

Pathshala: Student Information Management using Cutting-Edge Technology

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Abstract

An Education Information Management System is developed using the Flutter framework integrated with Firebase for data storage and authentication. The system addresses the challenges faced by educational institutions in managing student information, attendance, grades, and communication with parents. Traditional methods of managing school-related tasks are often cumbersome, time-consuming, and error-prone. Thus, there is a need for an efficient and user-friendly solution that can streamline these processes and enhance productivity. The development of the school management system utilizes the Flutter framework, a cross-platform development tool, to create a mobile application as well as web application. Firebase, a comprehensive cloud-based platform, was integrated to handle data storage, authentication, and communication. The system focused on meeting the needs of school administrators, teachers, students, and parents. Key features included student enrollment, attendance tracking, grade management, and notice announcement functionalities. The implementation of this system resulted in significant benefits, such as easier student registration, efficient attendance tracking, streamlined grade management, improved communication, and enhanced engagement among administrators, teachers, students, and parents.

Keywords: Flutter, Cross-platform, Firebase, authentication

1. Introduction

The speed of technology is transforming the way of living, working and learning. The need for adaptation in every sector, the development of technology, and digitization have become necessary. In this modern era, where automation is in almost every sector of development, the education sector, which is the most important part of any country, has been unable to cope with the pace of development. The educational sector is still far behind in adapting to digitalization in every aspect of its business. The effect or loss of lack of digitalization in the educational sector, or in educational institutions, has been exposed during the pandemic. The whole educational system collapsed during that time, and it pushed our educational calendar 6 to 7 months back, which directly affects each and every sector of the country's development. The process of digitalization has already started, but still, the use of paper results in less productivity. The use of paper leads to less productivity, unnecessary time-consuming work, less efficiency, difficulty managing, and lots of other negative aspects that finally drag us backward from the path of optimality. A proper analysis is also required to achieve optimality in every sector. For the development of students and also for the development of educational institutions, proper analysis of data is required. Tracking the performance of students is hard and inefficient without digitization, and the same is true for the whole education institution. All these problems need to be solved by developing and utilizing the digital environment in the educational sector to achieve the results everyone needs. The full digitalization of the country can only be achieved by introducing a proper school management system in every institution.[1]

1.1 Motivation

In today's fast-paced world, schools are facing increasing pressure to manage their operations efficiently and effectively. With the growing number of students, teachers, and administrative staff, it has become increasingly challenging to keep track of student records, attendance, grades, and other important information. A school management system provides a centralized platform for managing these tasks, streamlining operations, reducing administrative workload, and improving communication between teachers, parents, and students. By investing in a school management system, schools can make data-driven decisions, improve student outcomes, and enhance the overall learning experience. It is a powerful tool that can help schools stay competitive in today's digital age and provide a better education for their students.

1.2 Problem Statement

Inefficient and outdated Education Information management systems pose significant challenges to effectively managing educational institutions. Manual and paper-based processes consume valuable time and resources, leading to inefficiencies and errors in tasks such as student enrollment, attendance tracking, grade management, and communication between stakeholders. The lack of integration with modern information and communication technology (ICT) tools further exacerbates these issues, hindering the delivery of quality education. As a result, there is an urgent need to develop and implement a comprehensive Education Information management system that integrates ICT solutions, streamlines administrative processes, and enhances communication and collaboration among teachers, administrators, students, and parents. This research aims to address these challenges by designing and implementing an efficient and user-friendly education information management system that improves administrative efficiency, enhances data management, and promotes effective communication and engagement within educational institutions.

1.3 Objectives

1. To develop the software for the management of all educational institutions (school, colleges and universities).
2. To apply most feasible and optimized form of record keeping system in educational institutions.

1.4 Scope of Project

The scope of the education information management System includes the development, implementation, and deployment of a comprehensive software solution to support the administrative and academic processes of the school.

1.5 System Requirement

System Requirements are essential for the system to work efficiently.

1.5.1 Software Requirement

Software Requirements of the projects are as follows:

1. Operating System: Windows 7 SP1 or higher, Linux, or Mobile Phones

2. Browser: Any web browser like chrome, Microsoft edge , opera mini etc.
3. Flutter SDK, IDE, VS Code, Android Studio, Firebase SDK

1.5.2 Hardware Requirement

Hardware Requirements of the projects are: -

1. Processor: Multicore processor with a clock speed at least 2.3 GHz
2. Memory: Minimum of 8GB of RAM
3. Internet Access
4. Android/iOS Device
5. Storage
6. Graphic Card: Used to improve the performance of the Android Emulator but not a strict requirement
7. USB Cable: Connect your Android device to your computer

2. Related Work

Visscher and at all, gathered a number of studies from many nations that look at the current state of computerized school information systems, the implementation of these systems in various schools, the results of these installations, and the implications of these installations for future directions in study. This publication provides possibly the most comprehensive look at ICT and school administration from a MIS perspective. However, it is evident from this research that the majority of attention is now paid to data collection and entry rather than data transfer or analysis (and this is especially true at the instructor level). [2].

Every responsible stakeholder's success at a given institution is significantly impacted by the usage of technology to update academic facilities. In order to create and implement effective information systems for any academic institution, it is crucial to start with the actual demands of the administration, faculty, and students. [3].

When Durnali (2013) compared the data collection, processing, storage, accuracy, analysis, and dissemination of student data before and after an e-class management system was implemented in their academic institutions, it was evident from the study that there had been

advancements in these areas. When technology is used to administer and create classes, it affects how society reflects socioeconomic, cultural, and technological change. [4,5].

The effectiveness of the class management strategy was demonstrated through research on creative information management in Taiwan. Innovative information management boosts the notion of classes and academic institutions being defined, inspires students more, and improves their learning. [6].

According to a study conducted in Turkey, teachers and the principal think the e-class management system is sufficient for managing administrative matters, student affairs, and the time required for students to complete report cards. Academic institutions that require the application to support learning, teaching, and administration quality and effectiveness might leverage a created web-based information system for class management. A current class management and information system is always required. [7,8].

It is essential to maintain academic records and manage them appropriately since they are a crucial part of the institution's leverage in maintaining order and ensuring quality processing and record-keeping. Additionally, this will aid institution administrators in their decision-making and improve the use of usable records in educational institutions, which will result in cost savings, transparency, simple accessibility, accountability, and the capacity to retrieve necessary data from storage. Open standards, interoperability, transition, accessibility, cost effectiveness, statutory-based innovations, and usability are the critical components that must be present in an e-class information and management system. [9,10].

Digital Nepal, initiated in 2014, started as a campaign and has evolved into a transformative movement in the education sector of Nepal. It was triggered by the inefficiencies of the traditional school management system, which consumed significant time and human resources. Recognizing the need to bridge the gap between traditional and digital systems and ensure quality education, Digital Nepal aimed to integrate information and communication technology (ICT) into the education sector. Within a short period, they successfully digitalized over 700 schools and colleges across the country, establishing credibility and trust among educational institutions. With their head office in Kathmandu and branches in Janakpur and Itahari, Digital Nepal's influence can be seen throughout the nation. Concurrently, Ingrails, founded in 2014, focused on delivering high-quality digital products and customer service [11].

Veda was introduced to address the inefficiencies and lack of technology adoption in schools. Starting with St. Xavier's School in 2016, Veda expanded outside Kathmandu and reached 100 schools by 2018. By 2020, Veda had become the most downloaded educational app in Nepal and continued to grow, reaching 500 schools in multiple cities. Currently, Veda is incorporating AI-based learning and has plans to expand internationally, targeting over 1200 schools. In 2022, Veda successfully implemented its school management software in its first international location, Brunei. These initiatives highlight the growing importance of digitalization and technology integration in the education sector, empowering schools and improving the quality of education in Nepal and beyond [12].

The school, like any other organisation, has procedures and processes for admissions, data processing, and the creation of reports that are comparable to those of a business or industry. A centralized system for storing, processing, and retrieving data and information enables such procedures. All schools in the country are implementing computer-based systems to streamline student and school-related transactions. The lack of a computer system and the institution's reliance on paper-based procedures led to the development of the School Management Information System for a community college in northern Mindanao. [13].

3. Proposed Work

3.1 System Development Life Cycle

The Agile model for a school management system involves defining the vision of the study and goals, creating a product backlog, and planning short development iterations known as sprints. During each sprint, the development team implements selected items from the backlog, collaborates with stakeholders for feedback, and conducts daily stand-up meetings to address challenges. Continuous integration and testing ensure system stability, while quick reviews and retrospective meetings gather feedback and improve processes. The iterative development approach allows for ongoing refinement and expansion of the system based on changing requirements. During each iteration, it goes through different steps, such as plan, design, develop, test, deploy, and review. Finally, the system was launched.

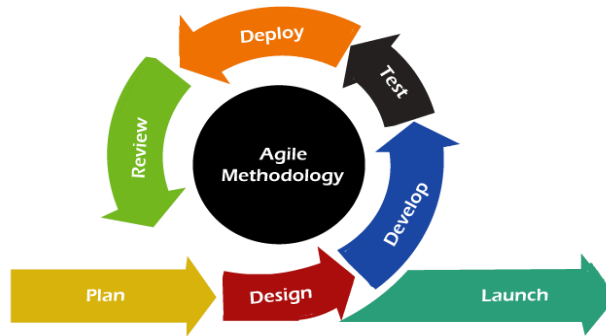


Figure 1. Agile Development Model [14]

3.2 Flowchart

The flowchart explains how the research works in real time and can also be defined as a graphical representation of a problem. When the system browses a website, it enters a new interface, then finds out if it is a new user or not. If you are a new or existing user who has forgotten their password, please contact the administrator; otherwise, proceed to the login page. On the login page, validated users can enter into the new interface, or else go to the login page by showing a notification error. After validation, it is mandatory to know if the validated user is an admin, student, parent, or teacher. After identification of the user, each user has its own panel and permissions. The user uses its features to accomplish the work.

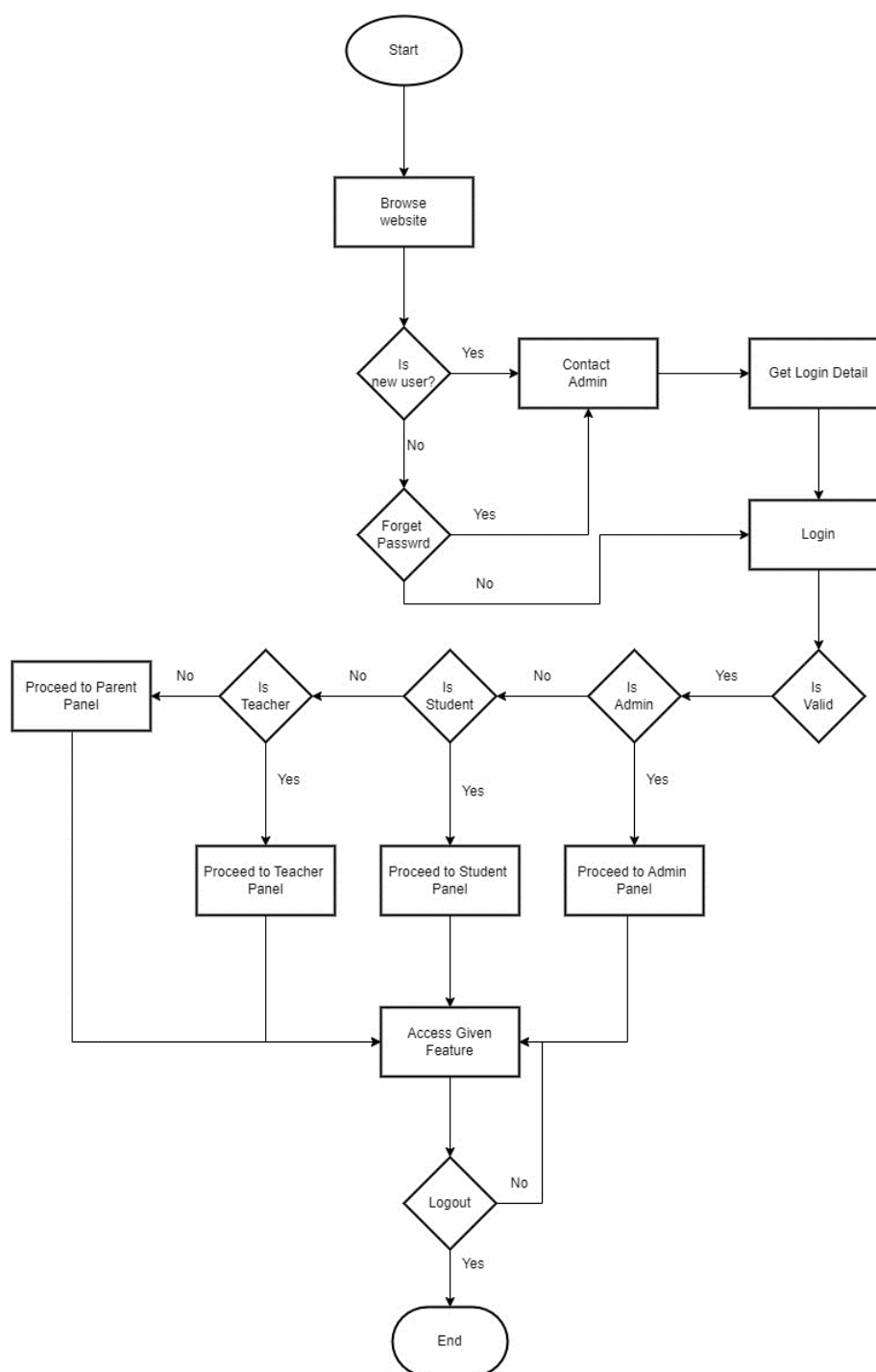


Figure 2. Flowchart

3.3 Technology Overview

3.3.1 Frontend

Flutter: Google developed the open-source Flutter framework for building mobile applications. Using a single codebase, it enables developers to create robust, cross-platform mobile applications for iOS and Android. Flutter makes use of the simple-to-learn Dart

programming language, which has features like hot reload that let developers observe changes as they happen.

3.3.2 Backend

1.Firebase: Firebase is a mobile and web application development platform that provides a range of services, including authentication, real-time databases, cloud storage, and hosting. Firebase offers a scalable and secure backend infrastructure for mobile and web applications, allowing developers to focus on building the frontend of their applications.

2.Firebase Authentication: Firebase Authentication provides a simple way to add user authentication to mobile and web applications. It supports a range of authentication methods, including email and password, Google Sign-In, Facebook Login, and more.

3.Firebase Cloud Firestore: Firebase Cloud Firestore is a real-time NoSQL database that allows developers to store and sync data in real-time. It provides a flexible data model and supports offline data access, making it easy to build real-time applications, such as chat applications or collaborative tools.

4.Firebase Cloud Functions: Firebase Cloud Functions allows developers to run serverless functions in response to events triggered by Firebase services or HTTP requests. This allows developers to add custom logic into their applications without the need to manage servers or infrastructure.

5.Firebase Cloud Storage: Firebase Cloud Storage provides a simple way to store and serve user-generated content, such as images, videos, and audio files. It supports secure uploads and downloads and integrates with other Firebase services such as Firebase Authentication and Firebase Cloud Functions.

Overall, usage of Flutter and Firebase together provides a powerful and efficient platform for mobile application development, allowing developers to build high-performance, scalable, and secure mobile applications with ease. By leveraging the frontend capabilities of Flutter and the backend infrastructure of Firebase, developers can focus on building great user experiences without having to worry about managing servers or infrastructure.

3.4 Working

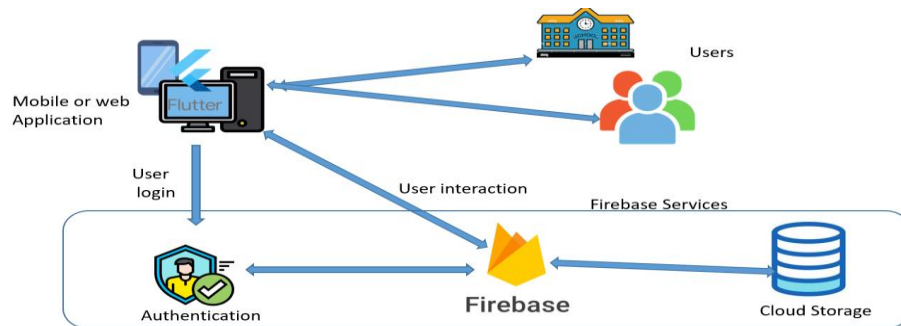


Figure 3. Working Procedure

The flutter used as the frontend technology, which holds the design of the app. A Flutter app is an open-source mobile application as well as a web application. The mobile app is already given, and for the web version, the following link is used: pathshala-684b7.firebaseio.com

In backend Firebase is used, and it helps in many applications such as Firestore databases based on NoSql, authentication, and cloud storage. Cloud Firestore stores every piece of information about the system that is not available to the end user, but can be viewed by the owner or the programmer. The demo of Cloud Firestore is shown below:

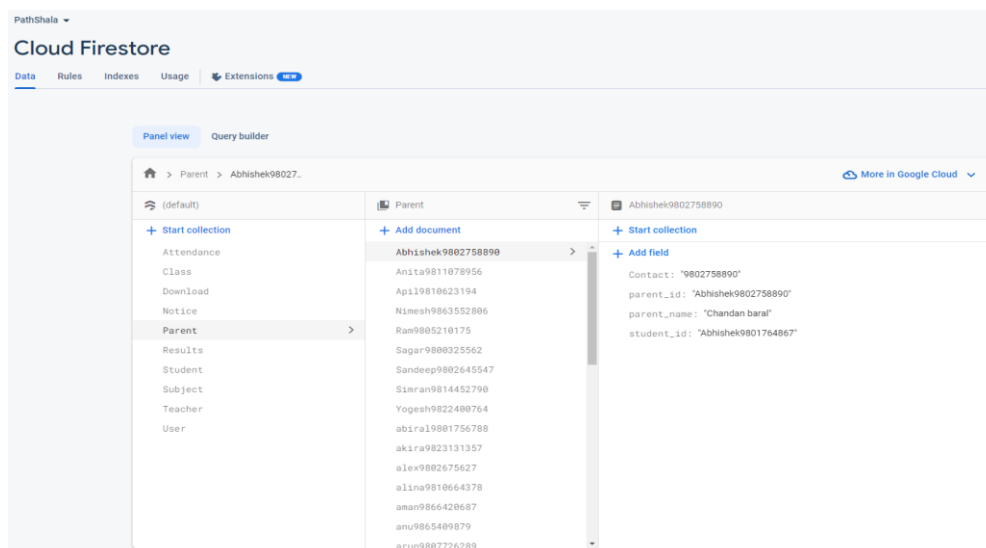


Figure 4. Demo of Cloud Fire Store

Firebase also allows different users for different purposes according to their permission, which is given by an owner or administrator. A mobile app and web app are then applied for blackbox testing, different test cases are applied (for more detail, see next 3.5), and then the app is ready to deploy. For more detail about the frontend, use a mobile app or a web app.

3.5 Test Cases

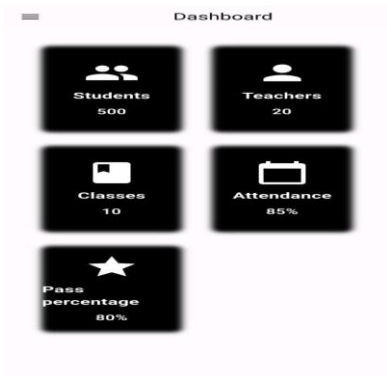
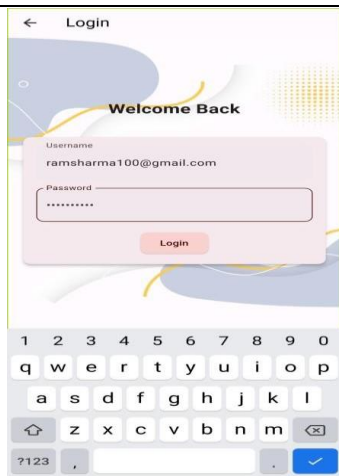
The testing performed for this project is Blackbox testing. The test cases performed are given below:

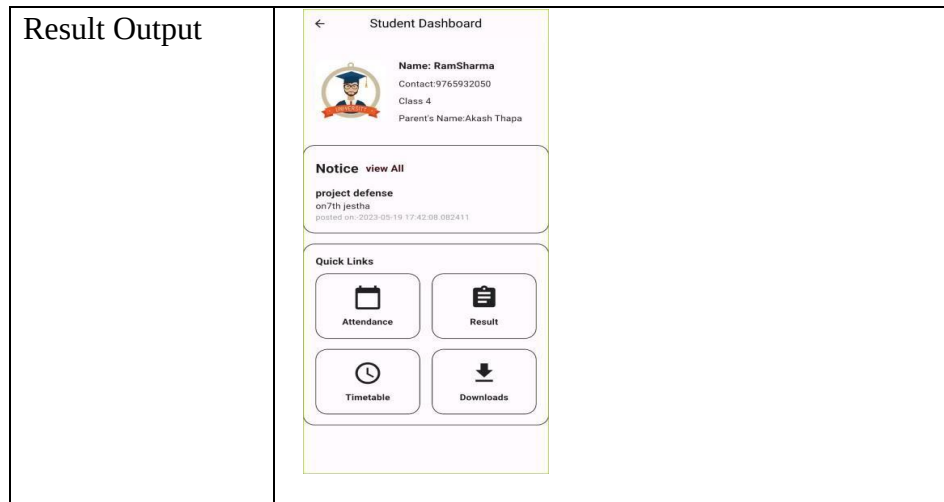
Table 1. Test Cases List

Test Case ID	Test Objectives
T1	To check the admin login
T2	To check the student registration
T3	To check the teacher registration
T4	To check the Teacher login
T5	To check notice announcement or post
T6	To check the student login
T7	To check the resource update

Table 2. Test Cases Analysis and Result

Test Objectives	To check the admin login
Test Data	

Expected Result	After the valid credentials are filled and tapped on login button, the user must be navigated to landing page.
Actual Result	After the valid credentials are filled and tapped on login button, the user must be navigated to landing page. 
Test Objective	To check the student login
Test Data	
Expected Output	After the valid credentials are filled and tapped on login button, the user must be navigated to landing page.
Actual Output	After the valid credentials are filled and tapped on login button, the user must be navigated to landing page.



4. Results and Discussion

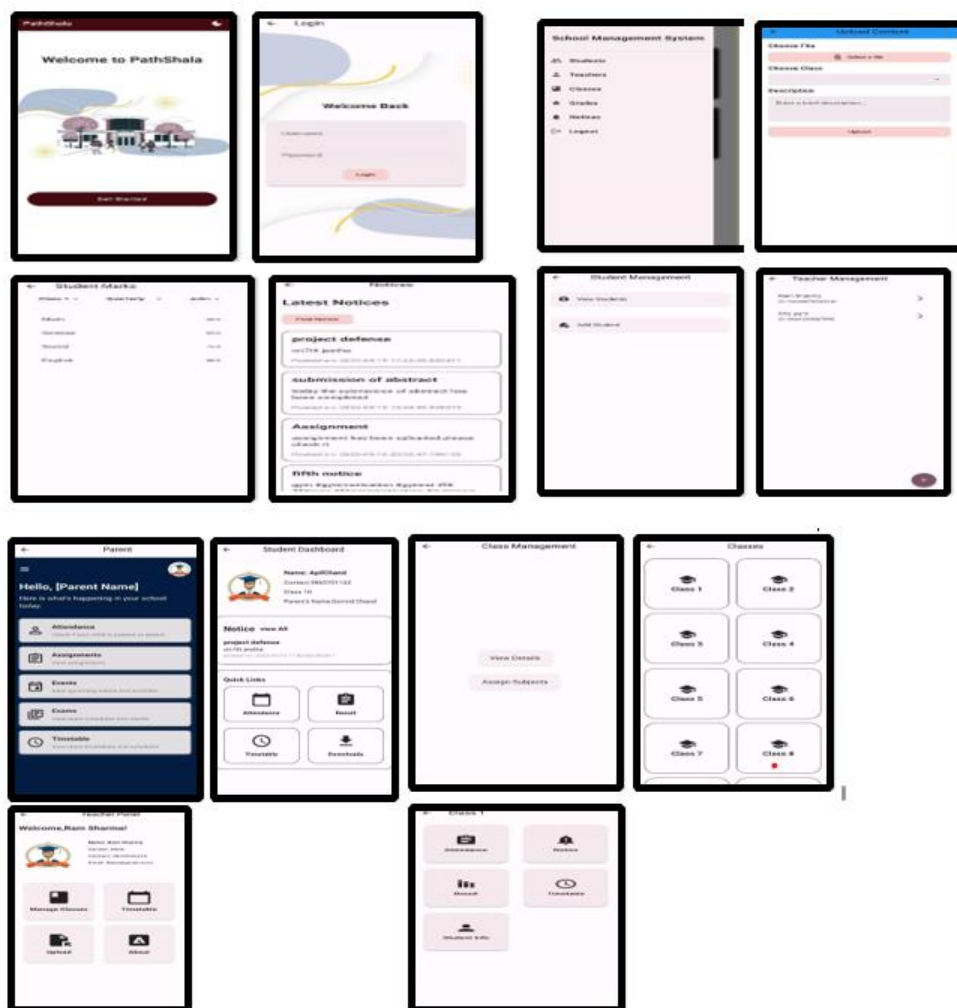


Figure 5. Snaps of an App

The implementation of the Education Information management system yielded positive results and significant improvements in Education Information management processes. The system, which incorporated features such as student enrollment, attendance tracking, grade management, and communication channels, were successfully implemented with modifications tailored to meet the specific needs of educational institutions. It resulted in notable time savings on administrative tasks and increased efficiency. Qualitative feedback from teachers, administrators, and students emphasized the system's effectiveness in enhancing education information management and communication. Despite encountering challenges during implementation, such as technical issues and user adoption, the overall impact of the digital system surpassed traditional methods in terms of time, resource utilization, and accuracy. The discussion highlighted the significance of the system's role in improving administrative efficiency, data management, and user satisfaction. Additionally, limitations concerning technical requirements, user training, and scalability were addressed. Overall, the successful implementation of the education information management system demonstrated its positive influence on education institutions, validating its effectiveness in transforming education information management processes and facilitating better communication among stakeholders.

The following link will take to the respective application developed

<https://drive.google.com/file/d/1wONBKCbFh36RzhLayZvKuv4rHLcBLX23/view?usp=sharing>

5. Conclusion

In conclusion, the development of the education information management system has been transformative research for any institution. Through careful planning, collaboration, and implementation., A robust system that addresses the complex needs of any school has been successfully created. The research has resulted in significant improvements in various areas of school management. With the system in place, streamlined administrative processes, reduced paperwork, and increased efficiency can be witnessed. Tasks such as student enrollment, attendance tracking, timetable scheduling, and resource management have become automated, saving valuable time and resources. Moreover, the Education Information management system has greatly enhanced communication and collaboration among stakeholders. Teachers, students, parents, and administrators can now easily access and share information through online portals and communication channels. This has fostered better engagement and involvement from all parties, leading to improved parent-teacher relationships and student

support. Furthermore, the system's data-driven features have provided us with valuable insights for informed decision-making. Real-time data on student performance, attendance trends, and resource utilization has allowed us to identify areas for improvement and implement targeted interventions. This will positively impact student outcomes and overall school performance. Overall, the development of the education information management system has been a resounding success. It has revolutionized the school's operations, promoting efficiency, transparency, and collaboration. This system will surely continue to evolve and adapt to meet the changing needs of the school community, ensuring a more effective and student-centered learning environment.

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