SMART GPA CALCULATOR: DYNAMIC SOLUTION FOR ACADEMIC PERFORMANCE

A DESIGN PROJECT REPORT

submitted by

SANTHOSH B

SERALATHAN S

VASAN S

in partial fulfilment for the award of the degree

of

BACHELOR OF ENGINEERING

in

COMPUTER SCIENCE AND ENGINEERING

K RAMAKRISHNAN COLLEGE OF TECHNOLOGY

(An Autonomous Institution, affiliated to Anna University Chennai, Approved by AICTE, New Delhi)

Samayapuram – 621 112

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BONAFIDE CERTIFICATE

Certified that this project report titled **“SMART GPA CALCULATOR: DYNAMIC SOLUTION FOR ACADEMIC PERFORMANCE”** is bonafide work of SANTHOSH B(811722104132) SERALATHAN S(811722104136) VASAN S(811722104177) who carried out the project under my supervision. Certified further, that to the best of my knowledge the work reported here in does not form part of any other project report or dissertation on the basis of which a degree or award was conferred on an earlier occasion on this or any other candidate.

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DECLARATION

We jointly declare that the project report on **“SMART GPA CALCULATOR: DYNAMIC SOLUTION FOR ACADEMIC PERFORMANCE”** is the result of original work done by us and best of our knowledge, similar work has not been submitted to **“ANNA UNIVERSITY CHENNAI”** for the requirement of Degree of Bachelor Of Engineering. This project report is submitted on the partial fulfilment of the requirement of the awardof Degree of Bachelor Of Engineering.

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ABSTRACT

The project involves the development and implementation of a CGPA Calculator application designed to assist students in effectively tracking and managing their academic performance. This innovative application integrates dynamic user input handling and SQLite database functionality to deliver precise and efficient calculations of Semester Grade Point Averages (SGPA) and Cumulative Grade Point Averages (CGPA).

Key features of the application include the capability to input grade points and credit details for multiple semesters and subjects, alongside the use of a robust algorithm to perform automated calculations based on weighted averages. The application ensures data accuracy and reliability by incorporating comprehensive input validation and handling various edge cases, including incomplete data entries and erroneous inputs. This approach enhances the application's usability and ensures a seamless experience for the user.

The system architecture combines a user-friendly interface with backend support powered by SQLite, allowing for persistent data storage and efficient query execution. This enables users to save, retrieve, and update their academic data effortlessly. The application's design prioritizes intuitive navigation, ensuring that users with minimal technical knowledge can leverage its functionalities with ease.

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LIST OF ABBREVIATIONS

ABBREVIATION	FULL FORM
API	Application Programming Interface
CLI	Command Line Interface
SSL	Secure Sockets Layer
RTDB	Real-Time Database
AI	Artificial Intelligence
AR	Augmented Reality
UPI	Unified Payment Interface
HTML	Hyper Text Markup Language
CSS	Cascading Style Sheet
SQL	Structured Query Language
UID	User Identifier
JS	JavaScript

CHAPTER 1

INTRODUCTION

1.1 BACKGROUND

The CGPA Calculator App was conceptualized to address the challenges students face when calculating their academic performance across multiple semesters. Academic grading systems often rely on Grade Point Averages (GPA), which are calculated based on the grades earned in various subjects and their respective credit hours. While tools like spreadsheets or manual calculations are common, they are prone to errors and lack user-friendliness. This app provides a reliable, efficient, and accurate solution for such calculations. Many students struggle with manually calculating SGPA and CGPA due to the complex nature of weightage and credits, and the app automates these calculations, reducing the likelihood of errors and saving time. Students often need a tool that is intuitive and adaptable to their academic structure, and by allowing users to dynamically input semesters, subjects, and their details, the app caters to diverse academic requirements. During exam periods, students face immense pressure, and providing a tool to quickly calculate their academic performance can ease their workload and give clarity on their progress. Traditional manual methods or basic calculators lack precision when dealing with decimal values for grades and credits, but using BigDecimal, this app ensures high precision and accurate rounding of results. With the increasing reliance on digital tools, this app is designed to integrate seamlessly into the everyday academic workflow of students, making it a convenient alternative to traditional methods. The CGPA Calculator App emphasizes the importance of academic performance metrics, which are pivotal in higher education, and students use CGPA not only to assess their progress but also for scholarships, internships, and job opportunities. By creating this app, we aim to empower students with a modern, efficient, and accessible tool to manage their academic data effectively. This app lays the foundation for more advanced academic tools, with potential future enhancements including saving student data for future reference, integration with academic portals for automated data entry, and visualization of academic progress through charts and graphs. By creating the CGPA Calculator App, we strive to bridge the gap between traditional academic practices and modern technological advancements.

1.2 OVERVIEW

The CGPA Calculator App is a user-friendly Android application designed to help students efficiently calculate their Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA). It simplifies complex academic calculations by automating the process, ensuring accuracy and precision, and providing an intuitive interface tailored to students' needs. Users can input the number of semesters and subjects for each semester dynamically, with the ability to specify grade points and credit hours for each subject. The app calculates SGPA for each semester based on user inputs of grades and credits, ensuring precision using BigDecimal for mathematical operations, and aggregates all semester GPAs and credits to compute the CGPA, providing a comprehensive view of overall academic performance. It validates inputs to prevent incorrect or incomplete data, ensuring reliability and user trust, and includes a reset feature to clear all inputs and results, allowing users to start fresh with new data. The app displays SGPA and CGPA results in a readable format with detailed breakdowns, making it easy for users to understand their performance. With an interactive UI, the app offers ease of use, time-saving benefits by eliminating manual calculations, high precision in calculations, and flexibility to adapt to any academic system, accommodating diverse grading and credit structures. Primarily designed for students in schools, colleges, and universities, it is also beneficial for educators who wish to demonstrate or validate CGPA calculations. By offering a seamless, accurate, and flexible solution for calculating CGPA, the app stands out as an indispensable tool for students managing their academic journey.

1.3 PROBLEM STATEMENT

In academic settings, students are often tasked with calculating their Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA), both of which are critical metrics in evaluating their academic performance. These calculations typically involve managing multiple variables, including grade points earned in each subject, the credit hours assigned to those subjects, and the weight of each course across different semesters. For students, especially those with multiple semesters or numerous subjects in each term, performing these calculations manually can be both complex and overwhelming. Manual methods are prone to errors due to the intricacies of summing grades and credits, applying the right weightage, and following the correct formulas. A small error in data entry or calculation can have a significant impact on the accuracy of the results, potentially leading to an inaccurate understanding of their academic standing.

Moreover, the time-consuming nature of manual calculations diverts students' attention away from other important academic or personal tasks. Instead of focusing on studying or engaging in extracurricular activities, students may find themselves spending hours inputting data into spreadsheets or performing calculations by hand. This is particularly challenging when dealing with large amounts of data from multiple semesters. In addition, many students lack access to standardized, reliable tools that align with their specific academic institution's grading system. Even when such tools are available, they may not always provide the necessary flexibility to accommodate different grading structures or the various credit systems adopted by different universities or colleges.

Errors arising from manual input, misunderstanding of academic formulas, or misinterpretation of credit weights can result in incorrect results. This not only adds stress but can also cause confusion, as students may mistakenly believe their academic performance is better or worse than it actually is. Furthermore, academic structures vary greatly between institutions, with some using weighted averages or specific grading scales, making it difficult for students to find one-size-fits-all solutions. As a result, many students are in need of a solution that is not only reliable but also adaptable to various academic grading systems.

The CGPA Calculator App addresses these key challenges by providing a dynamic, intuitive, and reliable platform for students to calculate their SGPA and CGPA. The app removes the complexity and errors associated with manual calculations by automating the entire process, ensuring accuracy and precision in the results. Students simply need to input their semester details, including the number of subjects, grade points, and credit hours, and the app will handle the rest. This significantly reduces the time spent on calculations, freeing up students to focus on other academic responsibilities. Moreover, the app is designed to be flexible, allowing users to adjust the inputs according to their specific academic system, whether it’s the number of semesters, the number of subjects, or the credit weighting for each course. By automating calculations and ensuring precise results, the app provides students with a clear, reliable overview of their academic performance, empowering them to make informed decisions regarding their studies. Ultimately, the CGPA Calculator App becomes an indispensable tool, offering both efficiency and adaptability, making it a valuable asset to students worldwide, regardless of their institution’s grading system.

1.4 OBJECTIVE

The CGPA Calculator App is a comprehensive tool designed to simplify the often overwhelming and complex task of calculating Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA) for students. In many academic systems, calculating SGPA and CGPA involves multiple variables such as grades, credit hours, and weighted averages across several semesters, which can often lead to mistakes when done manually. This app aims to remove the burden of these calculations by automating the entire process, ensuring both accuracy and ease of use. The core objective of the app is to provide students with a reliable platform that delivers precise academic performance data, eliminating the common errors associated with manual calculations, such as incorrect summations or applying the wrong grading formulas.

The app's adaptability is one of its key strengths. It caters to students across a broad spectrum of educational systems, offering flexibility to accommodate various numbers of semesters, subjects, and credit systems. For example, it can adjust the number of subjects per semester or the credit values based on a student's specific curriculum. This adaptability ensures that the app is not only useful for students from different countries or academic institutions but also for those pursuing unique or personalized academic tracks. Whether a student is enrolled in a system that uses a fixed number of credits per subject or a more dynamic approach, the app's flexibility ensures that it remains a valuable tool throughout their academic journey.

A significant advantage of the CGPA Calculator App is its user-friendly interface, designed to guide users step by step through the process of inputting data and calculating their grades. This intuitive design reduces the complexity that often arises when using other manual methods or spreadsheet-based tools. Students can easily input grades, credit values, and other necessary information, and the app automatically calculates the SGPA for each semester and the cumulative CGPA based on these inputs. The simplicity of the user interface ensures that even users with little technical experience can use the app effectively and without confusion. This approach also helps eliminate common pitfalls associated with manual input, such as overlooking required fields or making incorrect entries.

Time management is another crucial aspect of academic life that the app addresses. Manual calculations, especially when performed for multiple semesters and subjects, can be time-consuming and cumbersome. The CGPA Calculator App automates the entire process, allowing students to focus on their studies, coursework, or other important tasks rather than spending valuable time on complex calculations. By reducing the time spent on grade calculations, the app enhances the efficiency of students' academic workflows and helps them stay on top of their academic performance with minimal effort.

Furthermore, the app promotes accuracy by ensuring that all calculations are done with a high degree of precision. Using BigDecimal for mathematical operations, the app eliminates rounding errors that might occur with simpler data types, ensuring that results such as SGPA and CGPA are calculated with maximum accuracy. This feature provides students with a higher level of confidence in their academic standing, as they can rely on the app's results without worrying about errors or inconsistencies.

In addition to being a valuable tool for students, the app also benefits educators who may want to demonstrate CGPA calculations or validate students' academic standing. Teachers and administrators can use the app to verify the accuracy of students' grades or provide a clearer understanding of how academic performance is calculated in different grading systems.

The app's potential for future enhancements is significant. There is room for additional features, such as saving student data for future reference, integration with academic portals for automated data entry, and even the ability to visualize academic progress through graphs or charts. Such features could further streamline academic tracking, providing students with a more comprehensive overview of their performance over time. These enhancements could also include customized notifications, such as alerts when a student's CGPA falls below a certain threshold, or a reminder to input grades for the current semester.

With its powerful combination of accuracy, flexibility, and ease of use, the CGPA Calculator App addresses a critical need in the academic world by offering a solution to the problems of manual calculations and data entry. By automating SGPA and CGPA calculations, the app not only saves time but also helps reduce stress, increase accuracy, and foster better academic planning for students. Ultimately, this app is designed to be an indispensable tool for students, offering them a reliable way to track and manage their academic performance with minimal effort, allowing them to focus on what matters most: their education.

1.5 IMPLICATION

The CGPA Calculator App has far-reaching implications for both students and academic institutions, driving improvements in educational outcomes, operational efficiency, and overall academic management. For students, the app provides an efficient means to track academic progress by calculating SGPA and CGPA after each semester, enabling them to gain a clear understanding of their performance. This allows students to identify areas for improvement and take corrective actions before it’s too late, helping them stay on track with their academic goals. Educators and academic counselors can also benefit from this app, as it allows them to monitor student performance in real-time, quickly identifying struggling students and offering timely support, ultimately fostering a more supportive learning environment.

The app significantly reduces the common errors found in manual CGPA calculations, ensuring more accurate results. Human errors, such as misadding credits or grade points, are virtually eliminated, promoting fairness in grading and providing students with confidence in the accuracy of their academic data. The elimination of manual calculations also saves both students and administrators a great deal of time. Students no longer need to spend precious time performing complex calculations, allowing them to focus more on their studies and academic improvement. Administrators, on the other hand, can rely on the app’s automated process to manage and track student performance, reducing their administrative workload and increasing operational efficiency.

Furthermore, the app standardizes the CGPA calculation process across different academic institutions, ensuring a consistent and uniform grading system. This is particularly useful for students who transfer between institutions or those studying in programs with different grading structures, as it provides a reliable method for comparing and transferring grades seamlessly. The app’s mobile nature also increases accessibility, allowing students to access their academic performance anytime and anywhere. Whether they are on campus, at home, or traveling, students can easily check their grades, facilitating real-time academic tracking and progress monitoring.

The app also empowers students by giving them the tools they need to make informed decisions regarding their academic trajectory. By clearly displaying their academic standing, students can adjust their course selection, semester load, and career plans based on their CGPA goals, ensuring they stay on track for future opportunities. Additionally, over time, the app could generate valuable data on student performance trends. This data could provide educational institutions with insights into potential challenges, identify areas for curriculum improvement, and contribute to the development of more targeted support programs.

One of the significant long-term benefits of the CGPA Calculator App is its promotion of academic planning. By allowing students to input their grades and course information across multiple semesters, the app encourages thoughtful academic planning. Students can see how their grades will impact their overall CGPA, helping them make strategic decisions to meet academic milestones or pursue specific career paths. The ability to visualize their performance over time gives students greater control over their educational journey, enhancing their ability to set and achieve academic goals.

In conclusion, the CGPA Calculator App simplifies the process of calculating SGPA and CGPA for students while offering substantial benefits to educational institutions. It promotes efficiency, accuracy, and accessibility, empowering students to take control of their academic progress. The app also supports educational institutions by streamlining administrative tasks, improving decision-making, and enabling data-driven insights. By offering a user-friendly, reliable platform for academic performance tracking, the app enhances both the student experience and the operational effectiveness of academic institutions.

CHAPTER 2

LITERATURE SURVEY

1.TITLE: Automated GPA Calculation and Its Impact on Education.

AUTHORS: Wilkerson

YEAR: 2014

The author examines the benefits of automating the Grade Point Average (GPA) calculation process, which traditionally relied on manual inputs and administrative oversight. Wilkerson highlights how automation improves accuracy, reduces administrative workload, and allows students to track their academic progress in real-time, providing them with immediate feedback for better decision-making. The paper also explores how automated systems contribute to uniformity and fairness in grading, benefiting both students and educational institutions. However, it also acknowledges the challenges of ensuring data security, privacy, and aligning automated systems with evolving educational standards.

2.TITLE: A Study on the Design and Implementation of CGPA Calculators

AUTHORS: Abdul et al

YEAR: 2016

The authors explore the design and development of CGPA calculators, focusing on their importance in academic institutions for accurately computing students' cumulative grade point averages. The study delves into the technical aspects of implementing CGPA calculation systems, including the selection of appropriate algorithms and the integration of user-friendly interfaces. Abdul et al. also discuss the challenges faced during the development process, such as ensuring compatibility with different grading systems and maintaining data integrity. The paper emphasizes the role of automated CGPA calculators in reducing errors, saving time for both students and faculty, and providing students with real-time insights into their academic performance, which can aid in decision-making and academic planning.

TITLE: The Impact of Digital Tools on Student Academic Success

AUTHORS: Liu & Lin

YEAR: 2019

The authors examine the role of digital tools in enhancing students' academic performance. The study highlights how various digital tools, such as online learning platforms, digital grade trackers, and automated academic calculators, contribute to improving students' engagement, understanding, and management of their academic responsibilities. Liu and Lin argue that these tools not only provide convenience but also help students to better track their progress, set academic goals, and receive immediate feedback. By analyzing the impact of such tools on student success, the paper underscores their potential in fostering more personalized learning experiences and supporting students in achieving higher academic outcomes. The authors conclude that the strategic use of digital tools can significantly boost student productivity, motivation, and overall academic achievement.

TITLE: Mobile Applications for Academic Success

AUTHORS: Chen

YEAR: 2017

The author explores the growing impact of mobile applications on student academic performance. The study highlights how mobile apps have become essential tools for students in managing their academic tasks, enhancing learning experiences, and improving overall productivity. Chen discusses various types of academic mobile applications, including those for time management, note-taking, study assistance, and grade tracking, emphasizing their role in helping students stay organized, access resources quickly, and monitor their progress. The paper also examines the advantages of mobile apps in promoting self-directed learning and facilitating communication between students and educators. Chen concludes that mobile applications are crucial in modern education, offering students greater flexibility, convenience, and support to succeed academically.

TITLE: Technological Innovations in Academic Performance Tracking

AUTHORS: Bates & Poole

YEAR: 2003

Bates and Poole investigate the role of emerging technologies in transforming the way academic performance is tracked and evaluated. The paper focuses on the integration of digital tools, such as software systems and online platforms, which provide real-time data on students' grades, progress, and overall academic development. Bates and Poole discuss how these technological innovations enhance the efficiency of performance tracking, enable personalized feedback, and improve communication between students, educators, and administrators. The study also explores the potential benefits of technology in offering students a more transparent and accessible means of monitoring their academic achievements, while promoting a data-driven approach to educational decision-making. Ultimately, the authors emphasize the transformative impact of technology on academic performance management, highlighting its capacity to streamline processes and support continuous improvement in education.

TITLE: Learning Analytics and Student Success

AUTHORS: Siemens

YEAR: 2013

George Siemens explores the growing field of learning analytics and its potential to improve student success. The paper discusses how data collected from students' interactions with educational technologies can be analyzed to provide insights into their learning behaviors, performance patterns, and areas of struggle. Siemens highlights the role of learning analytics in identifying at-risk students, providing timely interventions, and personalizing learning experiences to enhance student outcomes. The study also touches on the ethical considerations of data use in education, emphasizing the importance of privacy and transparency. Siemens argues that learning analytics, when used effectively, can transform traditional educational practices by allowing educators to make data-informed decisions that support student success, ultimately contributing to a more efficient and effective learning environment.

CHAPTER 3

SYSTEM ANALYSIS

3.1 EXISTING SYSTEM

Currently, most students rely on manual methods or basic tools for calculating their Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA). These systems, while functional to some extent, have several limitations that the CGPA Calculator App aims to address. Below is an overview of the commonly used existing systems:

1. Manual Calculations

Description:

Students perform calculations manually using paper, calculators, or spreadsheets.

Advantages:

- No technological dependency.
- Flexible for small datasets.

Limitations:

- Prone to human error in summing grades, credits, or applying formulas.
- Time-consuming, especially for multiple semesters and subjects.
- Difficult to verify accuracy without re-calculations.

2. Spreadsheet Tools (e.g., Microsoft Excel, Google Sheets)

Description:

Spreadsheets are commonly used for automating repetitive tasks like summing grades and applying weighted averages.

Advantages:

- Partial automation of calculations reduces errors compared to manual methods.
- Can handle moderate amounts of data.

Limitations:

- Requires knowledge of spreadsheet formulas.
- Limited accessibility on mobile devices for on-the-go calculations.
- No dynamic adaptability to different grading structures or subject-credit systems.

3. Academic Institution Portals

Description:

Some institutions provide internal systems or portals that calculate SGPA and CGPA based on data uploaded by faculty.

Advantages:

- Highly accurate as data is directly integrated into institutional systems.
- No user input required, reducing errors.

Limitations:

- Limited availability to students outside the institution's system.
- Lack of flexibility for personal use or planning future academic goals.
- Often accessible only after official grades are released, offering no room for speculative planning.

4. Online CGPA Calculators

Description:

Various websites provide online tools where users can input grades and credits to compute SGPA and CGPA.

Advantages:

- Easy to use without technical knowledge.
- Accessible from any device with an internet connection.

Limitations:

- Dependence on internet access.
- Cannot save or manage data for multiple semesters dynamically.
- May lack customization for different grading scales or credit systems.
- Security concerns about sharing academic data online.

5. Mobile Apps (General Purpose)

Description:

Some mobile applications provide basic SGPA and CGPA calculation features.

Advantages:

- Convenient and accessible on smartphones.
- Simple user interfaces for quick calculations.

Limitations:

- Limited functionality for advanced academic planning or storing historical data.
- Rarely offer customization for different grading policies or credit systems.
- May lack precision in calculations, especially for complex grading schemes.

Gaps in Existing Systems

The current systems, while addressing basic needs, lack several critical features that students require for efficient academic performance tracking:

- **Dynamic adaptability:** Existing systems are not flexible enough to handle varied academic structures across institutions.
- **User experience:** Tools often lack an intuitive interface, making them less user-friendly.
- **Error prevention:** Most systems do not validate inputs, leading to potential inaccuracies.
- **Offline accessibility:** Many online tools require internet access, which can be a limitation for some users.

3.2 PROPOSED SYSTEM

The proposed CGPA Calculator App is a robust and user-friendly Android application designed to address the challenges faced by students in calculating their Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA) accurately and efficiently. It simplifies the complex process of manual calculations by employing well-defined formulas and advanced algorithms.

For SGPA, the app uses the formula:

$SGPA = \sum(Ci \times Gi)/\sum Ci$

where Ci represents the credit assigned to the i-th subject, and Gi is the grade point for the same subject. This ensures that each subject's contribution is weighted appropriately based on its credit value.

For CGPA, the formula is:

$CGPA = \sum(Ci \times Gi)/\sum TCi$ of Total semesters

where Ci represents the credit assigned to the i-th subject, and Gi is the grade point for the same subject. This ensures that each subject's contribution is weighted appropriately based on its credit value. This allows for an accurate cumulative assessment of a student’s performance across multiple semesters.

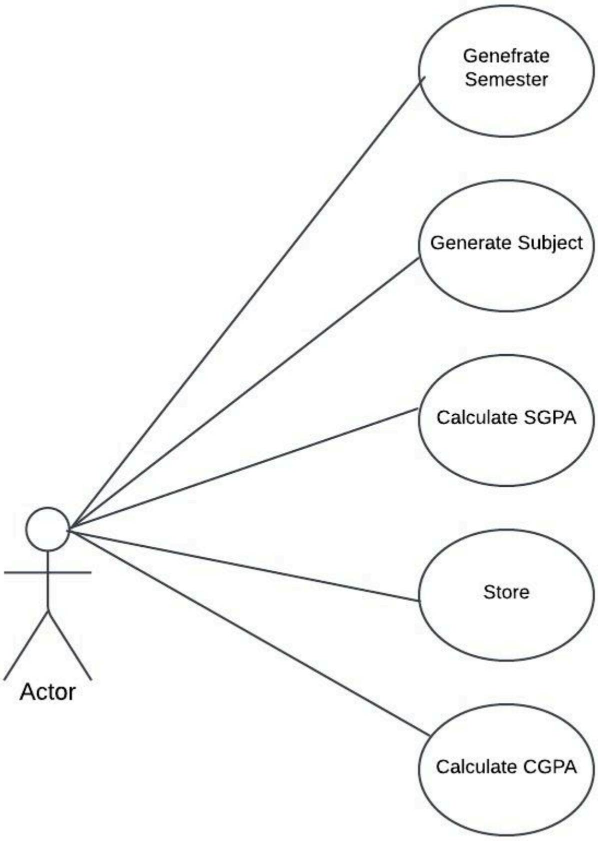
The app dynamically accommodates varying academic structures by allowing users to input the number of semesters, subjects per semester, credit values, and grade points for each subject. It automates the entire process, reducing the likelihood of errors in summations or formula misapplications. The app also validates user inputs to prevent incomplete or incorrect data from skewing results.

Beyond the core functionality of calculating SGPA and CGPA, the app includes features like a reset option to start afresh, detailed breakdowns of results for clarity, and offline access for seamless usage anytime, anywhere. It promotes accessibility and empowers students by providing an accurate and real-time view of their academic standing.

By leveraging precise calculations, the app saves time, reduces stress, and fosters better academic planning. Students can strategically evaluate their progress, make informed decisions about their course loads, and plan for improvements. Additionally, educators and academic institutions can use the app to monitor student performance and maintain consistency in academic evaluations. Future enhancements, such as visualizing trends through graphs, saving historical data, and integrating with academic systems for automated data entry, could further increase its utility.

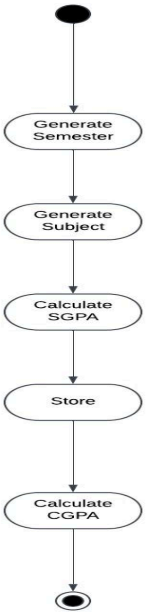
In conclusion, the CGPA Calculator App is more than just a tool; it is a comprehensive solution that bridges the gap between traditional academic practices and modern technology, empowering students to achieve their academic goals with accuracy and efficiency.

3.3 BLOCK DIAGRAM OF PROPOSED SYSTEM



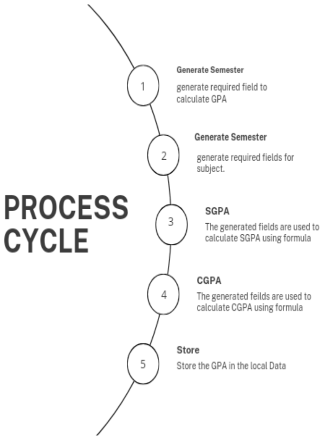
1.3.1 Block Diagram for application

3.4 FLOWCHART



1.3.2 Flow Chart for application

3.5 PROCESS CYCLE



Generate Semester
generate required field to calculate GPA

Generate Semester
generate required fields for subject.

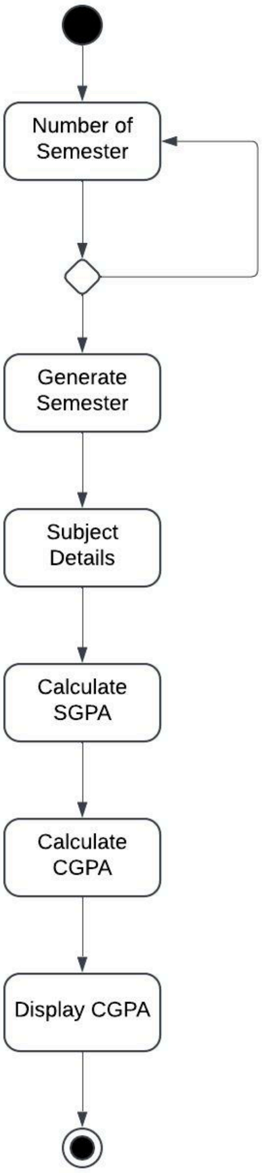
SGPA
The generated fields are used to calculate SGPA using formula

CGPA
The generated feilds are used to calculate CGPA using formula

Store
Store the GPA in the local Data

1.3.3 Process cycle for application

3.6 ACTIVITY DIAGRAM



1.3.4 Activity Diagram

CHAPTER 4

MODULES

4.1 MODULE DESCRIPTION

- Input Module
- Semester Generation Module
- Subject Generation Module
- SGPA Calculation Module
- CGPA Calculation Module
- Error Handling and Validation Module
- User Interface Module
- Result Display Module
- Reset/Clear Module
- Data Storage and Processing Module

4.1.1. INPUT MODULE

The Input Module is a crucial component of the CGPA calculator application, responsible for gathering essential data from the user to facilitate the calculation of SGPA (Semester Grade Point Average) and CGPA (Cumulative Grade Point Average). Upon launching the application, the user is prompted to provide basic information such as the number of semesters, the subjects taken in each semester, and the corresponding grades and credit hours. This module employs dynamic field generation, meaning it adjusts the number of input fields based on the number of semesters specified by the user. For example, if the user indicates that they have completed six semesters, the module will automatically generate six semester layouts, each with editable rows for entering subject names, grade points, and credit hours.

One of the key aspects of the Input Module is its ability to validate the data entered by the user. It ensures that no field is left blank, and that the grade points and credit hours are within acceptable numerical ranges. This validation occurs in real time, providing immediate feedback to the user if any input is incorrect, such as an invalid grade or missing data. The user cannot proceed until all errors are corrected, ensuring that the data collected is both accurate and complete. Additionally, the module is designed to be highly user-friendly, with clear labels and an intuitive interface that guides the user through the data entry process. This not only makes the application more accessible but also reduces the chances of input errors.

Once the data is entered and validated, the Input Module aggregates the information and passes it along to the subsequent modules for SGPA and CGPA calculations. Its role in gathering accurate and reliable data is pivotal to ensuring that the overall application functions smoothly, and that the calculations performed in later stages are based on correct input. By combining dynamic field generation, real-time validation, and a user-friendly design, the Input Module ensures that users can quickly and efficiently input their academic details, paving the way for accurate and timely results.

4.1.2. SEMESTER GENERATION MODULE

The Semester Generation Module is an essential component of the CGPA Calculator application, designed to simplify and streamline the process of academic data entry by adapting to the user's specific requirements. Upon receiving the user's input specifying the total number of semesters, the module dynamically generates a dedicated layout for each semester. Each layout is thoughtfully structured, starting with a clear and visually distinct header, such as "Semester 1," "Semester 2," and so forth, to provide a logical and organized framework for data entry.

Within each semester layout, the module incorporates user-friendly fields for entering the number of subjects, as well as associated grades and credits. These fields are generated dynamically based on the number of subjects specified by the user for that particular semester. This dynamic approach eliminates clutter and ensures that users are presented only with the fields they need, avoiding scenarios where they might feel overwhelmed by excessive fields or hindered by too few.

The Semester Generation Module emphasizes a highly responsive and intuitive interface. It adapts in real-time to changes made by the user. For example, if the user decides to revise the number of semesters or adjust the number of subjects within a semester, the module automatically recalibrates the layout to reflect these modifications. This adaptability ensures that users can modify their inputs without disruptions, offering both flexibility and convenience.

Furthermore, this module ensures a smooth workflow by organizing data entry in a logical sequence, guiding users step-by-step through the process. It enhances usability by minimizing errors and confusion, providing a seamless interaction that caters to both novice and experienced users. By aligning its functionality with the principles of responsive design and user-centricity, the Semester Generation Module plays a critical role in enhancing the overall efficiency and accuracy of the CGPA Calculator application, ultimately empowering users to effortlessly manage their academic data.

4.1.3. SUBJECT GENERATION MODULE

The Subject Generation Module is a vital component of the CGPA Calculator application, meticulously designed to facilitate detailed and accurate academic data entry for each subject within a semester. This module operates after the user specifies the total number of subjects for a particular semester, dynamically generating the exact number of rows required to accommodate the user's input. Each row is thoughtfully structured, containing dedicated fields for entering a subject's grade points and credit hours, ensuring that users can input precise and comprehensive information for every subject.

By breaking down each semester into its constituent subjects, the Subject Generation Module provides a highly organized and systematic approach to data entry. Each subject's data—its grade points and credit hours—is grouped logically under the corresponding semester. This modular arrangement not only enhances the clarity of the data but also empowers users to focus on specific details without the risk of overlooking any key information.

This module is designed to align seamlessly with user input. If the user specifies a particular number of subjects for a semester, the module generates exactly that number of rows, avoiding redundancies or shortages. This precise synchronization eliminates potential inconsistencies and ensures that the application responds dynamically to user needs. If the user revises the number of subjects for a semester, the module instantly adapts, updating the layout to reflect the changes in real-time. This responsiveness contributes to a smoother and more efficient workflow.

Moreover, the Subject Generation Module plays a critical role in promoting data accuracy and efficiency. By grouping each subject's grade points and credit hours in a structured manner, it minimizes errors and ensures that all necessary information is accounted for. This level of organization simplifies subsequent calculations, such as the SGPA for individual semesters and the cumulative CGPA, enabling the application to deliver precise results with minimal user effort.

In addition to its functional benefits, the module prioritizes a user-friendly experience. Its dynamic adaptability and logical design reduce the cognitive load on users, making the process intuitive and accessible even for those less familiar with GPA or CGPA calculations. By seamlessly integrating responsiveness, accuracy, and clarity, the Subject Generation Module serves as a cornerstone of the application's ability to help users track and manage their academic performance with confidence and ease.

4.1.4. SGPA CALCULATION MODULE

The SGPA Calculation Module is an essential feature of the CGPA Calculator application, designed to compute the Semester Grade Point Average (SGPA) for each semester based on the grades and credits entered by the user. Once the user has provided the necessary information for each subject within a semester, the module performs several operations to calculate the SGPA and give feedback to the user. The module ensures that all necessary calculations are carried out accurately and promptly, providing the user with a clear understanding of their academic performance in each semester.

The module begins by collecting the data entered by the user, which includes the grade points and credit hours for each subject within a semester. Before proceeding with any calculations, the module validates the inputs to ensure they are accurate and complete. It checks that all fields for grades and credit hours are filled in properly, the grade points are within a predefined range (e.g., 0 to 10, depending on the grading system), and the credit hours are positive numbers, as negative values would be nonsensical in this context. If any of these fields are left empty or contain invalid data, the module will not proceed with the calculation and will notify the user to correct the inputs.

Once the data is validated, the module computes the weighted grade points for each subject. This is done by multiplying the grade point for each subject by its respective credit hours. The weighted grade points are then summed across all the subjects in the semester. This sum represents the total contribution of all subjects to the SGPA. It ensures that subjects with more credits (i.e., more weight) have a greater impact on the final SGPA calculation. Simultaneously, the module calculates the total number of credits for the semester. This is done by summing up the credit hours for each subject. The total credits will serve as the denominator in the SGPA calculation, ensuring that the final result accurately reflects the student's workload across all subjects.

With the total weighted grade points and the total credits, the module proceeds to calculate the SGPA using the formula:

$$SGPA = Total\,Weighted\,Grade\,Points/Total\,Credits$$

The SGPA Calculation Module incorporates robust error-handling mechanisms to ensure the calculation process is smooth and accurate. If there are any inconsistencies, such as division by zero (e.g., when total credits are zero), the module will prompt the user with an error message. Other issues, such as missing or invalid data, are also flagged, preventing incorrect calculations from being performed. These safeguards enhance the module's reliability and ensure that users receive meaningful results.

After calculating the SGPA, the result is dynamically displayed within the user interface. The SGPA is shown in the corresponding semester layout, allowing the user to see their performance for that specific semester immediately. This real-time feedback helps users track their academic progress and makes the information accessible in an easily understandable format. The SGPA value is presented clearly, with labels and appropriate formatting to ensure it is visible and easy to read.

The SGPA Calculation Module provides several key benefits. First, it offers accuracy and precision by automating the calculation process, eliminating the possibility of human error. Second, it provides real-time feedback, giving students immediate insight into their academic performance after entering their grades and credits. This immediate feedback loop encourages students to take proactive steps to improve their academic standing. Third, the module is error-resilient, designed to handle edge cases such as invalid inputs or zero credits, ensuring the application remains reliable in all situations. The module also focuses on user experience, making the calculation process seamless and intuitive. By simplifying the data entry process and providing instant feedback, it reduces the burden on users, particularly those with limited technical knowledge. The result is a user-friendly tool that enhances the academic management process for students, making it easier for them to track their performance throughout their academic journey.

In summary, the SGPA Calculation Module is a crucial part of the CGPA Calculator application. It automates the process of calculating SGPA, ensuring accuracy, efficiency, and user-friendliness. By validating inputs, calculating weighted grade points and total credits, and handling errors, the module provides a reliable and precise result. The real-time feedback ensures that users can track their performance effectively, making this module an indispensable tool for students managing their academic progress.

4.1.5. CGPA CALCULATION MODULE

The CGPA Calculation Module significantly enhances the functionality of the app by offering students a holistic view of their academic performance over multiple semesters. Unlike the Semester Grade Point Average (SGPA) module, which evaluates the student's performance in each individual semester, the CGPA module aggregates all semester-wise data, providing an overall measure of academic achievement throughout the course of study. This is especially helpful for students who wish to track their long-term progress and identify areas for improvement.

In this module, after the SGPA for each semester has been calculated, the system takes the total grade points and total credit hours across all semesters. These data points are then used to compute a weighted average, similar to the SGPA calculation method. The weight of each semester's contribution is determined by the number of credits assigned to that semester. This ensures that semesters with more credit hours have a proportionally larger impact on the final CGPA, offering a more accurate reflection of a student's overall academic performance.

A key feature of the CGPA Calculation Module is its robust error handling and validation mechanism. Before any calculations are made, the module ensures that the data entered is complete and accurate. For instance, it checks for missing semester grades or incomplete credit hour entries, which could otherwise skew the results. In cases of missing or invalid data, the module alerts the user, preventing erroneous calculations. This validation process ensures that the results displayed are both reliable and meaningful for academic decision-making.

Once the data is validated, the CGPA is computed by dividing the sum of the weighted grade points by the total number of credit hours. This calculation method guarantees that each semester's performance is weighted according to its academic significance, which is particularly important in programs where certain semesters may carry more weight due to the nature of the courses taken. The final CGPA value is displayed in real time, giving students instant feedback on their cumulative academic performance.

In terms of usability, the CGPA module is designed to be intuitive and user-friendly. Students can easily enter their semester details, and the module automatically handles the complex calculations. It provides immediate feedback on both individual semester results (SGPA) and the overall CGPA, making it a valuable tool for students to monitor their academic journey. Furthermore, the results are presented in a clear and understandable format, helping students quickly assess their progress and plan for future academic goals.

The CGPA module also contributes to long-term academic planning by helping students identify trends in their performance. For example, a student may notice a decline in their CGPA over multiple semesters and take corrective actions, such as seeking academic support or focusing on particular subjects. This real-time tracking system is a powerful tool for students who are aiming to improve their performance and for academic counselors who may use it to guide students toward successful outcomes.

Overall, the CGPA Calculation Module serves as an essential feature for any academic tracking system. By aggregating data from multiple semesters, performing weighted calculations, and ensuring data validity, it offers students a comprehensive and accurate assessment of their academic journey. The transparency and real-time feedback provided by the system ensure that students can stay informed about their academic standing, allowing for better decision-making and planning throughout their course of study.

4.1.6. ERROR HANDLING AND VALIDATION MODULE

The Error Handling and Validation Module plays a pivotal role in ensuring the accuracy and integrity of data entered by users in an academic performance tracking app. This module is designed to safeguard against the entry of incorrect or incomplete information, which could compromise the correctness of SGPA (Semester Grade Point Average) and CGPA (Cumulative Grade Point Average) calculations. By enforcing strict validation criteria, it prevents users from submitting invalid or logically inconsistent data, thus ensuring that the results are based on accurate and reliable inputs.

The module continuously monitors user input to ensure compliance with predefined validation rules. These rules include checks for numeric values, ensuring that grades and credits are entered as numbers, and enforcing specific range limits for grade points (for instance, between 0 and 10). Additionally, it ensures that fields are not left empty and that logical constraints are respected, such as non-zero credit values. This real-time validation helps prevent errors at the point of data entry, providing an immediate feedback loop to users and guiding them to make corrections before proceeding. For example, if a user attempts to enter a grade point outside the allowed range, the system will trigger an error message such as “Grade points must be between 0 and 10,” prompting the user to correct the input before submitting it.

One of the core functions of the Error Handling and Validation Module is to prevent invalid data from being processed in the SGPA and CGPA calculations. If any errors are detected—such as non-numeric values, missing data, or logically inconsistent entries—the system halts the calculation process until all issues are resolved. This ensures that only complete and valid information is used in the final results. By preventing the system from proceeding with faulty data, the module upholds the accuracy and reliability of the academic performance metrics generated by the app.

To enhance the user experience, the module uses clear and concise error messages or toast notifications to communicate issues with the data. These messages are designed to be easily understandable and actionable, avoiding technical jargon and instead offering simple instructions for correction. Visual cues, such as red outlines or icons, are used to highlight the problematic fields, ensuring users can quickly locate and address the errors. This approach not only enhances the usability of the app but also minimizes frustration and confusion among users.

Moreover, the Error Handling and Validation Module operates in real time, providing instant feedback as users input their data. This dynamic validation process ensures that users are alerted to potential issues before submitting their information, reducing the likelihood of errors and streamlining the overall process. The ability to catch errors early enhances the app's efficiency, allowing users to focus on entering correct data rather than spending time troubleshooting or recalculating results.

The module also promotes flexibility by supporting customizable validation rules, making it adaptable to various grading systems or institutional requirements. Whether an educational institution uses a different grading scale or specific requirements for the number of credits, the module can be easily tailored to accommodate these variations. This adaptability ensures that the app remains useful across different academic settings.

In conclusion, the Error Handling and Validation Module is a critical component that ensures the integrity, accuracy, and user-friendliness of the app. By preventing invalid or incomplete data from being processed, it guarantees that both SGPA and CGPA calculations are based on reliable information. Through real-time validation, clear error notifications, and logical constraints, the module provides a seamless and trustworthy experience for users, fostering confidence in the app's results and functionality.

4.1.7. USER INTERFACE MODULE

The User Interface (UI) Module is an essential component of the app that ensures a seamless and interactive experience for the user. It is responsible for dynamically generating and organizing all visual elements, such as text fields, buttons, labels, and input areas. These components are designed to be responsive to user input, providing real-time updates as the user interacts with the system. For instance, when a user specifies the number of semesters or subjects, the UI module adjusts the layout to show the corresponding fields, making the interface adaptable and intuitive.

One of the key aspects of the UI module is its ability to structure the layout in a user-friendly manner. It ensures that components are logically grouped, which helps users easily navigate through the app. For example, semester details, subject entries, and action buttons for calculating SGPA or CGPA are organized in a clear sequence, reducing confusion. This logical arrangement contributes significantly to a smooth and efficient interaction, making it easy for users to input data and understand the process.

The UI module also focuses on responsiveness, ensuring that the application adapts well to different screen sizes and devices. Whether the user is interacting with the app on a desktop, tablet, or smartphone, the layout remains functional and visually appealing. This is achieved through responsive design techniques, such as using grid systems and flexible containers that adjust based on the device's screen resolution and orientation. This ensures that the user's experience remains consistent, regardless of the device being used.

In addition to layout organization and responsiveness, the UI module integrates interactive elements to enhance user engagement. Buttons are prominently placed for actions like calculating SGPA, calculating CGPA, resetting fields, and displaying results. These buttons are designed to be large enough for easy interaction, ensuring that users can efficiently perform the required tasks. Furthermore, real-time updates are a core feature of the UI module. As users input their data, such as grade points or credit hours, the interface reflects these changes instantly, helping users track their inputs and calculations with minimal delay.

Another critical feature of the UI module is its integration with the Error Handling and Validation Module. The UI is designed to visually highlight any errors, such as invalid grade point entries or missing fields. For instance, input fields with incorrect data may be marked with a red border, and error messages will appear to guide the user to correct the issue. This integration ensures that only valid data is processed, maintaining the integrity of the calculations and preventing errors from affecting the final results.

The UI module also includes customization options, allowing users to personalize their interface experience. For example, users can toggle between light and dark mode or adjust font sizes for better readability. These features cater to a variety of user preferences, ensuring that the app is accessible and comfortable to use for a wider audience.

Furthermore, the UI module is built to be scalable, allowing for future additions or modifications without disrupting the current layout. As the app evolves and new features are added, the UI can accommodate these changes seamlessly, preserving its user-friendly design.

Overall, the UI module plays a pivotal role in making the app both functional and engaging. It not only facilitates the accurate entry of data but also enhances the user experience by providing a clean, responsive, and interactive interface. The design ensures that users can easily track their academic performance by viewing their SGPA and CGPA calculations in real-time, making it an indispensable part of the app's success.

4.1.8. RESULT DISPLAY MODULE

The Result Display Module is a crucial component in the CGPA and SGPA calculation app, as it ensures that the results are presented to the user in a clean, readable, and intuitive format. The module's primary responsibility is to display the calculated SGPA for each semester and the cumulative CGPA, ensuring these results are presented in a clear and organized manner. It achieves this by using formatting tools such as text formatting (bold, large fonts) to highlight key results, making it easier for users to interpret their academic performance. Additionally, the display can use tables to present semester-wise SGPA alongside credit hours, providing a comprehensive view of the user's academic journey.

Real-time updates are a key feature of this module, ensuring that any changes in user inputs or recalculations are immediately reflected in the displayed results. For instance, if the user adjusts a grade or credit value, the app recalculates and updates the SGPA and CGPA instantly, giving users immediate feedback on their academic status. This dynamic updating enhances the user experience by eliminating the need for manual refreshes and providing up-to-date information in real-time. It makes the app responsive and user-friendly, fostering an interactive environment where users can experiment with different scenarios and observe the effects on their academic performance.

Interactive elements are another critical aspect of the Result Display Module. Buttons for recalculating results or clearing the displayed data ensure that the user has full control over the input and output process. For example, users can recalibrate their data based on updated semester performance or reset the results to enter new data. These interactive features make the app highly customizable, offering flexibility for users to adjust and reanalyze their performance with ease. Moreover, the result display is designed to handle invalid or incomplete data, showing error messages or prompts when the necessary input is missing or incorrect. This prevents confusion by guiding users toward correct data entry.

In addition to basic result presentation, the module can also include visual elements such as graphs or charts that help users visualize their academic trends over time. This could include bar charts or line graphs that display SGPA across different semesters or highlight any upward or downward trends in the student's performance. These visual aids provide an intuitive way for users to track their academic progress and easily identify areas for improvement. For example, if a student's performance is declining in recent semesters, a simple chart can highlight this trend and encourage the user to focus on specific subjects.

The Result Display Module also includes essential accessibility features. This includes the ability to adjust font sizes, switch to high-contrast modes, and use screen readers for visually impaired users. These features ensure that all users, regardless of their abilities, can access and understand their results. This commitment to accessibility not only broadens the app's usability but also reflects an inclusive approach to design. By ensuring that all users can effectively interact with the app, the Result Display Module enhances the overall user experience, making it both comprehensive and accessible.

Finally, the module supports additional functionalities like result sharing. Users can export or share their results via email or social media, allowing for seamless communication with others, such as academic advisors, family, or friends. This option adds another layer of interactivity to the app, making it more versatile and useful for different purposes. For example, students might want to share their CGPA with a mentor or keep a record of their results over time for future reference. This sharing feature makes the Result Display Module not only a tool for calculation but also a part of a larger ecosystem for managing academic progress.

In conclusion, the Result Display Module plays a critical role in transforming raw academic data into useful, readable, and interactive feedback for the user. By ensuring that results are displayed in real-time, offering visual and interactive tools, and supporting features like result sharing, it contributes significantly to the overall user experience. This module not only helps users track their academic progress but also provides actionable insights that can guide decision-making, such as identifying areas that need improvement or celebrating achievements..

4.1.9. RESET/CLEAR MODULE

The Reset/Clear Module is a key feature designed to enhance user convenience and ensure flexibility in the application. It enables users to reset all data inputs and clear previously displayed results efficiently, creating a fresh interface for new calculations or corrections. This module ensures that all input fields, such as the number of semesters, subjects, grades, and credit hours, are cleared promptly, resetting the interface to its default state and ready for fresh data entry.

Displayed results, including SGPA, CGPA, or error messages, are removed entirely, leaving no residual data or distractions. To provide clarity and reassurance, the module offers integrated feedback, such as toast notifications or visual indicators, confirming that the reset action was successfully completed.

The module's design emphasizes accessibility and ease of use. It is prominently positioned within the app and employs intuitive visual cues, like contrasting colors, to differentiate the reset function from other features. To prevent accidental data loss, the module often incorporates a confirmation dialog, ensuring that the user is intentional about clearing the data.

Efficiency is a primary advantage of the module, allowing users to clear all data or specific sections swiftly, saving time and enabling multiple calculations without restarting the app. It also supports error correction by eliminating incorrect or incomplete data effortlessly, promoting accuracy in subsequent operations.

Advanced features, such as undoing a reset action or preserving the current state before clearing, further enhance the user experience. By working seamlessly with other components, such as error handling and result display modules, the reset/clear module ensures that the application remains responsive, reliable, and user-friendly, significantly contributing to the app’s overall functionality.

4.1.10. DATA STORAGE AND PROCESSING MODULE

The **Data Storage and Processing Module** is a foundational component of the application, responsible for efficiently managing, validating, and processing user data to ensure accurate academic calculations. This module handles the data lifecycle, from capturing inputs to storing them in appropriate data structures and performing precise mathematical operations for calculating the SGPA and CGPA. It ensures that user-provided data, such as grades, credit hours, and semester details, is stored and processed systematically for reliable results.

A key aspect of this module is its robust **data management system**, which organizes inputs using optimized data structures, such as arrays, hash maps, or relational databases. This organization facilitates quick access and retrieval, enabling seamless interaction between different modules of the app. It also includes mechanisms for storing data persistently, allowing users to save their academic records for future reference. For instance, data may be stored locally on the device or synchronized with cloud storage services for accessibility across multiple platforms.

In terms of **data processing**, the module ensures mathematical accuracy by using advanced algorithms and tools, such as the BigDecimal class in Java, to prevent rounding errors during calculations. The module processes data by computing weighted averages for SGPA and CGPA, ensuring the inclusion of all relevant grade points and credit hours. These computations are designed to reflect the user's true academic performance with high precision, even for large datasets or multiple semesters.

Data validation is another critical responsibility of this module. It ensures that only valid data is processed, minimizing errors. Validation checks include ensuring grades fall within an acceptable range (e.g., 0 to 10), credit hours are non-negative, and all required fields are completed. If invalid data is detected, the module works in conjunction with the Error Handling Module to provide appropriate feedback, prompting users to correct errors before proceeding.

Additionally, the module is designed to handle real-time updates, dynamically processing changes as users modify their inputs. This ensures that recalculated results are instantly displayed, providing a smooth and responsive user experience. The module also integrates seamlessly with the Result Display Module, formatting and presenting calculated results in a clear, readable manner.

To enhance security and scalability, the module employs encryption techniques to protect sensitive user data during storage and transfer. Its scalable design supports increasing amounts of academic data without compromising performance, making it suitable for users with extensive academic records.

In summary, the Data Storage and Processing Module plays an essential role in maintaining the accuracy, integrity, and reliability of the app's academic performance tracking features. By combining efficient data storage, precise mathematical processing, and rigorous validation, it ensures a seamless and trustworthy experience for users.

CHAPTER 5

SYSTEM SPECIFICATION

5.1 SOFTWARE REQUIREMENTS

The development and functioning of the app require the following software components:

Development Environment:

- **Android Studio:** Version Arctic Fox (2020.3.1) or higher.
- **JDK (Java Development Kit):** Version 8 or higher.
- **Programming Languages:** Java, XML.

Frameworks & Libraries:

- **Android SDK:** API Level 21 or higher (for Lollipop and above).
- **Gradle:** Latest version for building and managing dependencies.
- **Database:** For saving user progress, SQLite can be integrated.
- **Third-party Libraries:** Toast library for enhanced user notifications, Material Design Components for UI/UX enhancements.

Operating System for Development:

- **Minimum:** Windows 7, macOS Sierra, or Ubuntu 18.04.
- **Recommended:** Windows 10, macOS Big Sur, or a later version.

5.2 HARDWARE REQUIREMENTS

To run the CGPA Calculator App smoothly, the device must meet the following hardware specifications:

Processor:

- **Minimum:** Quad-core processor (1.5 GHz or higher).
- **Recommended:** Octa-core processor (2.0 GHz or higher) for faster performance.

RAM:

- **Minimum:** 2 GB.
- **Recommended:** 4 GB or higher for better multitasking and responsiveness.

Storage:

- **Minimum:** 50 MB of free storage space for the app installation. Additional space for user data, logs, or backups as needed.

Display:

- **Minimum:** 4.5-inch screen with 720p resolution.
- **Recommended:** 5.5-inch or larger screen with Full HD (1080p) resolution for better usability.

Operating System:

- **Minimum:** Android 5.0 (Lollipop).
- **Recommended:** Android 9.0 (Pie) or higher for optimal compatibility and features.

Battery:

- **Minimum:** 2000 mAh battery for handling multiple tasks without excessive drain.

5.2.1.ANDROID STUDIO

Android Studio is the official Integrated Development Environment (IDE) for Android app development.It provides tools for code editing, testing, and debugging in a user-friendly interface.

Key features include a visual layout editor, Gradle build system, and emulator support for testing apps on virtual devices.

Version Arctic Fox (2020.3.1) and later include enhanced tools for modern app development.

5.2.2.ANDROID SDK

The Android Software Development Kit (SDK) is a collection of tools and libraries necessary for developing Android applications.

It includes emulators, development tools, and APIs for accessing Android system features.

Developers use the SDK to build apps compatible with specific Android API levels, ensuring functionality across different versions of Android.

5.2.3.JDK (JAVA DEVELOPMENT KIT)

The JDK is a software development kit required for building Java-based applications.It includes tools like javac (compiler), java (runtime environment), and libraries necessary for writing and executing Java programs.

JDK 8 or higher is recommended for Android app development as it supports modern Java language features.

5.2.4.OPERATING SYSTEM (OS):

The development environment can run on various operating systems, including:

Windows

A widely used platform with tools like Android Studio and Gradle support.

macOS

Preferred for cross-platform developers as it supports Android and iOS development.

Linux

A lightweight and efficient OS for developers, offering robust command-line tools and high performance.

Recommended versions

Windows 10, macOS B

CHAPTER 6

METHODOLOGY

6.1. REQUIREMENT ANALYSIS

Objective

Define the problem statement, user requirements, and system specifications.

User Requirements

Students need an intuitive platform to calculate their SGPA and CGPA by entering grades and credits. They require features such as the ability to handle multiple semesters, subjects, and credits for accurate calculations.

System Specifications

The app should function on Android devices, with features for semester-wise and cumulative GPA calculation, data persistence, and error-free data entry.

Constraints

The app must be designed for a user-friendly experience, support dynamic inputs (semester count, subjects), and ensure data integrity.

6.2. SYSTEM DESIGN

Objective

Create an architecture that supports dynamic user inputs and calculation processes.

Frontend Design

The user interface (UI) is designed using XML layouts, with clear sections for entering semester and subject data.

Input Fields

Fields for entering the number of semesters, subjects per semester, grades, and credits.

Buttons

Buttons for generating semesters, calculating SGPA and CGPA, and clearing data.

Result Display

TextViews to display calculated SGPA and CGPA after user inputs.

Backend Design

Database Design

Use SQLite as the local storage database for storing semester, subject, grade point, and credit data.

Tables

Semesters (id, semester_name), subjects (id, semester_id, subject_name, grade_point, credit).

The app should be able to dynamically handle any number of semesters and subjects.

Data Flow

The app will allow users to input data for multiple semesters and subjects. Each semester's SGPA will be calculated based on the grades and credits for that semester, and the CGPA will be calculated cumulatively as the user progresses.

6.3. DEVELOPMENT PHASES

Objective

Implement core functionalities based on the defined system design.

Phase 1: Setup Basic Android Project

- Initialize a new Android project with the required dependencies in the build.gradle file.
- Create necessary Activity classes and XML layout files to define the app's structure.
- Implement the DatabaseHelper class to manage SQLite database interactions (inserting, updating, and querying data).

Phase 2: Implement Semester and Subject Generation

- Provide the option for users to input the number of semesters and subjects they wish to include in the calculation.
- Dynamically generate input fields for each semester, and subject-specific fields for grades and credits.
- Allow users to input the grades and credits for each subject.

Phase 3: SGPA Calculation Logic

- Implement the logic to calculate SGPA for each semester:
- Formula:

$$\text{SGPA} = \sum(\text{Grade Points} \times \text{Credits}) / \sum \text{Credits}$$

- Validate user input for correctness (e.g., valid grade points and credits).
- Provide an option for users to calculate SGPA after entering data for each semester.

Phase 4: CGPA Calculation Logic

- Implement the logic to calculate CGPA based on the SGPA values from multiple semesters:
- Formula:

  CGPA = ∑(Grad Point of each subject×Total credits in each subject)/∑(Total credits of all semesters)

- Display the calculated CGPA in a user-friendly format.

Phase 5: Error Handling

- Implement error handling for invalid inputs such as missing grades, incorrect credit values, or division by zero.
- Provide feedback to users via Toast messages or AlertDialog prompts.

6.4. TESTING

Objective

Ensure the app works as expected, with all functionalities implemented correctly and no errors.

Unit Testing

- Test individual components such as the DatabaseHelper methods, SGPA and CGPA calculation logic, and input validation.
- Verify database insertions and retrievals.

UI Testing

- Manually test the UI by inputting various valid and invalid data to check if the app responds appropriately.
- Test the dynamic generation of input fields for different numbers of semesters and subjects.

Integration Testing

- Ensure that the SGPA and CGPA calculations correctly reflect the data entered by the user.
- Ensure that the app handles dynamic inputs efficiently and accurately updates the displayed results.

6.5. DEPLOYMENT AND FEEDBACK

Objective

Deploy the initial version of the app and gather user feedback for further refinement.

Alpha Testing

Share the app with a small group of users (e.g., students, educators) to gather feedback on usability and functionality.

Bug Fixing and Updates

Based on feedback, fix any bugs, refine user interactions, and optimize performance.

6.6. USER DOCUMENTATION

Objective

Provide the users with clear instructions on how to use the app.

User Manual

Include a brief guide on how to enter semester details, subject grades, and credits, and how the SGPA and CGPA are calculated.

CHAPTER 7

CONCLUSION AND FUTURE ENHANCEMENT

7.1 CONCLUSION

The SGPA and CGPA Calculator Application is a user-friendly and efficient tool designed to simplify academic performance tracking for students across multiple semesters. By leveraging the robust features of Android Studio, Android SDK, and Java, this application provides an intuitive interface that allows students to input their grades and credit hours for each subject, calculate SGPA for individual semesters, and derive their overall CGPA with precision. The use of BigDecimal ensures high accuracy in computations, addressing the potential for rounding errors common in floating-point operations. The inclusion of a clear design layout, validation for inputs, and error handling enhances usability and ensures a seamless experience for the end-users.

The application caters to students who want a convenient way to manage their academic records without relying on manual calculations. Its ability to dynamically adjust to the number of semesters and subjects per semester provides versatility, accommodating various academic structures. Additionally, features like dynamic UI updates for SGPA display and comprehensive CGPA calculations make the application a valuable tool for students striving to maintain and understand their academic performance.

7.2 FUTURE ENHANCEMENT

While the application serves its current purpose effectively, there are several enhancements that can be introduced to make it more robust, feature-rich, and versatile. Below are some potential improvements for future versions:

Cloud-based database Integration

Store students' data in a cloud-based database to allow them to save and retrieve academic records.

This would enable users to track performance trends over time and access historical data for reference.

User Authentication

Introduce user login and authentication features to support multiple user accounts.This would allow the app to cater to a larger audience, such as university departments or coaching institutes.

Advanced Statistical Features

Add statistical analysis tools such as grade distribution graphs, semester-wise trends, and predictions for future performance based on historical data.

These insights can help students identify patterns and make informed decisions about their academic efforts.

Support for Grading Systems

Expand the app to support different grading systems (e.g., percentage, GPA scale of 4.0, letter grades) to cater to international academic standards.

Export and Sharing Options

Enable users to export their SGPA and CGPA reports in PDF or Excel formats for sharing or printing.

Integration with email and messaging apps for easy dissemination of results.

Cross-Platform Availability

Develop a web-based or iOS version of the application to cater to a broader user base.Ensure data synchronization across platforms using cloud-based solutions like Firebase or AWS.

Enhanced UI/UX Design

Incorporate modern UI/UX practices, such as themes, animations, and accessibility features, to make the app visually appealing and inclusive for users with disabilities.

Offline Mode

Add offline functionality, enabling students to perform calculations without an internet connection and sync their data when online.

Integration with Educational Platforms

Collaborate with universities and institutions to integrate the app with official academic systems, allowing direct import of grades and credits.

Gamification and Motivation Tools

Introduce gamified features like badges, rewards, or progress trackers to encourage students to engage actively with their academic goals.

By incorporating these enhancements, the SGPA and CGPA Calculator Application can evolve into a comprehensive academic management tool that not only assists students in their current performance tracking but also supports long-term academic planning and success. These future developments will ensure the app remains relevant, scalable, and beneficial to a diverse range of users in the ever-evolving educational landscape.

APPENDIX 1

SOURCE CODE

MainActivity.java

```
package com.example.designproject;

import android.os.Bundle;

import android.view.View;

import android.widget.Button;

import android.widget.EditText;

import android.widget.LinearLayout;

import android.widget.TextView;

import android.widget.Toast;

import androidx.appcompat.app.AppCompatActivity;

import java.math.BigDecimal;

import java.math.RoundingMode;

import java.util.ArrayList;

public class MainActivity extends AppCompatActivity {

private EditText etNumberOfSemesters;

    private Button btnCalculateCgpa, btnClear;

    private LinearLayout semesterContainer;

    private TextView tvResult;

    private final ArrayList<BigDecimal> cred = new ArrayList<>();
private final ArrayList<BigDecimal> gradd =new ArrayList<>();
private final ArrayList<LinearLayout> semesterLayouts = new ArrayList<>();
@Override
protected void onCreate(Bundle savedInstanceState) {
    super.onCreate(savedInstanceState);
    setContentView(R.layout.activity_main);
    etNumberOfSemesters = findViewById(R.id.et_number_of_semesters);
    Button btnGenerateSemesters = findViewById(R.id.btn_generate_semesters);
    btnCalculateCgpa = findViewById(R.id.btn_calculate_cgpa);
    btnClear = findViewById(R.id.btn_clear);
    semesterContainer = findViewById(R.id.semester_container);
    tvResult = findViewById(R.id.tv_result);
    btnGenerateSemesters.setOnClickListener(view -> generateSemesters());
    btnClear.setOnClickListener(view -> {
        gradd.clear();
        cred.clear();
        semesterLayouts.clear();
        semesterContainer.removeAllViews();
        btnClear.setVisibility(View.INVISIBLE);
        btnCalculateCgpa.setVisibility(View.INVISIBLE);
        tvResult.setText("");
    });
    btnCalculateCgpa.setOnClickListener(view ->{
            try {
                calculateCgpa();
            }catch(Exception e){
                android.widget.Toast.makeText(this, e.getMessage(),
Toast.LENGTH_SHORT).show();
            }
        });
    }
    private void generateSemesters() {
        gradd.clear();
        cred.clear();
        String numSemestersStr = etNumberOfSemesters.getText().toString().trim();
        if (numSemestersStr.isEmpty()) {
            Toast.makeText(this, "Please enter the number of semesters",
Toast.LENGTH_SHORT).show();
            return;
        }
        int numSemesters = Integer.parseInt(numSemestersStr);
        semesterContainer.removeAllViews();
        semesterLayouts.clear();
        for (int i = 0; i < numSemesters; i++) {
            LinearLayout semesterLayout = new LinearLayout(this);
            semesterLayout.setOrientation(LinearLayout.VERTICAL);
            semesterLayout.setPadding(0, 16, 0, 16);
            TextView semesterTitle = new TextView(this);
            semesterTitle.setText("Semester " + (i + 1));
            semesterTitle.setTextSize(18);
            semesterLayout.addView(semesterTitle);
            EditText etNumberOfSubjects = new EditText(this);
            etNumberOfSubjects.setHint("Enter number of subjects");
          etNumberOfSubjects.setInputType(android.text.InputType.TYPE_CLASS_NUMBER);
            semesterLayout.addView(etNumberOfSubjects);
            Button btnGenerateSubjects = new Button(this);
            btnGenerateSubjects.setText("Generate Subjects");
            semesterLayout.addView(btnGenerateSubjects);
            LinearLayout subjectContainer = new LinearLayout(this);
            subjectContainer.setOrientation(LinearLayout.VERTICAL);
            semesterLayout.addView(subjectContainer);
            int finalI = i;
            btnGenerateSubjects.setOnClickListener(view ->
    generateSubjects(etNumberOfSubjects, subjectContainer, finalI));
            semesterContainer.addView(semesterLayout);
            semesterLayouts.add(semesterLayout);
        }
        btnCalculateCgpa.setVisibility(View.VISIBLE);
        btnClear.setVisibility(View.VISIBLE);}
```

```
 private void generateSubjects(EditText etNumberOfSubjects, LinearLayout
subjectContainer, int semesterIndex) {
        String numSubjectsStr = etNumberOfSubjects.getText().toString().trim();
        if (numSubjectsStr.isEmpty()) {
            Toast.makeText(this, "Enter the number of subjects",
Toast.LENGTH_SHORT).show();
            return;
        }
        int numSubjects = Integer.parseInt(numSubjectsStr);
        subjectContainer.removeAllViews();
        for (int j = 0; j < numSubjects; j++) {
            LinearLayout subjectRow = new LinearLayout(this);
            subjectRow.setOrientation(LinearLayout.HORIZONTAL);
            EditText etGradePoint = new EditText(this);
            etGradePoint.setHint("Grade Point " + (j + 1));
            etGradePoint.setInputType(android.text.InputType.TYPE_CLASS_NUMBER);
            subjectRow.addView(etGradePoint);
            EditText etCredit = new EditText(this);
            etCredit.setHint("Credit " + (j + 1));
            subjectRow.addView(etCredit);
            subjectContainer.addView(subjectRow);
        }
```

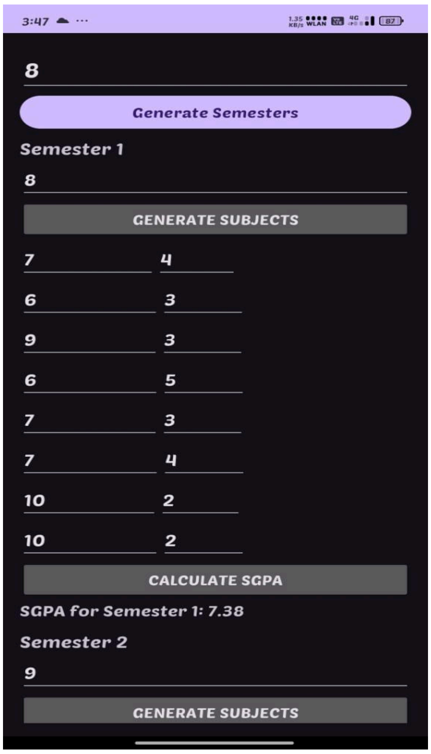
```
    Button btnCalculateSgpa = new Button(this);
    btnCalculateSgpa.setText("Calculate SGPA");
    subjectContainer.addView(btnCalculateSgpa);
    btnCalculateSgpa.setOnClickListener(view -> {
        try {
            calculateSgpa(subjectContainer, semesterIndex);
        } catch (Exception e) {}
    });
}
private void calculateSgpa(LinearLayout subjectContainer, int semesterIndex) {
    BigDecimal sum = BigDecimal.ZERO;
    BigDecimal totalCredits = BigDecimal.ZERO;
    for (int i = 0; i < subjectContainer.getChildCount() - 1; i++) {
        LinearLayout subjectRow = (LinearLayout) subjectContainer.getChildAt(i);
        EditText etGradePoint = (EditText) subjectRow.getChildAt(0);
        EditText etCredit = (EditText) subjectRow.getChildAt(1);
        String gradePointStr = etGradePoint.getText().toString().trim();
        String creditStr = etCredit.getText().toString().trim();
        if (!gradePointStr.isEmpty() && !creditStr.isEmpty()) {
            try {
                BigDecimal gradePoint = new BigDecimal(gradePointStr);
                BigDecimal credit = new BigDecimal(creditStr);
                if (gradePoint.compareTo(BigDecimal.valueOf(5)) >= 0 && gradePoint.compareTo(BigDecimal.valueOf(10)) <= 0) {
                    cred.add(credit);
                    BigDecimal tc = gradePoint.multiply(credit);
                    sum = sum.add(tc);
                    gradd.add(tc);
                    totalCredits = totalCredits.add(credit);
                }
            } catch (NumberFormatException e) {
                Toast.makeText(this, "Invalid input. Please enter valid numbers.", Toast.LENGTH_SHORT).show();
                return;
            }
        }
    }
    if (totalCredits.compareTo(BigDecimal.ZERO) == 0) {
        Toast.makeText(this, "Total credits cannot be zero", Toast.LENGTH_SHORT).show();
        return;
    }
    // Calculate SGPA using BigDecimal division
    BigDecimal sgpa = sum.divide(totalCredits, 2, RoundingMode.HALF_UP);
    // Add SGPA to the list
```

```
      // Display SGPA dynamically on the screen
        TextView sgpaTextView = new TextView(this);
        sgpaTextView.setText("SGPA for Semester " + (semesterIndex + 1) + ": " +
sgpa.toPlainString());
        sgpaTextView.setTextSize(16);
        // Add the SGPA TextView to the semester's container
        subjectContainer.addView(sgpaTextView);
    }
    private void calculateCgpa() {
        BigDecimal grade = BigDecimal.ZERO;
        BigDecimal tcredits = BigDecimal.ZERO;
        // Sum up grades and credits
        for (int i = 0; i < gradd.size(); i++) {
            BigDecimal gradePoint = gradd.get(i);
            BigDecimal credit = cred.get(i);
            // Check if the grade point is in the valid range (5 to 10)
            if (gradePoint.compareTo(BigDecimal.ZERO) > 0 ) {
                grade = grade.add(gradePoint);
                tcredits = tcredits.add(credit);
            }
        }
        // Check for zero credits to prevent division by zero
        if (tcredits.compareTo(BigDecimal.ZERO) == 0) {
```

```
      Toast.makeText(this, "Total credits cannot be zero",
Toast.LENGTH_SHORT).show();
      return;
    }
    Toast.makeText(this, tcredits.toString(), Toast.LENGTH_SHORT).show();
    Toast.makeText(this, grade.toString(), Toast.LENGTH_SHORT).show();
    // Divide grade by total credits with rounding
    BigDecimal cgpa = grade.divide(tcredits, 2, RoundingMode.HALF_UP);
    // Display the CGPA
    tvResult.setText("CGPA: " + cgpa.toPlainString());
  }
}
```

APPENDIX 2

SCREENSHOTS



8

Semester 1

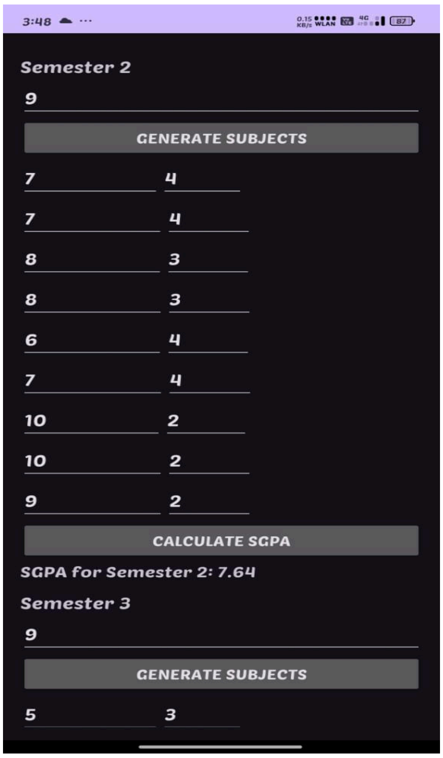
8

7 4
6 3
9 3
6 5
7 3
7 4
10 2
10 2

SGPA for Semester 1: 7.38

Semester 2

9



Semester 2

9

7 4
7 4
8 3
8 3
6 4
7 4
10 2
10 2
9 2

SGPA for Semester 2: 7.64

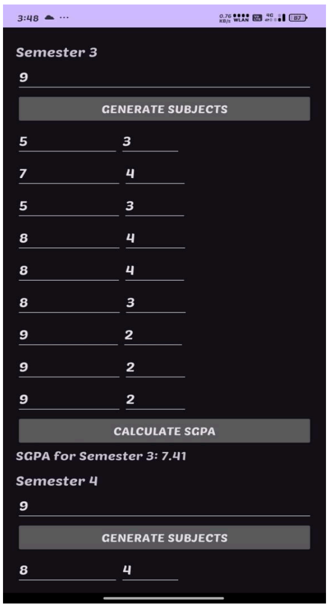
Semester 3

9

5 3

2.1.1 1st semester calculation

2.1.2 2nd semester calculation



Semester 3

9

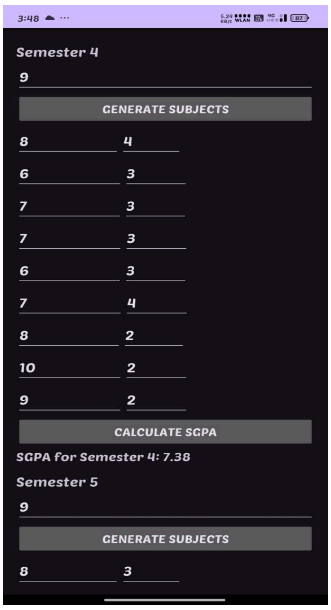
5 3
7 4
5 3
8 4
8 4
8 3
9 2
9 2
9 2

SGPA for Semester 3: 7.41

Semester 4

9

8 4



Semester 4

9

8 4
6 3
7 3
7 3
6 3
7 4
8 2
10 2
9 2

SGPA for Semester 4: 7.38

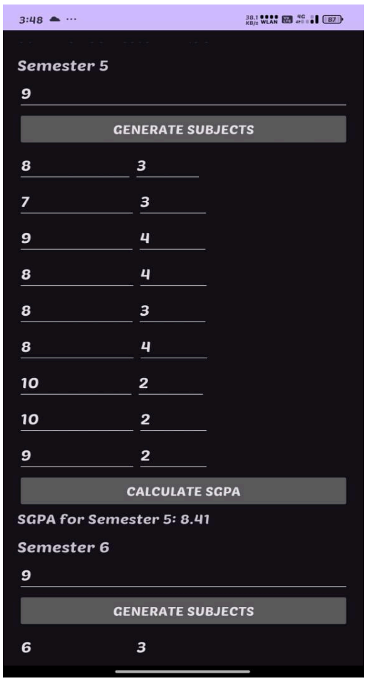
Semester 5

9

8 3

2.1.3 3rd semester calculation

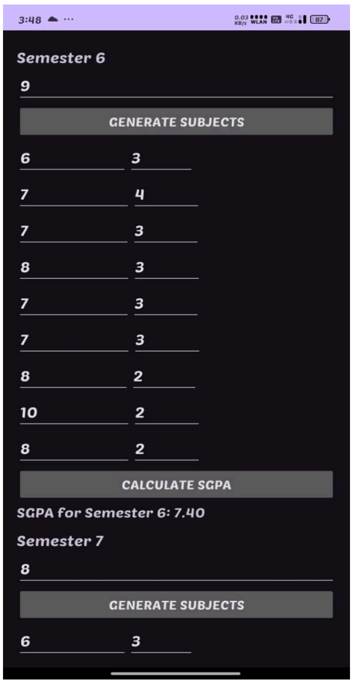
2.1.4 4th semester calculation



```
3:48

Semester 5
9
GENERATE SUBJECTS
8    3
7    3
9    4
8    4
8    3
8    4
10   2
10   2
9    2
CALCULATE SGPA
SGPA for Semester 5: 8.41
Semester 6
9
GENERATE SUBJECTS
6    3
```

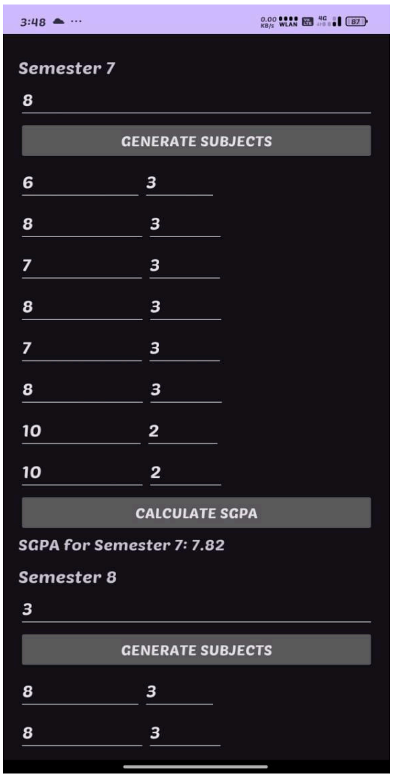
2.1.5 5th semester calculation



```
3:48

Semester 6
9
GENERATE SUBJECTS
6    3
7    4
7    3
8    3
7    3
7    3
8    2
10   2
8    2
CALCULATE SGPA
SGPA for Semester 6: 7.40
Semester 7
8
GENERATE SUBJECTS
6    3
```

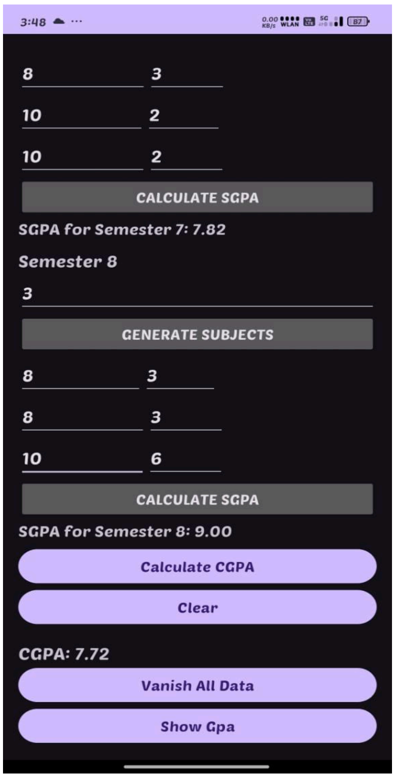
2.1.6 6th semester calculation



```
3:48

Semester 7
8
GENERATE SUBJECTS
6    3
8    3
7    3
8    3
7    3
8    3
10   2
10   2
CALCULATE SGPA
SGPA for Semester 7: 7.82
Semester 8
3
GENERATE SUBJECTS
8    3
8    3
```

2.1.7 7th SEMESTER CALCULATION



```
3:48

8    3
10   2
10   2
CALCULATE SGPA
SGPA for Semester 7: 7.82
Semester 8
3
GENERATE SUBJECTS
8    3
8    3
10   6
CALCULATE SGPA
SGPA for Semester 8: 9.00
Calculate CGPA
Clear
CGPA: 7.72
Vanish All Data
Show Gpa
```

2.1.8 8th SEMESTER AND CGPA

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