to allow users to make the app their own after initial access. This not only helped identify the user on the system but also provide a framework for further development. A user's credentials were validated by looking up their credentials in Firebase Authentication during the sign-in flow. If successful, it updated the 'last login' time for that user and attempted to retrieve that user's profile from the database. If it successfully retrieved user data, the application read the stored preferences and study history. And if we had some condition in which we could not get the database, then we would default to a profile provider just so people can log-in and post etc without their profiles.

4.5 Application Features

4.5.1 Home Page

StudyPlus's Home Page is a main dashboard screen providing users with an overall summary view of their study at a glance and quick entrance to the key features. The Interface into this webapp is clean and simple – Students can see at a glance how long they have studied for, move on to a new block without clicking.

Users can simply start a new study session by tapping the large "Start Studying" card at the top of the display. This was designed so that there is no, or as little barriers to you starting a session. When activated, the APP automatically jumps to the protocol module, where participants can input study details (e.g., subject, method, focus rating).
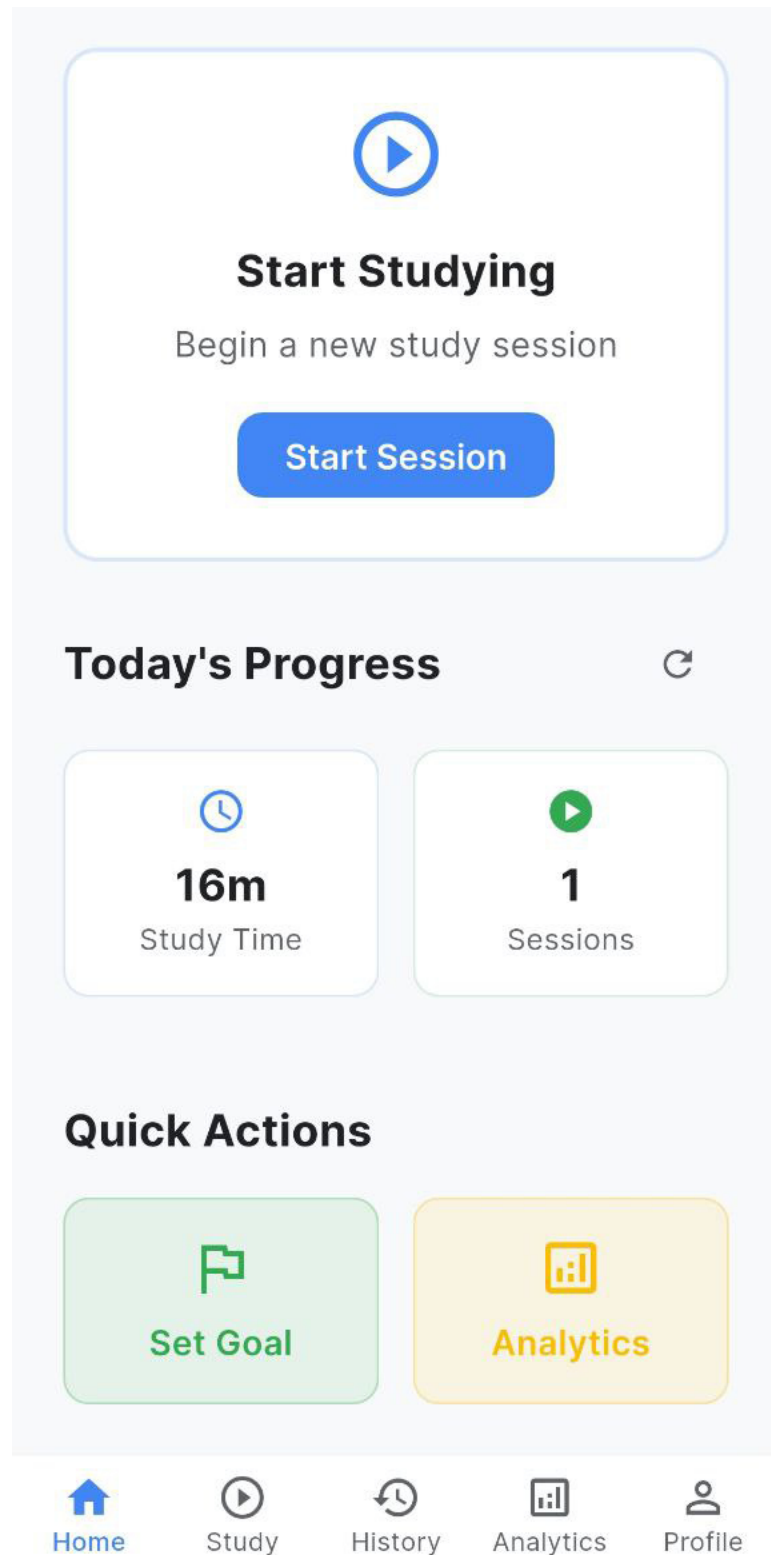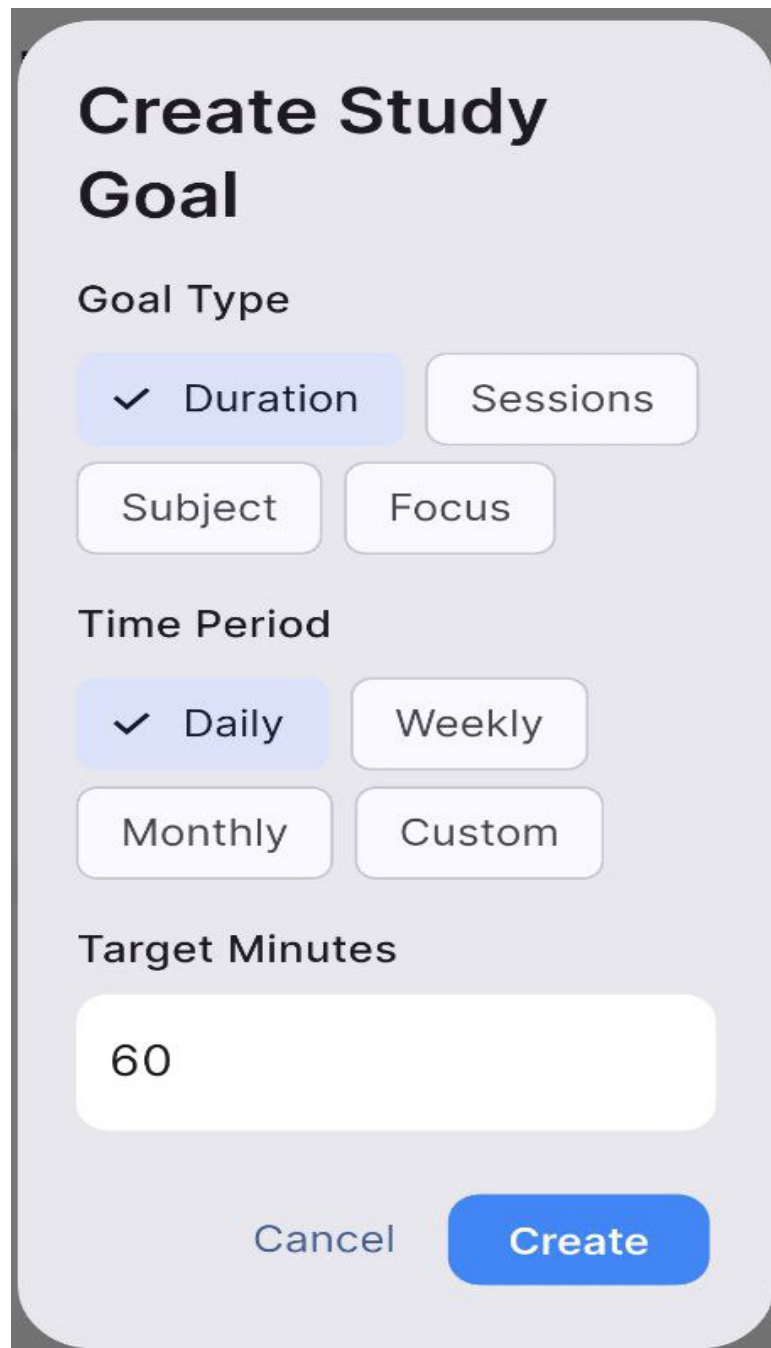
Figure 4.3: The StudyPlus dashboard

4.5.2   Goal Setting Features

StudyPlus includes a study goal-setting feature in order to assist learners set specific, measurable goals that they act on where their low-level study habits are based. Similarly, having organized goal setting as part of the application also serves to promote personalized coaching plans and three-dimensional goals for motivation. You can set goals in four separate categories with it Time, Sessions, Discipline, and Focus. The different goal-subtypes focus on various aspects of study behavior, e.g., time allocation with duration and equal proportion with the content-related goals.

Users can also define a time frame for each goal: Daily, Weekly, Monthly and Custom. This framework enables micro (e.g., number of study minutes/day) and macro (e.g., semester long consistency) goals. Users also have the flexibility to choose their own start dates and end dates, so this program can be tailored to accommodate exam times, project due dates or other obligations.

Figure 4.4: The create study goal interface in StudyPlus

4.5.3 Goal Management System

The Goals page on StudyPlus is the user's mission control for setting, monitoring and hopefully checking off daily study goals. It is, essentially, a single focused dashboard with all your goals laid out like cards – the kind of card-based design that walks you through each step and encourages you as well – all aptly integrated in

each garden based on its type (Duration or Sessions or Subject or Focus) and period (Daily, weekly etc.) at top and some motivational target detail below that tells you about what to focus; such as 'Study Hourly for 1); then: Study 1h 0m; Focuolustrating on Biology.. A progress line tells you how far you are already and wears fine support text how long you have left, including the target's date range. Situational status badges such as Completed or Expired provide quick semantic feedback and aid learner s attention.

It allows User to easily create goals by clicking on FAB (floating action button) that automatically opens a Create Goal dialog. This dialogue involves the users first choosing a goal type and then a period, using ChoiceChips, introducing the value to reach (or for subject based goals: a subject) and finally, if Custom is chosen for the period, they can fill in manually the start date or end date of such range or pick one from options accoladed by DatePicker in case of a start date. The service does some form validation (eg. subject must have subjectgoales, date between custom ranges 2date) and calculates the window of time based on the period(Date). When the user taps on the Submit button it would be inserted an goal document (userId, type, period, targetValue, targetSubject, startDate(endDate), currentProgress(isActive), createdAt) into goals node: and success should pop in SnackBar then it will refresh the list.
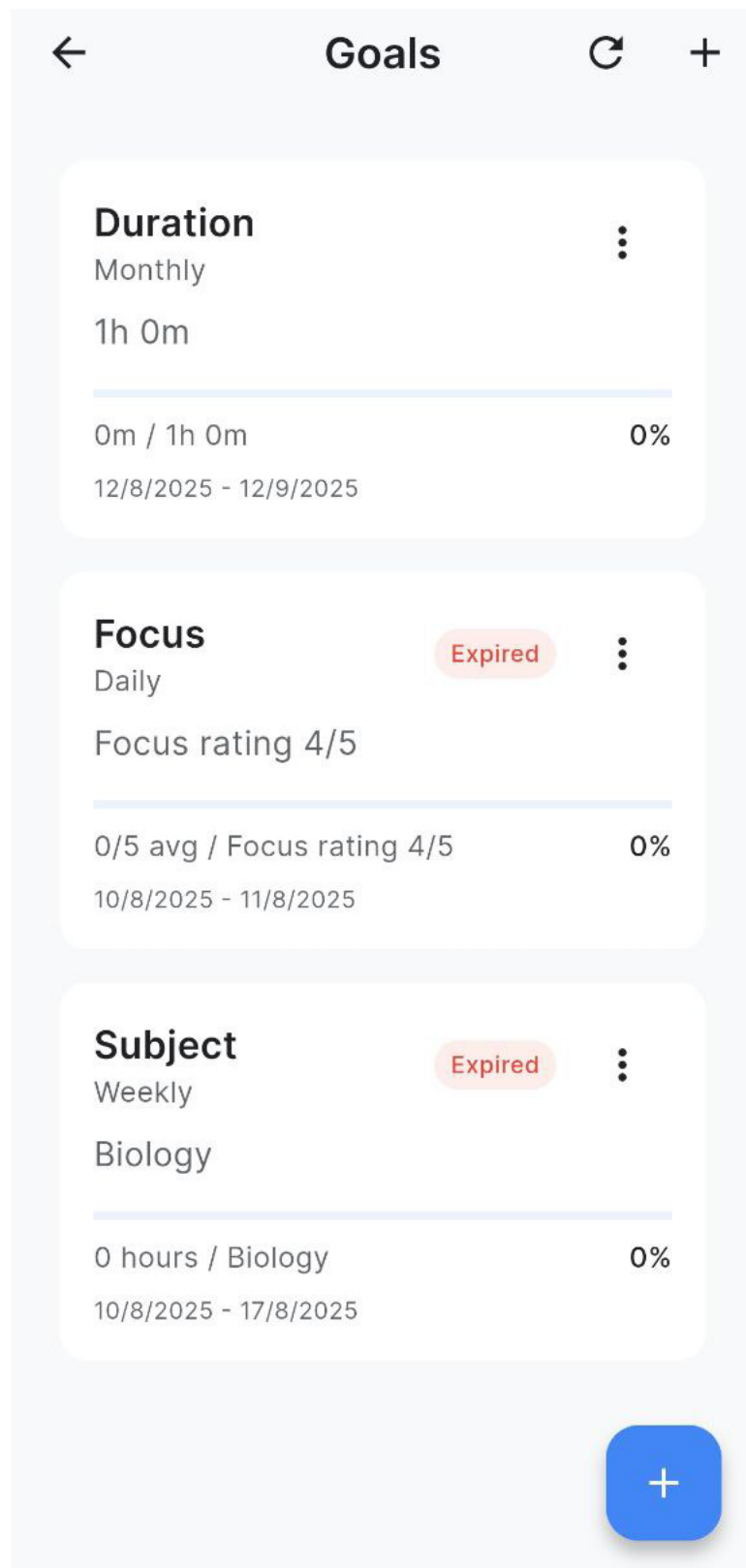
Figure 4.5: The goals section in StudyPlus

4.5.4   Study Setting Features

Study session module (also available with StudyPlus as one of the applications main features, which allows the user to see what he is studying with a timetable at that very moment, to look back on himself to how much he can concentrate, and on how much focusing on studying).
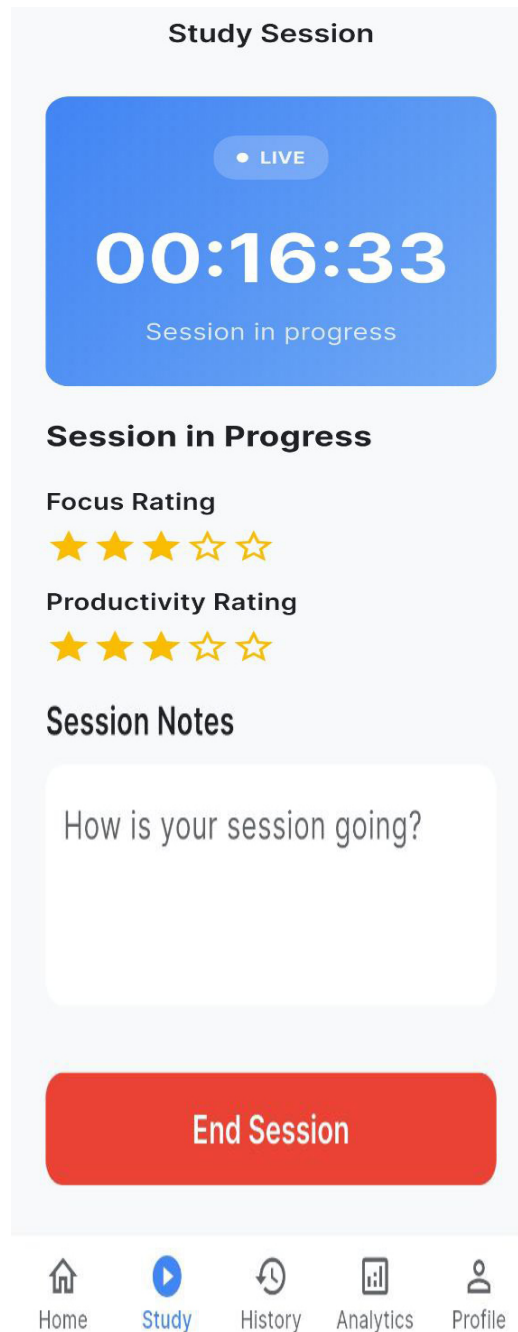
Figure 4.6: The live study session interface in StudyPlus

4.5.5 Study Session Tracking Module

The study session tracking feature in studyPlus gives users an organized approach to tracking, reviewing, and reflecting on their study related activities. This was done in an effort to capture more than just the time spent studying, i.e., not only how long and how often, but while you were doing what (focus vs productivity, session notes).

Figure 4.7: Study history in StudyPlus

4.5.6 Analytics Dashboard

We developed the StudyPlus Analytics Dashboard to change raw study data into a useful view - where students can see their progress, notice trends, and make adjustments in their study schedule as a result.
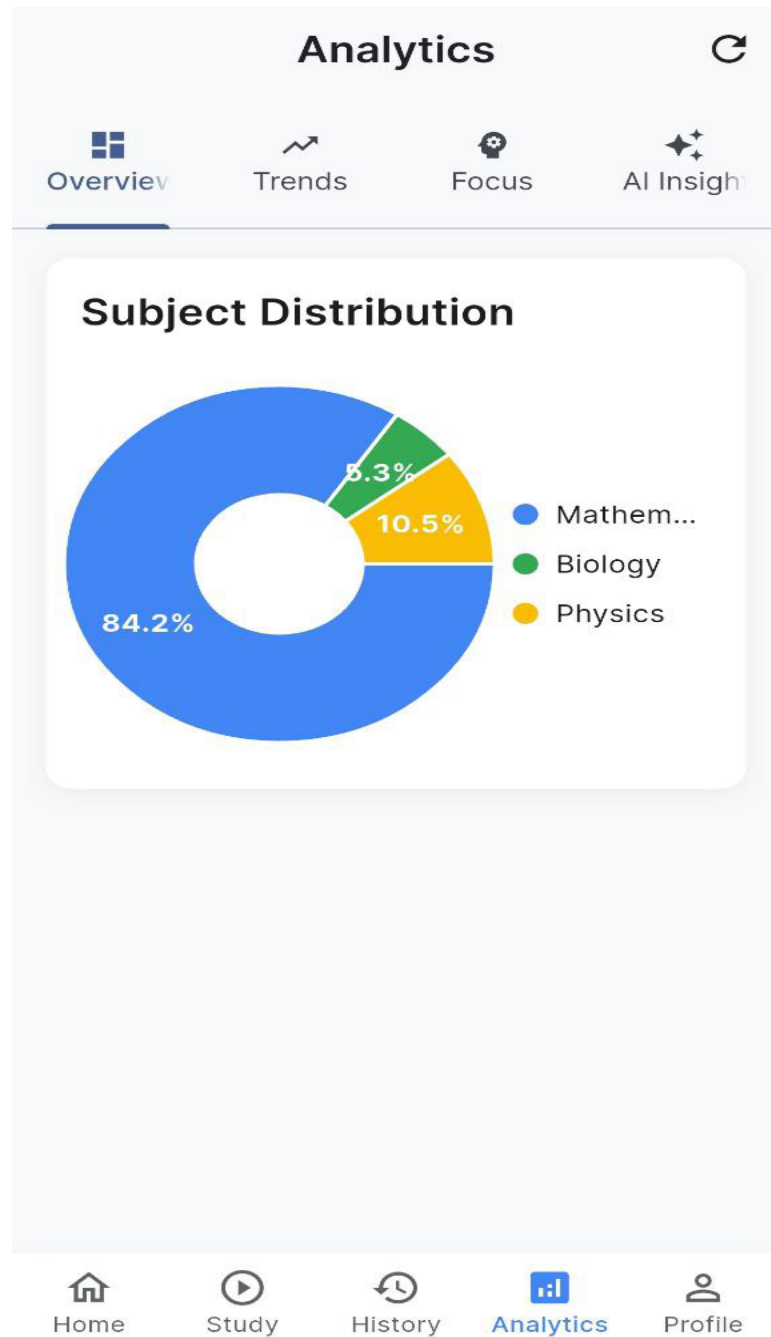
Figure 4.8: The subject distribution overview in StudyPlus

The dashboard is made of various ways to visualise, which contribute to a better

comprehension and operationalisation of the abstract performance indicators.

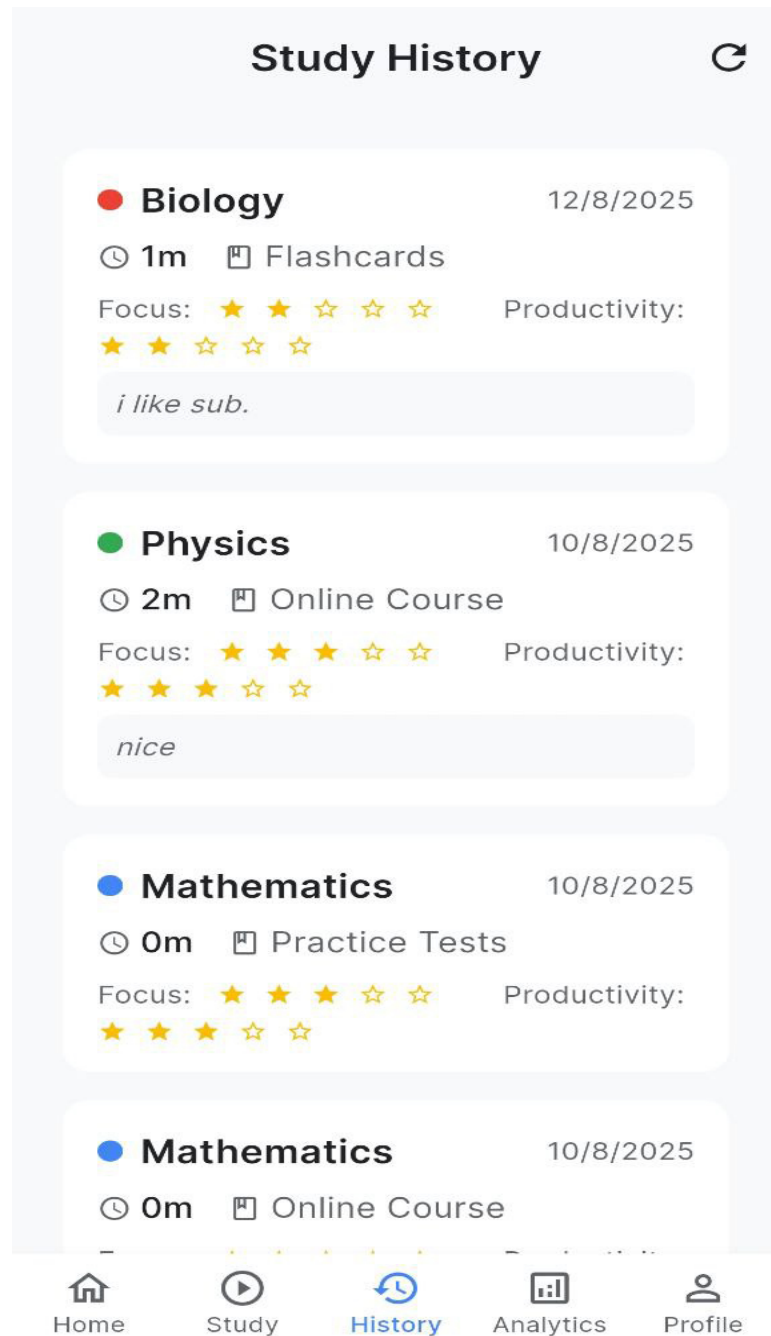The dashboard actually comes in four primary sections: Overview, Trends, Focus, and AI Insights. The Overview also includes a pie chart as shown below that shows the distribution by subject, to let you know how time has been allocated on those subjects you're studying. It is this feedback that enables the students to quickly identify imbalances (you've been working too much on X and not enough on Y), and hence to smooth out their effort across subjects.

4.5.7   Data Trends and Insights

StudyPlus Data Trends and Insights help you learn how your study habits change over time. Unlike the snapshot overviews, however, this module focuses on temporal behavior analyzing both weekly, and hourly study distributions. The aim is for students to learn when they are most productive and to coach them into establishing that as a routine.

Figure 4.9: The Trends section of the StudyPlus

4.5.8 Productivity and Focus Ratings

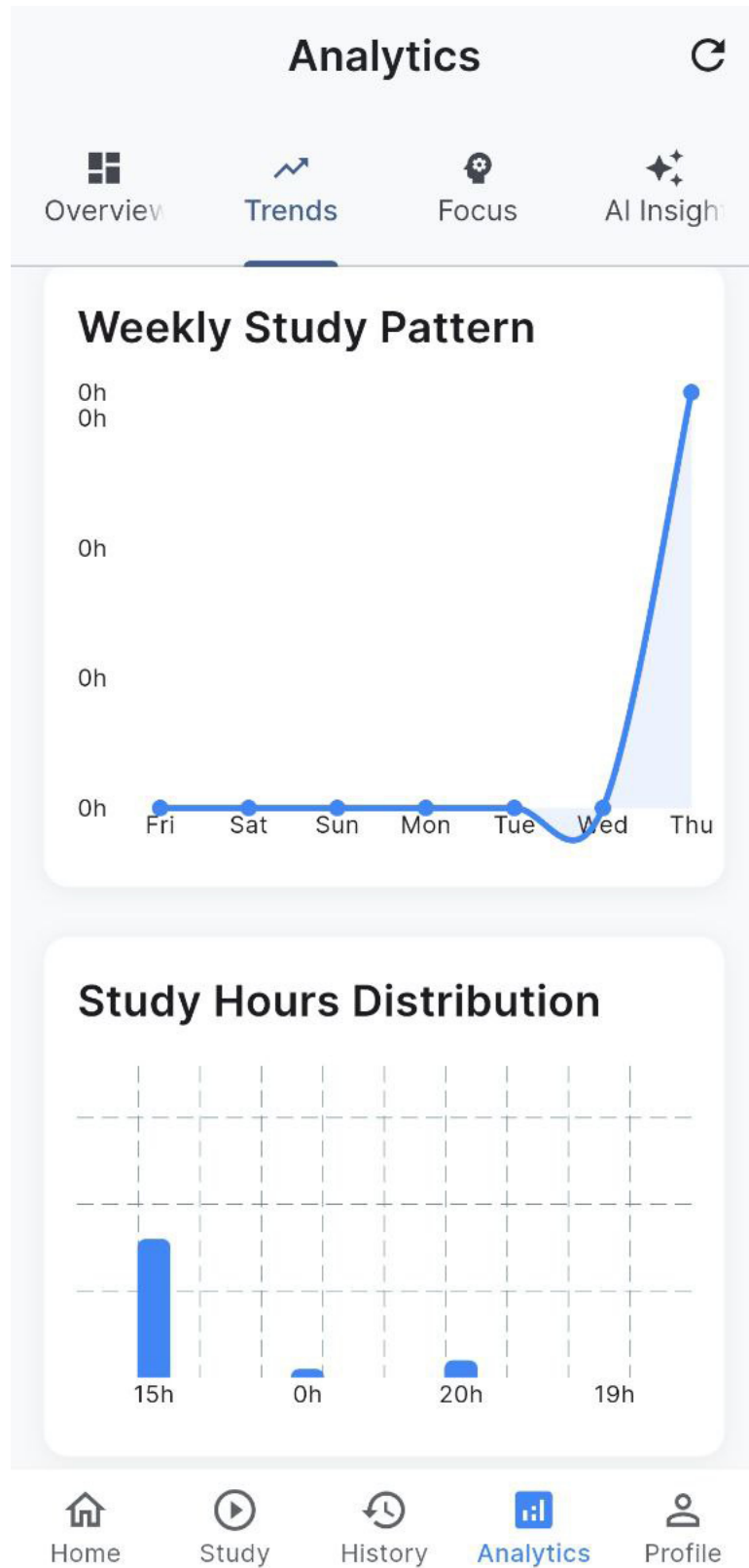The Productivity and Focus Ratings in StudyPlus give a qualitative aspect to study session tracking, which adds different depth to time and frequency metrics. Allowing students to self-rate their levels of concentration and efficiency, on a scale from 1 (very poor) to 5 (very good).
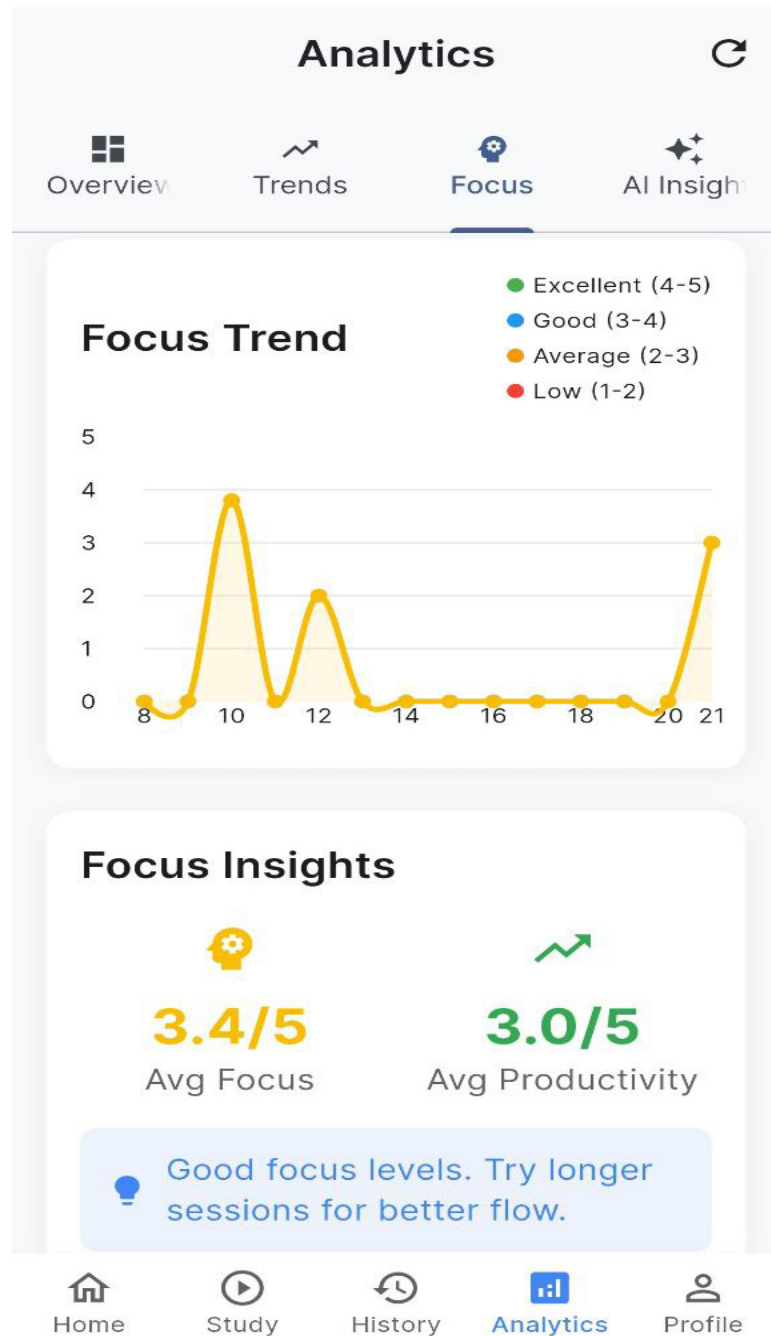
Figure 4.10: Focus trend graph from StudyPlus analytics

4.5.9   AI Recommendations Module

Through the AI Recommendations, raw activity logs are transformed into personalized learner support capabilities. He builds this on top of an analytics pipeline, where we get the user's recent sessions (subjects studied, duration, start and finish times, focus/productivity scores, values for notes written etc) and derives compact features like weekly totals/ balance ratios between subjects max study hours in a week/ rolling averages of focus or productivity or streaks. These features are concatenated into a fact prompt, and are then submitted to Google's Gemini model by our backend services. The model's structured response is shown in the AI Insights tab in four cards: Weekly Insights, Focus Duration (Focus level by day and time), Subject Balance (Balance of study over the week), and Optimized Study Schedule: Best Times to Study, Top Break Suggestions Recommended Session Length. This pipeline ensures that the generated output is not just tips, but can be contextually adaptive guidance based on learner own style.
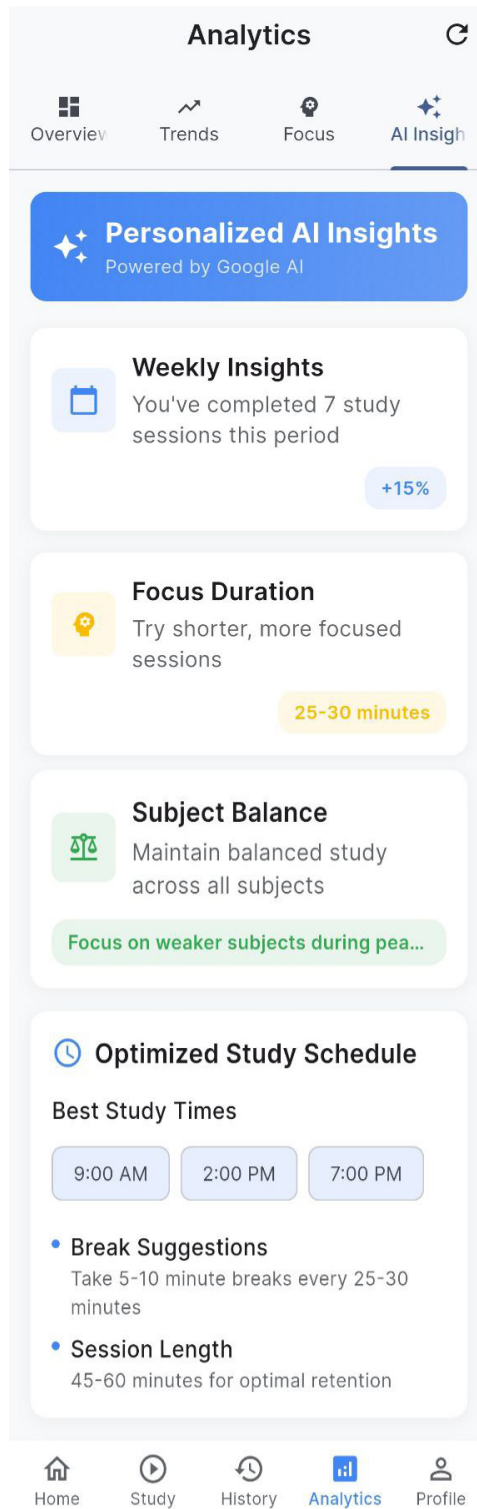
Figure 4.11: The AI recommendations section of StudyPlus

4.5.10   User Profile Page

The StudyPlus User Profile Page is a learner's exclusive space to manage their identity and customize their StudyPlus experience. It's an information and control center for several account-related tasks, including updating your profile picture and signing out.
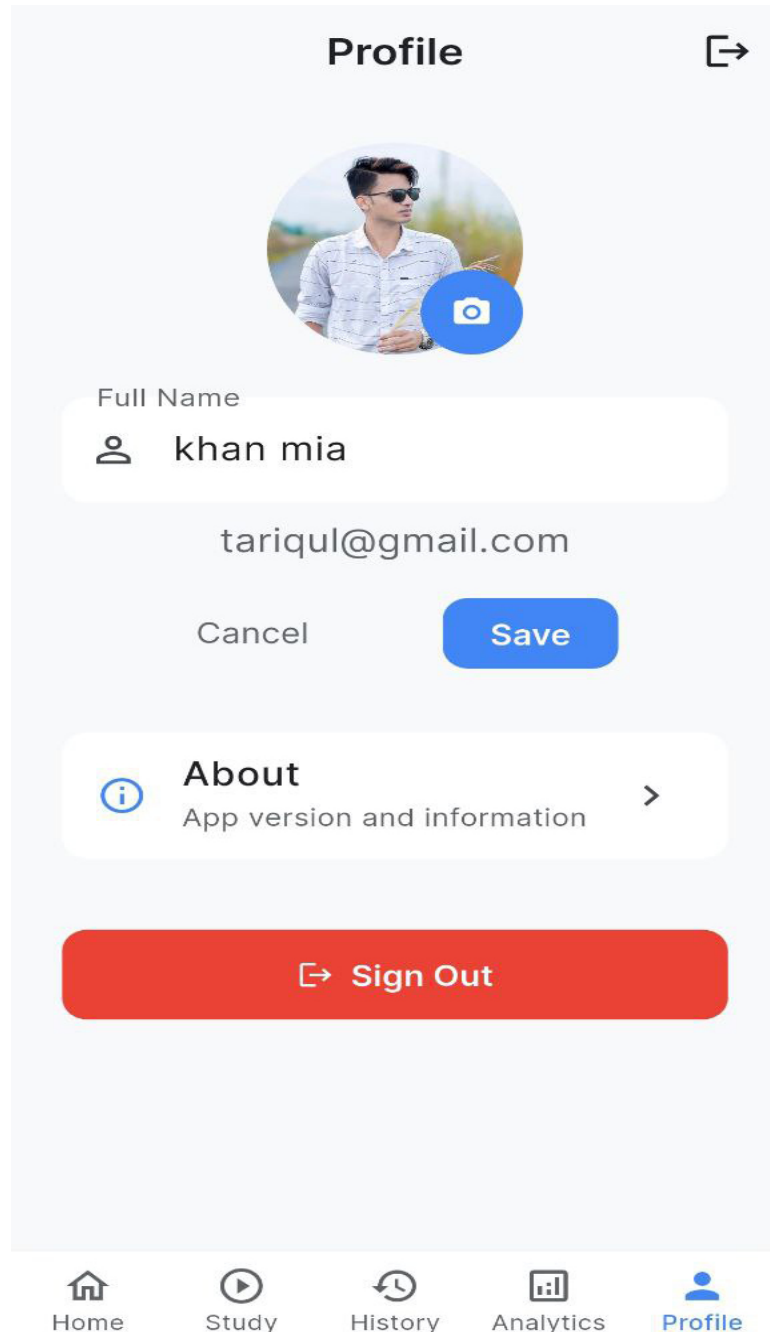
Figure 4.12: The profile editing screen of StudyPlus

On the user's profile page, a header displays above the content that includes an avatar of the user along with their full name and email address they signed up to OpenID with. If user has not set a profile picture, he is represented by the default placeholder icon. Users can edit display name and profile picture using the Edit Profile button will show when user is in edit mode. With the edit form profile turns to be a form fields and photo update, so effectively it's one single mechanism of switching from view to update. Any changes you make get synchronized with Firebase Authentication, so the user is treated consistently whether in their current session or in a different one.

CHAPTER V

Testing and Evaluation

5.1 Introduction

Testing and evaluation are the two important stages in developing StudyPlus so as to make it function according to expectation, be as user-friendly as posible and stable for optimal performance. 6 This analysis tests the system for its intended use and suggests changes. All sorts of test, from function, usability and performance were applied to the app. Additionally, it was analyzed whether study suggestions are precise enough (AI-driven as well) and those help users to become more productive.

5.2 Testing Methodology

The testing prototype was constructed by following black-box and user-centric manner, and then hybridized on the approach of blackbox testing in functionality validation and user-centric testing in interface verification test. Automated unit testing for some backend functionalities (login, DBl communication) and manual on the front-end. Response times and database effectiveness were evaluated in controlled experiments, including usability evaluation with a sample of target population users and performance benchmark tests.

5.3 Functional Testing

Functional testing focused on verifying the core functionalities of StudyPlus worked as specified. Some specific scenarios that could be utilized include the account registration, login/logoff, target setting and workout tracking, etc. and there are Still and The AI recommendation for example to present the analytics. All test cases were repeatedly executed to guarantee reusability and stability.

5.3.1 User Authentication Testing

Auth testing under several conditions, including successful sign ups, wrong credentials, password recovery when an account is deleted. Tests ensured user data got saved and fetched from Firebase Authentication, and expected error messages displayed when the authentication process failed. It could prevent someone from registering the same voter into it twice and would even accommodate incorrect input.

5.3.2 Study Session Tracking Testing

Validation tests consisted of starting, stopping and ending tracking of study sessions in various contexts. Testing the time, focus/productivity rating input and saving session notes with some expected values. Every session was manually compared with Firebase real-time database logs to verify the accuracy of the duration and metadata captured.

5.4 Usability Testing

In the usability testing phase, the app was confirmed to be easy to use and fun. In this review I paid special attention to user interaction, clarity of the features and ease of navigation.

5.5 Bug Fixing and Debugging

A couple issues were detected and updated while testing. There were a few typical issues: the UI would flicker at points when editing profiles, the timer would desync during study mode; there was also slow loading at times for analytics screen. Debugging involved looking at logs, breaking into Firebase interactions and enhancing error handling. Each fix was thoroughly tested to ensure it didn't introduce new problems, thus affording us massive confidence in the overall quality of the end product.

CHAPTER VI

Conclusion and Future Work

6.1   Summary of Findings

The StudyPlus design and evaluation demonstrated that the system supported solving problems students have in their studying game. The core features, such as user registration and log-in, target setting, study session tracking, and visual analytics were successfully realized through functional and usability testing. The features, it was claimed, were enabling users' self-regulation of motivation and learning style.

The always do surprise AI was I got at its study timing, duration focus and balancing subjects. All of these have been generally valid and helped users be productive and consistent. One or two of the ideas were dismissed as being a bit vague but the building was generally accepted to be vast improvement for learning and teaching the students own.

The user test indicated that the interface is usable, beautiful and nice to use -friendly, accessible students could perform without confusion and without techno issues. The findings of performance evaluation also indicated stability of the system; response time and database processes were acceptable and matched real-time usage.

6.2   Achievements of the Study

The project has met its key aim to develop and evaluate StudyPlus, integrated mobile app for study tracking, intelligent analytics and AI based recommendations. The project's an illustration of how combining a single integrated offering – goals, study sessions, performance analytics and adaptive feedback – can improve the nature of students' learning. Testing left me with a system that was operating, user friendly and responsive – able to interact in real time with Firebase. More importantly, the research also demonstrated that the AI-based hints were helpful to their work

and study styles, even from an early point in the students' progress. These successes suggest potential for leveraging modern mobile development tools and cloud resources to satisfy realistic academic requirements.

6.3   Contributions to the Field

The findings from this study will contribute to the growing findings in educational technology and intelligent learning systems. It is a mix of tracking your study session and live analytics and AI-powered recommendations, bridging the gap between habit-forming apps and personalized learning tools. Secondly, it demonstrates the achievement of applying Flutter (cross-platform) and Firebase (real-time data organization), as a reference model to future educational apps. Third, with usability and feedback-oriented design focus the study contributes for designing of user centred systems to track the course progress as well as motivate the users to complete it. Thirdly, the project provides a foundation for further work on adaptive and personalized study support systems, thus illustrating the potential of AI to transform practice in self-regulated learning.

6.4   Recommendations for Future Work

In doing what we aimed to do, StudyPlus has some several areas for growth and evolution in future versions. One of the crucial points is that the AI recommendation algorithms need to be more sophisticated. Currently the system provides non-personalized feedback, but by using a more complex learning model we can imagine personalized recommendations adapted to learner behavior or performance that up-date as learners preferences change.

Another stretch goal is the expansion for platform integration. Synchronizing with popular task management applications (digital calendars) used in LMS could support study tracking userspace-wide. In the same vein, going offline so that students can access content and cache their data locally would minimise such friction for students who have low internet access.

On the usability perspective, a next step could be to include gamification components that motivate students through badges and leader boards or motivational streaks in promoting regular study behaviour. And new charting designs and interactive graphic dashboards in the toolkit could help prompt greater learning gains for all users.

Finally, larger longitudinal replications with different student population are recommended. By including students across the range of academic performance, culture and discipline, researchers could have tested how well it works in varied situations. These kinds of augmentations would not only increase the market value of the tool, but also had the potential to contribute towards advancing research on intelligent student-centred learning technologies.

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