An automated system to maintain the departmental activities over cloud: An android application approach

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An automated system to maintain the departmental activities over cloud: An android application approach

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Abstract

Educational institutions nowadays follow different administrative approaches to fulfil different departmental administrative tasks. A department of an educational institution has a lot of things to do and manage for the students and teachers. The department has to post notices on the bulletin board, keep information about students, record attendance in class, manage students' attendance rate and results, and so on. Most educational institutions in many countries rely on paper-based administration, which requires a lot of staff and man-hours. Therefore, we have proposed an Android application for department management

that has two panels, namely an admin panel and a user panel. Our proposed Android application can be used to upload messages, enrol courses and students, record attendance, set attendance percentages, and calculate results. To access the proposed Android application, a user must create an account, while a specific email and password are provided for the admin panel, i.e., teachers. The users can only see the provided information, while the administrators can modify all kinds of data in the proposed application. The administrators have the ability and permission to upload messages, record attendance, formulate attendance percentage, calculate results and perform other department specific activities. We have developed our proposed application using various technologies like Java, Firebase and Recycler Window. This Android application reduces the effort for the user and saves time for students and teachers. We strongly believe that our proposed Android application will usher in a new era in managing departmental activities in educational institutions.

Keywords: Mobile application, Department management system, Cloud database, Online attendance, Result Making

1 Introduction

In practice, most institutions face several problems in managing departmental activities. It is difficult to manage student attendance, keep departmental records, manage courses, calculate outcomes, and more. The existing method of recording attendance and calculating percentages is old-fashioned and incompetent. The traditional method uses pen and paper to manually take attendance, which proves to be a repetitive and unproductive process. As a result, valuable man-hours and energy are lost in the traditional attendance-taking process, shortening the length of the lecture. In addition, faculty must calculate the percentage of attendance, which also takes a lot of time. Accordingly, the traditional attendance system affects students' study. So we need to replace the old-fashioned attendance system with a digital system. The use of paper has greatly decreased in today's world because everything is digitalized. In the traditional system, students have to go to the bulletin board to receive notices. As a result, students sometimes miss important notices, which can have a negative impact on their studies. Therefore, a dedicated bulletin board is required for institutions that need dedicated hosting sites and clouds to ensure an online bulletin board system. Most of the time, students do not know how to manage their course, and it is difficult for them to choose a book related to their course. Sometimes institutions or departments have lost students' data, which causes various problems for both students and institutions. As a result, the institution has to spend valuable time and money to solve the problems. Accordingly, each department must conduct course enrollment each semester and store student data in the department. In addition, student enrollment must be completed each semester in the department. The calculation of

the results is very important in each institution. Faculty must calculate and prepare the semester grade point average (TGPA) and cumulative grade point average (CGPA), which takes a lot of time and care and requires increased security. Therefore, the calculation and publication of results in each institution are important parameters for a faculty. Nowadays, many institutions use online platforms for calculating and publishing results, which must be available in each institution. The administrative and accounting departments need the students' data, which is kept in paper form. Therefore, the student data is not secure as the paper can sometimes get lost. So we need to replace the old method with a digital system with online functions. Currently, paper is used less compared to online systems, which means everyone uses email to share information or send important messages to the staff involved. So we are in the process of digitizing the whole world.

A number of researchers are working to make all of the department's activities more user-friendly. An Android-based attendance management mobile application has been proposed and developed, where application users scan QR codes to mark their attendance. However, there are also arguments for a proxy attendance [1]. However, in [2] the author presented an application that collects daily time records and performance reports before logging off so that the institute can monitor employee performance. However, without the attendance system, this program is useless. In [3], the author proposed a mobile application used in teaching mathematics to elementary school students to manage course enrollment. The project is completely static. There is currently no way to add a new course. To receive complaints from students, an android based mobile application is created in [4]. Management can use mobile apps to prevent the loss of complaint forms and keep track of records. This technology delivers comments and notifications to students' cell phones. However, this application is only used for one task. The authors of [5] have developed a new application system for student education service that easily organizes data for educational purposes to reduce and save time for searching using traditional techniques. However, this application was developed exclusively for a single college. Another Android application was developed as a student results automation system to evaluate student performance and publish the results. The system was designed using the PHP programming language and linked to the MySQL database [6]. It works only on devices with an Android operating system. A wireless electronic bulletin board was designed and implemented to post notices in institutions. The bulletin board was configured with NodeMCU, which can instantly display all messages posted by the administration or users [7]. However, a screen is required to run this application. Foong NS et al. developed an Android application to increase privacy in result management. With the mobile-based Android application, students can save time and energy by checking the results without visiting the instructor's office in a secure environment [8]. But there is no brief description of how it works.

In our proposed work, we developed an online system to solve the above problems. The main objectives of our research were to manage the departmental management system, save time in recording attendance and calculating results, provide a secure and reliable system, reduce costs, and provide better services to the departmental activities. Our developed online system can update all notices online and teachers can record attendance online, which saves time and money and ensures student safety. Therefore, we proposed an online department management system for a university, which comes with online student enrollment, attendance platform, and result calculation. In addition, a course management system was also developed so that students are able to get information about course details on the online platform. Users (students) can access information about course instructors, course-related books or documents, and other related information. In addition, student data, including ID and permanent address, is provided in the online system. In the online attendance system, students can easily ensure their presence by indicating their attendance. At the end of the semester or year, the student's attendance percentage is displayed, in conjunction with whether or not the student is eligible to take the final exam of the semester or year. In addition, the results of each semester (TGPA) and the final results (CGPA) can be calculated using our application. The online system we have developed will relieve teachers of the work they have to do to prepare the attendance percentage and results in the traditional system. Moreover, there will be no errors, which makes the online system an effective system.

With our proposed application, it is much easier for an educational institution to manage the department system. With it, users can upload new notices, keep courses and student data, calculate attendance rates and results. Moreover, our proposed Android application provides a flexible platform for both the user and the administrator. The user can easily find the administrator and the administrator can easily communicate with the user.

2 Application Development Procedure

Every day, thousands of mobile apps are released in the Google Play and Apple App Stores. These mobile apps include games, social networking apps, and e-commerce apps. When developed professionally, all of these apps should follow a similar mobile app development process. In this section, shown in *Figure 1*, we will explain our strategy, design, and development procedures for the proposed app.

Environment Setup: SDK Tools, Build Tools and Platform Tools are among the components of the Android Software Development Kit (SDK)[9]. The Android emulator, hierarchy viewer, SDK manager, and ProGuard are all part of SDK Tools. The Android SDK can be installed automatically with the latest version of Gradle or manually using various methods. Below is a list of the different approaches. After setting up the SDK, we need to enable USB debugging to run the mobile application on the device. On the working device,

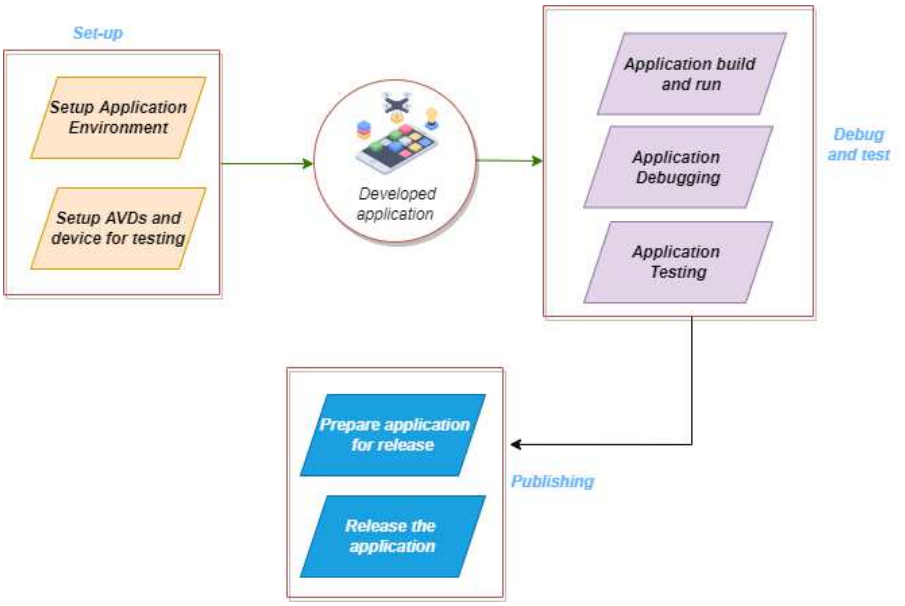

Fig. 1 Procedure of Mobile application development.

we need to select the developer settings to enable USB debugging. To do this, go to the Settings menu on the working device and look for the build number. The build number is located in different places on different devices.

Developed Application: The project deployment section contains all the source code and design resource files needed for the project. The design of the project is contained in an XML file. The Java programming language is used to write the code that ensures that the functionality of the design work is preserved.

Debug and Test: The Android SDK communicates with Android devices over USB when USB debugging is enabled. The PC can send commands, files, and other data to the Android device, and the Android device can send data back to the PC, such as log files[10]. To ensure that the app works as expected, different tests are needed to be executed. By regularly running tests on it, we can ensure the correctness, functionality, and usability of our app before we release it to the public.

Publishing: The process of distributing our Android apps to the broader public is known as "publishing". To publish an Android app, we must first complete two essential steps:

1. During the preparation phase, we create a release version of our software that Android consumers can download and install on their devices.
2. The application should be made available to the public in the release version.

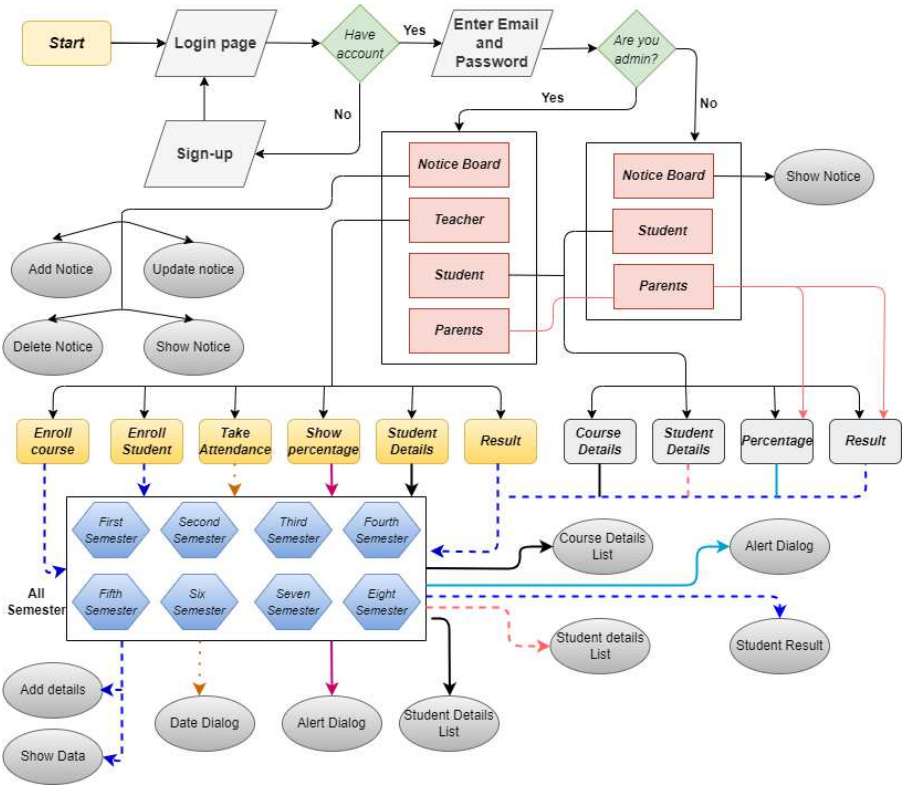

Fig. 2 Working procedure of our developed mobile application.

3 Application Functionalities

We plan the architecture of our project to ensure that the functionality of the developed mobile application works well. This is the most important stage in the project description process. A good design and architecture help in efficient development of software. The actions start with the design and architecture phase, which supports a wide range of features and activities. *Figure 2* shows the types of functions or activities that are present in our proposed system [11].

3.1 Create Account

All users must create an account to get into the apps. If the user does not already have an account, they will need to access the registration activity. The user must fill out the registration form by providing legal information. If the information is correct, an account will be created, otherwise the user will not get permission to use the Home activity. After the registration is completed, the provided data is stored in the Firebase database via the cloud and the user is registered.

3.2 Login

Once registration is complete, users and administrators can log in. Username and password are sent to the server for authentication once validated on the client side. After authentication is complete, the server sends a response to the client. If the user is a registered member of this system, the login will be successful. The email and password for the administrator are set for logging into the system. The hash method is used to store the password securely. It is a function that returns a fixed size integer regardless of the length of the input data. The method works based on a mathematical operation on binary input data.

3.3 Dashboard

The dashboard has four sections (Notice Board, teachers, students, and parents), but users can only access three of them. Users do not have access to the teacher section, as only the administrator has the ability to change, add, or delete data. Users who do not have access to the Teacher part can visit the other three areas, but they can only read the data and cannot change or delete anything. Our established system is divided into two phases, one for administrators and one for users, as described later in this section.

3.3.1 Admin panel

The admin of the entire project has full administrative access. Admin user is the only one who can insert, modify and delete all data stored on the server. The admin panel has a login page that allows the admin to access the admin panel dashboard. The system provider provides a username and password for login. *Figure 3* shows the block diagram for the admin panel. There are a total of seven functions in the application we developed that are most important and valuable to students. The administrator has complete control over each function and can change them at any time. All the functions are listed below.

1. Notice Board
2. Enroll Course
3. Enroll Student
4. Take Attendance
5. Show percentage
6. Student details
7. Result

Notice Board: Notices in PDF format can be added to the system by an administrator user. A header is also required to upload alerts to the Android application. The data can be added, deleted or modified by the administrator. Any notices or data from the application that the administrator does not want to be visible to the system users can be deleted by the administrator. This does not affect the server entry.

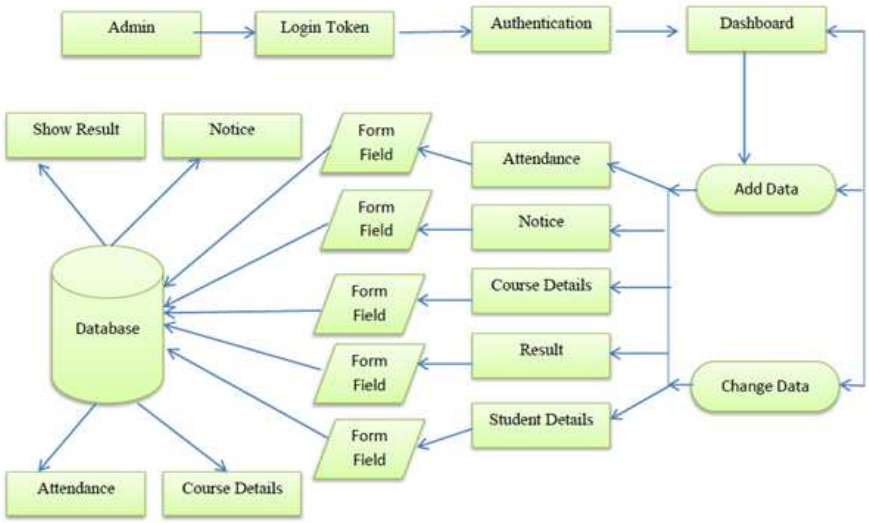

Fig. 3 An overview of admin working process.

Enroll Course: This feature allows the administrator to enter course details for each semester, including the course name, instructor, suggested book, and author name. There is an option to change the entered data if the administrator makes a mistake while adding details. There is also an option to delete if the administrator feels that he needs to delete all the information. The administrator can see the entire list of added courses after successfully adding the course details.

Enroll Student: When a new semester begins, each student must register for a course. For this purpose, the student's data is required. In this function, the administrator can add the details of a student with a picture. When the semester is over, the administrator can remove the student from this list. There is also an option to modify. If the administrator makes a mistake while assigning student details, he can change the details. Among all the details of a student, there is an important information, which is the blood type. This helps students and teachers to find a blood donor in case of emergency.

Take Attendance: Attendance is critical because it determines a student's readiness to take an exam. If a student's attendance falls below 60%, he or she will not be promoted for the following semester. A student's percentage ratio is automatically calculated. When the administrator selects a semester, a date dialogue is displayed on this page for the administrator to select the date. A list of all enrolled students for that semester is then displayed. From here, the administrator can record the attendance of each student.

Show Percentage: An alert dialogue in this area displays the total number of classes for the semester and the current status of that student during the semester. The total number of classes is then divided by the number of classes taken by that student, and that student's percentage of the classes is displayed. This dialogue will display a comment based on class attendance. If

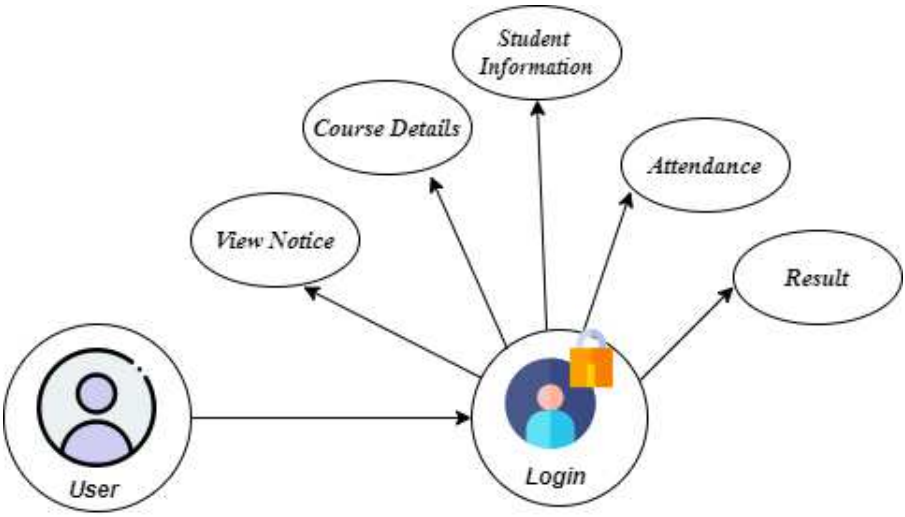

Fig. 4 Use case diagram for user.

the percentage is greater than 60%, the comment is genuine, otherwise it is marked as invalid.

Student Details: This area contains the personal information of all students for this faculty, with about ten records for each student. The student information is assigned according to the current semester. For example, all same-semester student information will only be included in the following semester. Both students and administrators can see this area.

Result: This part is for calculating a student's CGPA/ TGPA. There are some fields that must be filled in in order to calculate the outcome. The administrator must first obtain the student's name and ID number. Then there's the course code, credit, and TGPA to consider. The credit will first be multiplied by the TGPA, and then the result will be divided by the total credit. TGPA is determined in this manner. The outcome of the computation is displayed at the bottom of this page.

3.3.2 User panel

The system design can be clearly explained from the use case diagrams of user[12]. A use case diagram is the illustration of a user's interaction with the application system and illustrating the specifications. After entering the necessary information, the user can establish an account and access the system[13]. When a user logs into the system, they are presented with three options on the dashboard (Notice Board, Student and Parent). The user can only read the notices provided by the admin during the notice board session. They will have four options in the student sector. The user can only view the data in all of the options; there is no way to change it. The user's workflow is depicted in *Figure 4*.

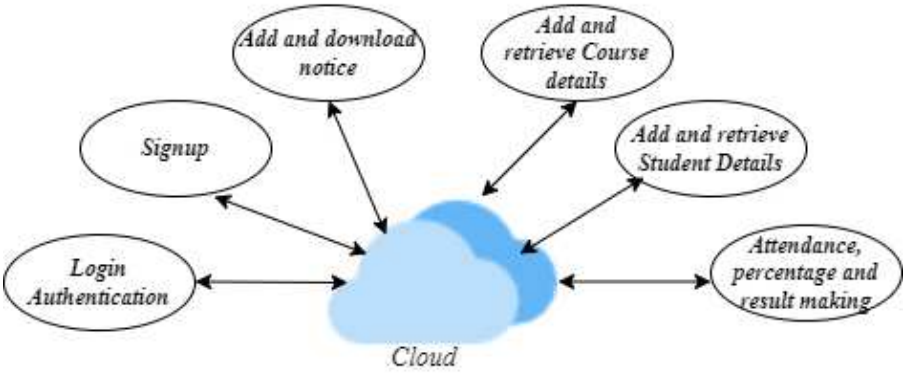

Fig. 5 Login authentication, store and retrieve data over cloud.

4 Authentication and store data over Cloud

The term "cloud computing" refers to servers accessible over the Internet, as well as the software and databases that run on those servers. Cloud servers are physically hosted in data centers spread throughout the world. Cloud computing eliminates the need for users and businesses to manage physical servers or execute software program on their own workstations [14, 15].

Cloud storage that is accessible via mobile devices such as computers, tablets, and smartphones is referred to as mobile cloud storage. Similar to other cloud computing models, mobile cloud storage companies offer services that enable users to create and organize files, folders, music, and images.*Figure 5* depict how cloud used to store the data and for login authentication.

When users want to use the app, users have to create an account. After creating account, user password and email are stored in the authentication part of the server. When the user login using the email and password, the authentication part tries to match the information what is stored in the server. If both information matches, user can use this apps otherwise not. *Figure 6* shows the window for user authentication.

The database is used to store all of the data that is entered by the administrator. All data in our system is stored in an online database, which is accessible via the cloud. The notification, student information, course information, result, attendance, and percentage will all be saved to the Firebase database. On the user's or administrator's request, data will be delivered. Data will be retrieved from the Firebase database whenever users or administrators request it. The Firebase database window is shown in *Figure 7*.

5 Illustrative examples

In this section, we present the illustrative examples of our proposed system. Registration of user, login activity, uploading of notices, enrolment of courses, attendance of students and results are illustrated and described in this section.

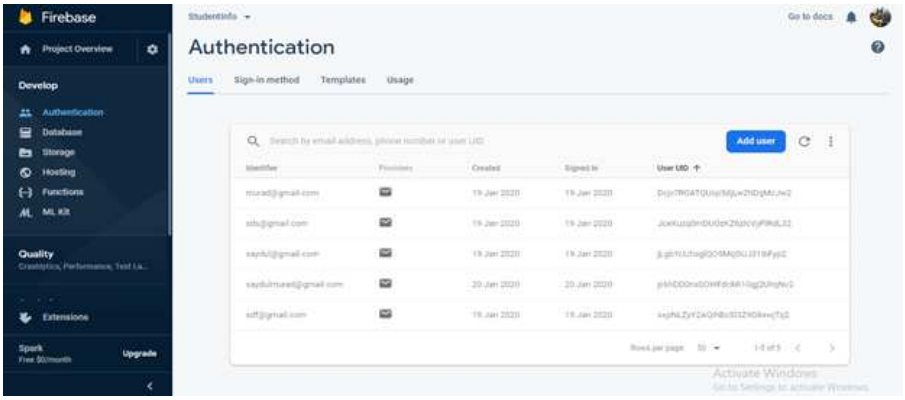

Fig. 6 Created user Id stored in Firebase database.

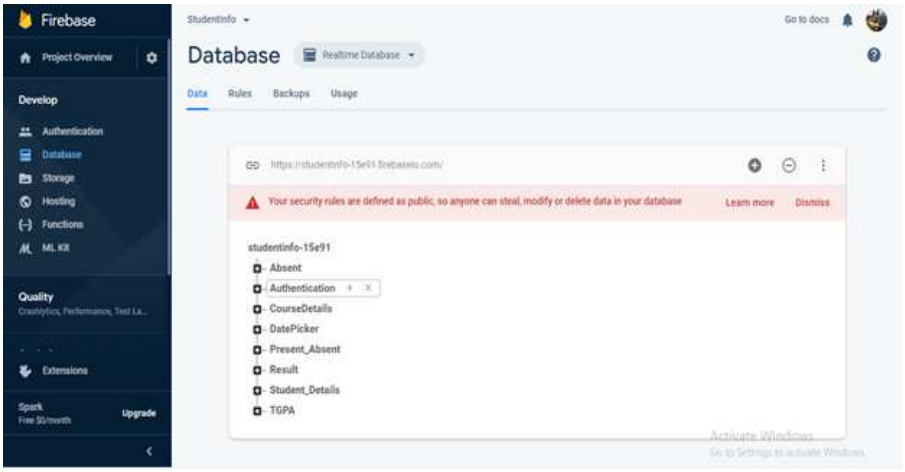

Fig. 7 All stored data in Firebase Database.

Registration: All users must register in order to use the application. When registering, the user must provide their full name, username, email address, and password. By providing this legal information, users can create an account to use the application and enjoy the desired features. *Figure 8* shows the registration form for signing up for the application.

Login: After completing registration, user needs to enter username and password to login in the system. Login will be successful, if the user is a registered member of the system. *Figure 9* represents the login window of our proposed application.

Addition of Notice: Admin has the capability and permission to add information for teachers and users. When there is needed to add any notice in the application, admins can upload the notice in the system at any time. The uploaded new notices will be stored in the Firebase server. *Figure 10* represents the window of adding any notices in the application by uploading a file.

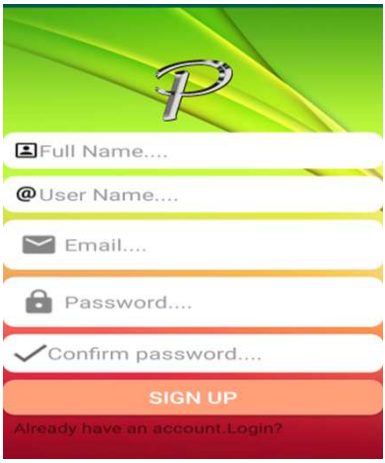

Fig. 8 Registration form to sign up in the application.

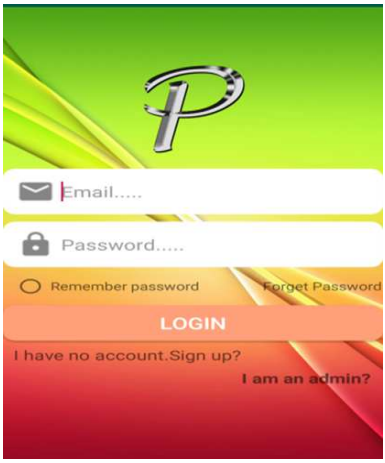

Fig. 9 Login window of the application.

Enrollment of Course: As discussed earlier, admin can add information in this application. For the enrollment of courses, admin can add teacher name, course name, reference book, writer name in the system. The course information will be stored in the Firebase database. *Figure 11* represents the window for the course enrollment of a term in our developed system.

Enrollment of Student: In our developed application, admin can add required information of students for their enrollment in each semester in the university. The activity contains photograph of the student, student name, roll, institution name, hometown, date of birth, mobile number and email. The information will be stored in the Firebase database. *Figure 12(a)* represents the window for the student enrollment in our developed system.

Attendance of Students: Admin can take attendance of the students according to semester scheme. When admin clicks on the student's name, a dialog box will be displayed in the mobile screen. The dialog box contains

Fig. 10 Window of adding notice by uploading a file in the application.

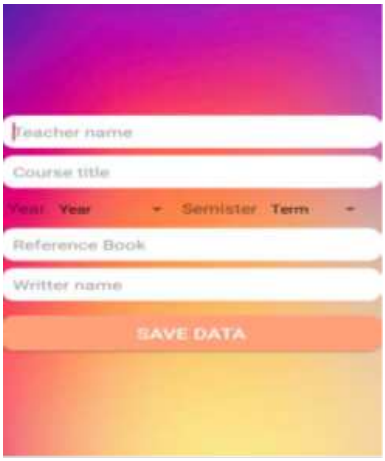

Fig. 11 Window for the course enrollment.

two options as per absent or present. Admin can select one option from there depending on whether the specific student present or not. *Figure 12(b)* shows the dialog box for taking the attendance of students.

Result Calculation: Online result system removes all hazard of delusion. Student name and roll have to be provided together with semester (term) and year. Admin selects year and term from the options designed in the system. Admin can calculate the term result of term grade point average (TGPA) of a student by entering course code, credit and grade of each course. Thus, TGPA of the students of each term can be obtained from our proposed application. *Figure 12(c)* shows the window for the term result calculation.

Window View of course details: Courses details can be visible for both users and admins. Users and admins can observe all kinds of data which are stored in Firebase database but only admins can modify or delete any information from the application if needed. There is total five fields which

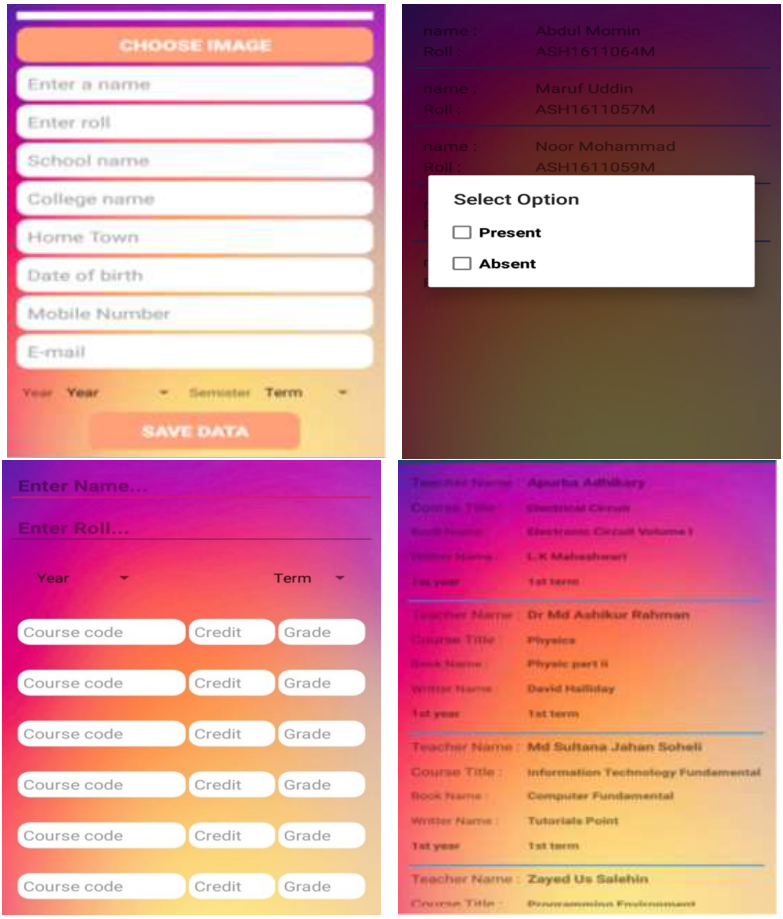

Fig. 12 (a) Window for the student enrollment. (b) Dialog box to take the attendance of students in the application. (c) Window for the term result calculation of a student. (d) Window view of course details of a semester.

contain the course teacher name, title of the course, a suggested book with writer for this course and number of terms. By seeing this, students can get an idea about overall course structure for the eight-semester journey that is shown in *Figure 12(d)*.

Window view of student information: This view shows the details of a student, which includes about ten fields. All users and administrators have access to this information. One person can see the information of others, but there is no way to change it. The data can only be changed by the administrator. This view will make it easier for the user and the administrator to get to know each other. *Figure 13(a)* depicts a window view of a student's information.

Window view of uploaded Notice: *Figure 13(b)* depicts the online notice board, where the administrators post all notices. When a user or

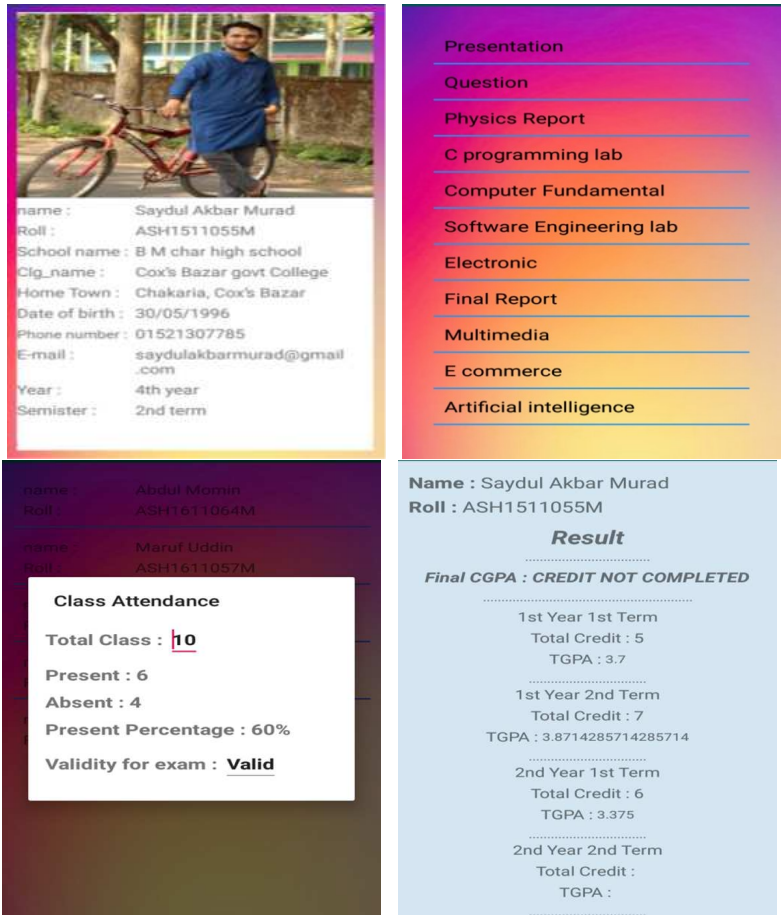

Fig. 13 (a) Window view of student information. (b) Window view of all uploaded notices. (c) Window view for a student to ensure either valid or invalid for the final examination. (d) Window view of CGPA of a student.

administrator clicks on a notice, it is downloaded and made accessible. The administrator has the authority to delete a notice from the list, but the user can only view or download the notice.

Window view of student percentage: *Figure 13(c)* shows the percentage of a student of a term indicating either valid or invalid for the final examination. Our developed android application will calculate automatically total class taken, total class present, and total class absent for a student to determine either valid or invalid for the examination. If percentage is less than 60% then the comment will be "Invalid" and if more than 60% then the comment will be "Valid". The comment depends on the percentage of attendance.

Window view of CGPA of a student: *Figure 13(d)* shows the CGPA of a student. The CGPA of a student will only be shown when the student completes total credit of the department. If a department has eight terms, then the final CGPA of a student can be visible when the student completes all credits of the eight terms; otherwise, any credit not completed will be shown. Hence, the results of the students can be calculated very easily by using our android application. Therefore, our developed application manages the departmental system by uploading notices, enrolling courses and students, taking class attendance, finding percentage of attendance and calculating results. In addition, our proposed system provides fast access to databases to deliver services and quick transactions, user-friendly applications with more storage capacity and single-threaded services. Thus, our developed android application manages the departmental system.

6 Conclusion

All departments of an educational institution have to keep up a lot of activities for the sake of students and teachers. The activities include the announcement of notices on the noticeboard, the preservation of information about the students, taking class attendance, formulation of percentage of attendance, and results of the students along with other activities. The traditional system of using a paper-based approach wastes a lot of time. Therefore, we developed an android application for the department management system, which will make the whole world easier, and it is the best option to solve department management troubles. Our developed android application can be used for uploading notices, enrollment of courses and students, taking class attendance, formulating percentage of attendance, and calculation of results. It is an efficient method to store all the data in the smart phone rather than wasting paper. It takes less time to collect student information, attendance and gives accurate results. We strongly believe that our developed android application will be helpful in educational institutions for managing systems effectively.

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Code availability:. https://github.com/Mmurrad/StudentInfo

Supplementary Files

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