Indonesian Journal of Computer Science
ISSN 2549-7286 (*online*)
Jln. Khatib Sulaiman Dalam No. 1, Padang, Indonesia
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Android-based Mobile Application with Rapid Application Development model for Village Administration Services

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Article Information

Submitted :23 Sep 2023
Reviewed: 1 Oct 2023
Accepted : 28 Oct 2023

Keywords

Android-based, Dart, Firebase, Flutter, Mobile, Rapid Application Development

Abstract

Village administration services are essential in a village's progress and villagers' satisfaction with village officials. There are many villages in Indonesia where services still need to be more optimal because they have limitations in disseminating information, unclear procedures, and the status of service applications that cannot be monitored. Mobile-based applications can optimize village administration services, which can bridge between villagers and village officials. From the results of several previous studies, the Rapid Application Development (RAD) model is relevant to be applied in designing Android-based village service applications with the Flutter framework. The SHA-512 algorithm is implemented to increase security by hashing passwords to strengthen database security in village service applications. The application produced in this research has been tested using the User Acceptance Test (UAT) method, and it was concluded that this system is suitable for use by villagers and improves Cihuni village services.

A. Introduction

Village administration services are very important in village progress and villagers' satisfaction with village officials [1]. There are still many villages in Indonesia whose services need to be more optimal because they have limitations in disseminating information, unclear procedures, and the status of service requests that cannot be monitored.

In the process of public services, many villages in Indonesia today still implement a conventional service system using paper as a medium for correspondence and permits to the community [2]. Referring to the 2022 E-Government Survey entitled The Future of Digital Government, which was announced on September 28, 2022, Indonesia is at the 77th level out of 193 UN member countries in implementing the "Sistem Pemerintahan Berbasis Elektronik" (SPBE) or *Electronic-Based Government Systems* [3]. Transforming administrative processes into digital form can accelerate and improve the quality of village government services [4].

Cihuni Village is one of the villages that still applies a conventional service system. This village is in the Pagedangan subdistrict, Tangerang Regency, Banten, Indonesia. In this village, there is the Gading Serpong housing complex. Based on the Google Maps, Cihuni Village is estimated to have an area of ± 571.70 ha [5]. Based on data from the site tangerangkab.bps.go.id, in 2020, there were 7,711 villagers in Cihuni Village, consisting of 3,949 men and 3,762 women [6]. Based on the population, the service process is still conventional, using paper for correspondence and permits in the administrative service process. This traditional method takes a long time and requires a lot of human resources, so there is a large gap in providing administrative services to the population because of its effectiveness. The efficiency of the services offered could be more optimal [7].

One solution to this problem is to design a village administration service based on a mobile application [8][9]. The application of mobile phones is flexible at times and places easily accessible to village villagers [10]. Apart from that, the issue of data security is also a concern in designing mobile applications for Cihuni village because it relates to villagers' data; therefore, database encryption will be strengthened with the implementation of the SHA-512 algorithm [11].

The contribution of this research is to help simplify administrative services in Cihuni Village [12]. Using the Flutter framework [13] with a database based on Firebase Cloud Firestore [14] and Firebase Authentication, which indicates that the user cannot manipulate data or use the identity of another user because of Firebase Authentication security and the strict data verification process [15]. To verify users using email and passwords that are hashed using SHA-512 only as an increase in security, whereas in previous research, the discussion regarding this matter is still limited [16].

B. Research Methodology

This research uses the Rapid Application Development (RAD) model. This model was chosen because it is suitable for the needs of this research due to the short time for system development with a short cycle, and there is no need to wait long to find out the results of the system being designed [17].

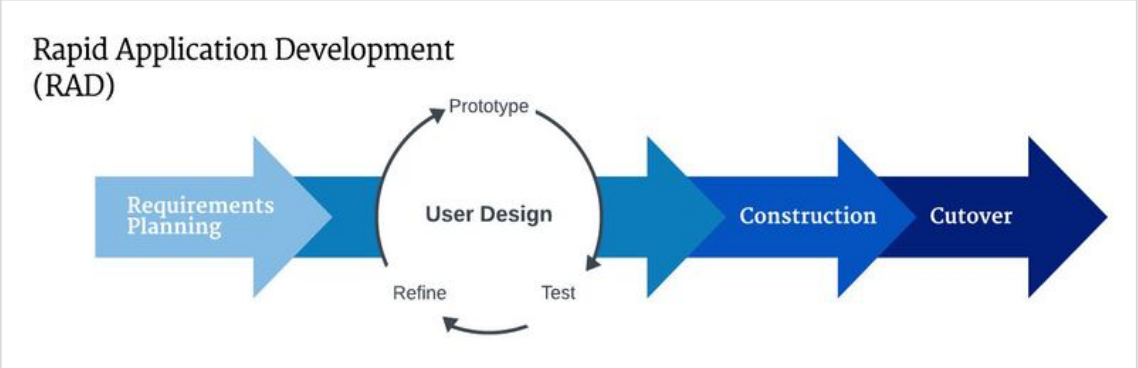

Figure 1. Rapid Application Development model with the four stages

The following is an explanation of the stages in the RAD model, which has four stages, as shown in Figure 1:

1. **Requirements Planning**
   At this stage, interviews with the village officers and questionnaires are distributed to the villagers to gather and observe problems. This stage is required for user design. The requirements for application design are determined to avoid communication errors with users.
2. **User Design**
   The User Design stage is the stage when a design or design of the application is created so that the system design runs according to plan and follows predetermined needs, which are expected to be able to overcome the problems found in the first stage. In this research, a design was designed using Unified Modeling Language (UML) tools, using use case, activity, and class diagrams [18].
3. **Construction**
   The Construction stage is the stage when starting the application design that has been planned previously. In this research, an Android-based application was designed, which will begin to be compiled using the Flutter framework for the front-end development and the Dart language for the back-end development [19].
4. **Cutover**
   This Cutover stage is the final testing stage for the entire application designed in the previous stage. This application was tested to reduce the risk of errors or defects in the application by the user using a User Acceptance Test (UAT) using the black box testing model. Black box testing will focus on testing the software's functionality [20].

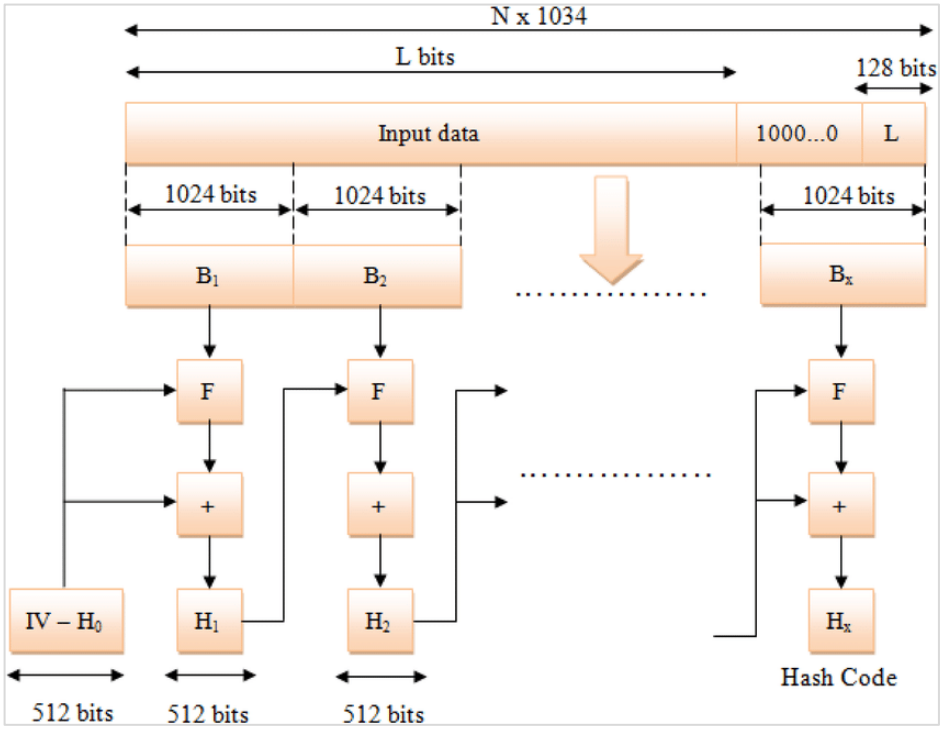

Figure 2. SHA-512 Algorithm for password hashing

The SHA-512 algorithm is implemented to increase security in Android-based village adminisration service applications. Authentication is carried out to verify users using email and passwords that are hashed using SHA-512 as increased security [21].

C. Results and Discussion

This section contains the results of research and discussion, as well as the implementation of the developed application design. In addition, in this section, the author should interpret the results of his findings and confirm his findings with other existing findings or theories.

1. Requirement Planning

In the initial stage of implementing the Rapid Application Development (RAD) model, requirement planning is carried out through interviews with representatives from Cihuni village, whom the village secretary usually delegates. During these interviews, an in-depth exploration of the needs and challenges faced by village officials in their public service processes is conducted.

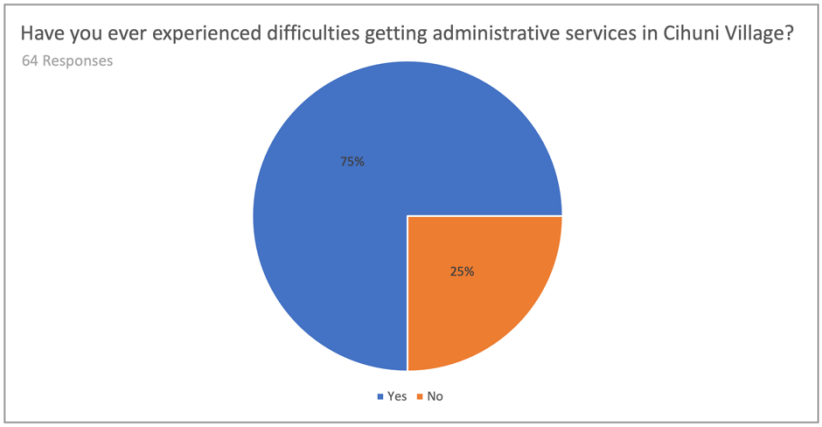

Figure 3. Questionnaire for the villagers' review towards the quality of services

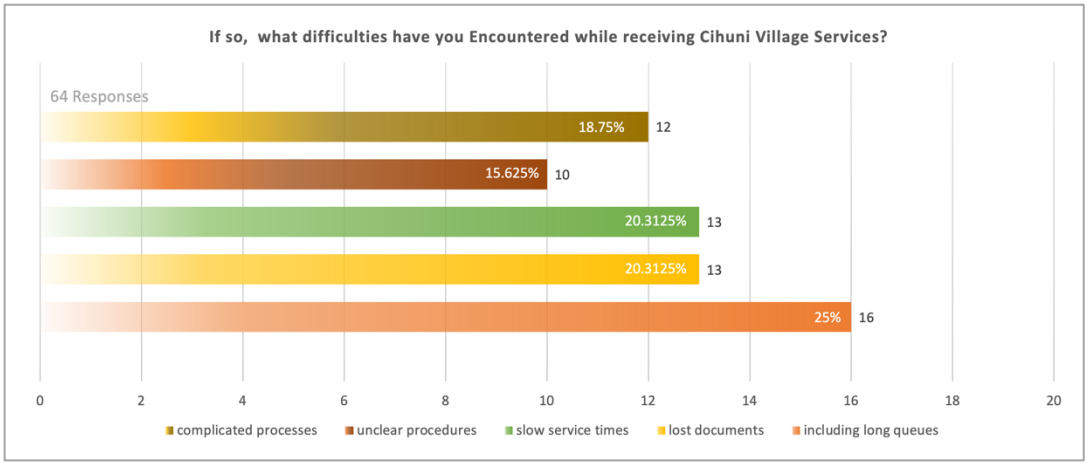

Figure 4. Questionnaire about the issue on the village administration services

Apart from conducting interviews with village officers whom the Cihuni village secretary represented, the data collection process was also carried out by distributing questionnaires to villagers via Google form. The questionnaire results in Figure 4 above show that most villagers, 75.7% (28 people) of the population, experienced difficulties while using the service.
Then, continuing from the results of the questionnaire regarding the obstacles faced by villagers, a further questionnaire was given, which further specified the difficulties that villagers complained about most, including long queues (43.2%), lost documents (35.1%), and slow service times (35.1%).), unclear procedures (32.4%), and complicated processes (27%).

The insights gathered from these interviews and quiestionnaire are then carefully observed and analyzed, forming the foundation for the next phase in the RAD model, which is user design. In the user design stage, the focus shifts towards translating the gathered requirements into practical design solutions.

2. User Design

Designing an Android-based application starts from the initial stage: forming or developing the application to be built. In this designed research,

the application modeling process was carried out using the Unified Modeling Language, often known as UML. In UML modeling, three diagrams are used to visualize the system to be built: use cases, activity diagrams and class diagrams.

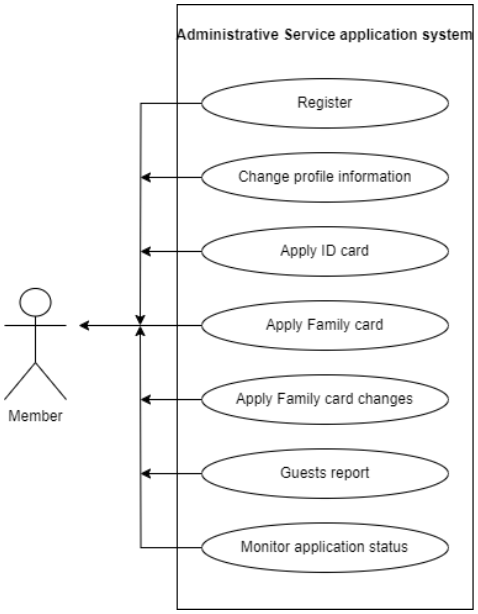

Figure 5. Use Case diagram of the Cihuni Village mobile application.

In the use case diagram, which can be seen in Figure 3 above, there are villagers as actors who have the task of first registering the application, then changing the profile information of the account owned by the villagers, verifying the user's email, applying for an ID, submitting Family card (KK), submit changes to Family card (KK), report guests, then villagers can monitor the status of the application, and exit the application (log out). The flow of interaction between villagers and the system in the mobile application with each feature based on the use case diagram is explained in the activity diagram below: Figure 4 below shows the very first activity that villagers must do, namely, register for the user account in the application. The activity begins with villagers opening the application and trying to log in if they already have an account. If not, then villagers must create an account.

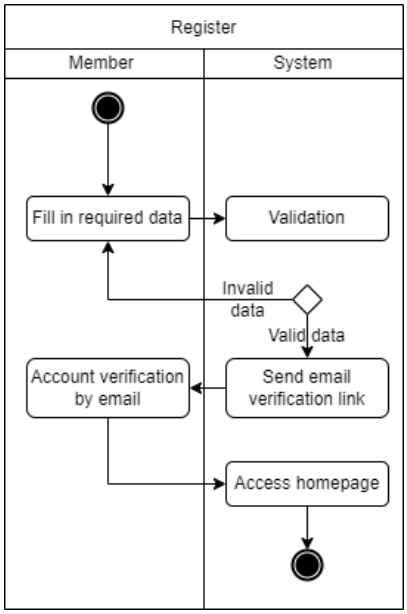

Figure 6. User account registration.

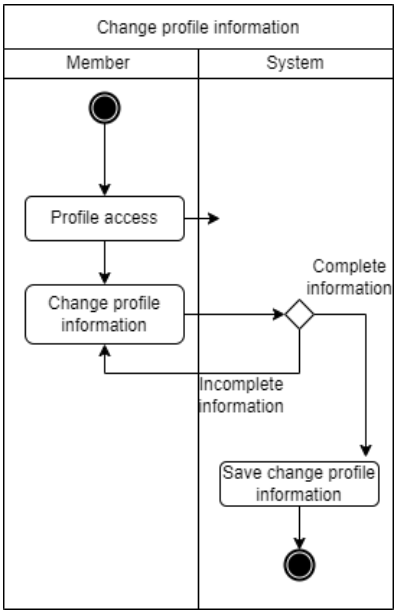

Figure 7. Change profile information.

As seen in Figure 5, the villagers can change the profile information on their account by opening the profile menu, selecting the change profile button, changing the data, and then saving it.

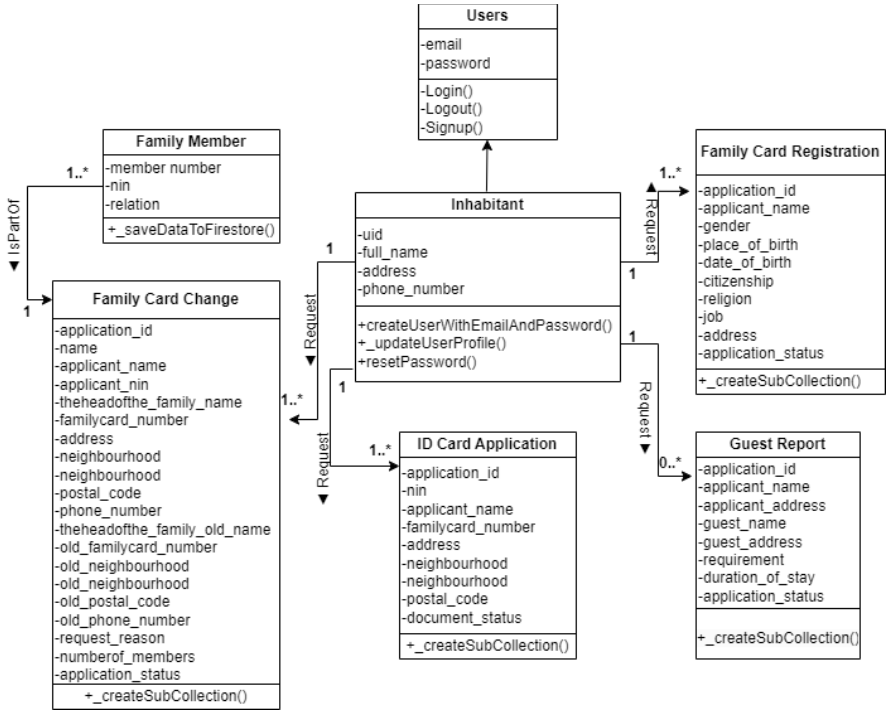

Figure 8. Class diagram of the Cihuni Village mobile application.

Figure 6 shows a class diagram showing the relationships between each class, which is used as a reference in application design. There are seven classes/entities with their attributes. The class is users, family

members, inhabitants, family card registration, family card change, ID card application, and guest report.

3. Construction

The Construction section will show the results of the Android-based mobile application design from Cihuni Village. This construction stage follows the previous stage, namely, user design. The following are some of the user interface results that Villagers can access:

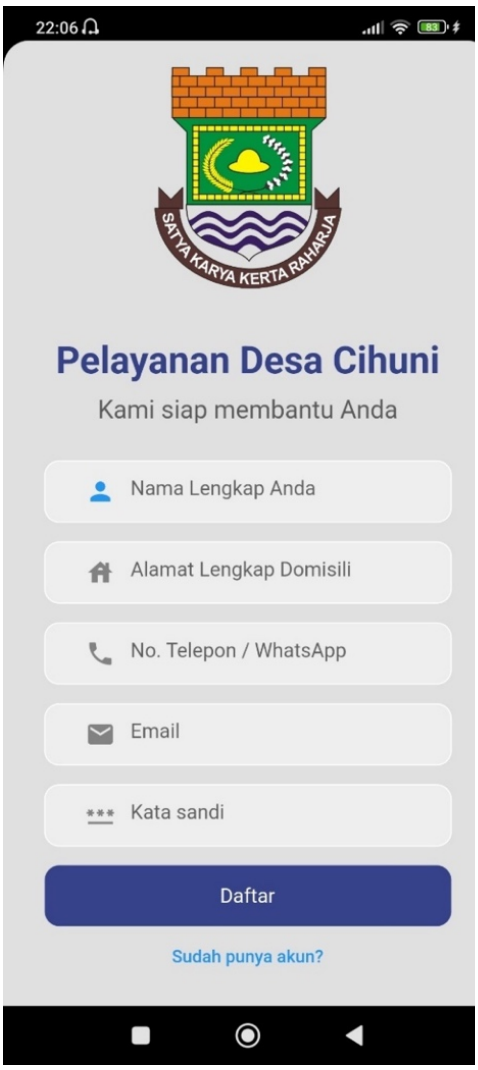

Figure 9. Registration form

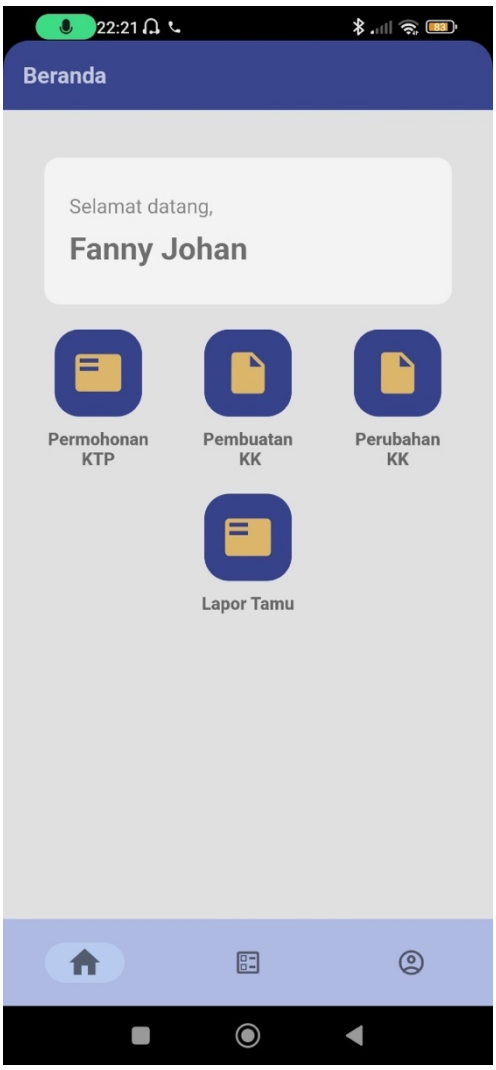

Figure 10. App dashboard

Figure 9 is the user interface for registering a user account, which villagers will fill in. If you have already registered, there is no need to register. Users must fill in all the required data to create an account. If there is incomplete data, the user cannot register an account. Email and password data goes to Firebase Authentication and is saved to the Firestore cloud. After the user logs in to the application using their account, the home page will be displayed, as shown in Figure 10 above. Then, four service features can be used by users

based on their needs, namely: Application for an ID Card (KTP), Making a Family Card (KK), Changing Family Card information, and Reporting a guest.

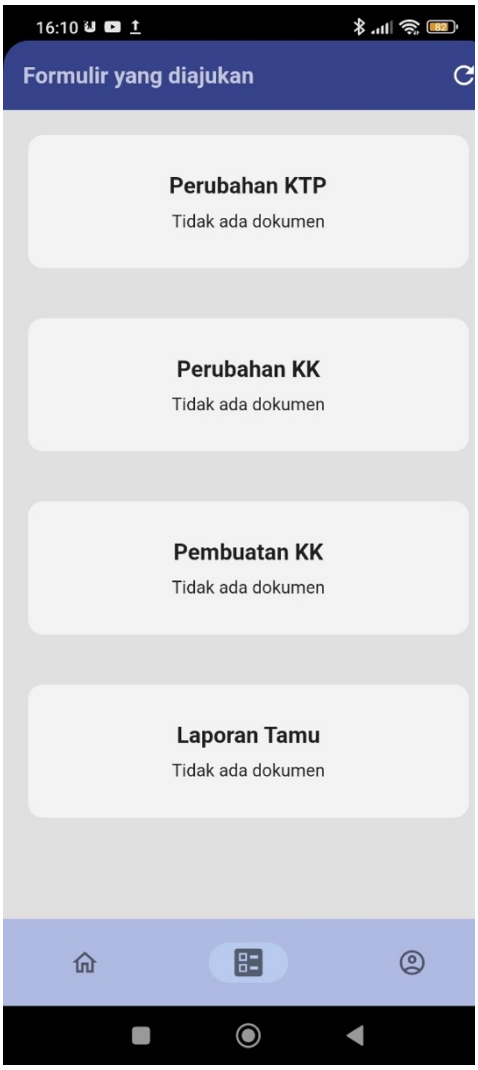

Figure 11. Villagers' submission

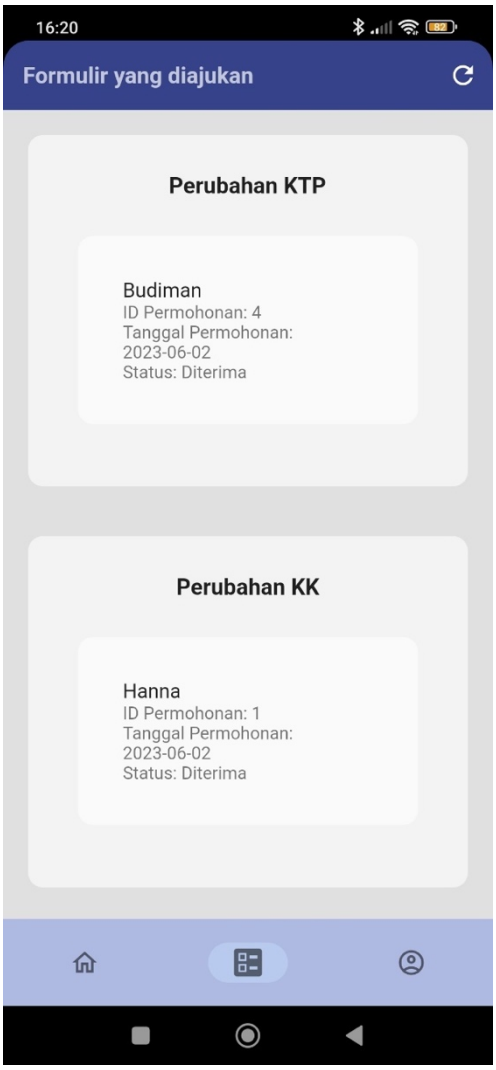

Figure 12. Submission status

Figure 11 presents a comprehensive overview of the submission activities undertaken by villagers, encompassing pertinent details pertaining to each submission. Notably, this includes the provision of descriptive information about the accompanying documents submitted with each request. On the other hand, Figure 12 provides valuable insights into the real-time status of these requests, delineating those that are currently in process. The introduction of this submission status functionality within the application serves to streamline the experience for villagers, obviating the need for physical visits to the village officers to inquire about the progress of their submissions. Simultaneously, this feature enhances the efficiency of village officers in discharging their responsibilities, affording them the ability to effortlessly monitor the progression of villager submissions via the dedicated dashboard. This harmonized and digitalized approach to administrative oversight greatly contributes to the overall efficacy of the system.

4. Cutover

In this fourth stage, the Android-based mobile application for village administration service was tested using the User Acceptance Test (UAT) method with a black box testing model to test the functionality of the application. Testing is also carried out to see the suitability between the results of the application and user needs obtained in stage 1 and described in stage 2 in the RAD model. Testing using the black box testing model is carried out on application users, namely representatives of villagers and also experts who are experienced as developers and application users.

Tabel 1. Alpha Testing

No	Features	Description	Results
	Navigation Button		
1	Registration	Apply for an user account for villagers	Successfull
2	Log in	User verification for use the application	Successfull
3	Log out	End the user session and back to login form	Successfull
4	Change Profile	Edit villagers data	Successfull
	Main Features		
5	Application for an ID Card (KTP)	Request recommendation letter for KTP	Successfull
6	Application for Family Card (KK)	Request recommendation letter for KK	Successfull
7	Family Card Information change	Edit villagers data on KK	Successfull
8	Reporting Guest	Reporting guest to the Head of Alley for staying overnight	Successfull

The testing process is carried out online via the Zoom meetings platform. In the testing process, test scenarios were carried out several times as a simulation when the application would be used by users who would submit KTP application letters. The test results obtained in Table 1 above show that all the features contained in the application have run according to the expected results.

D. Conclusion

In conclusion, this research has resulted in the development of an Android-based mobile application tailored to the specific needs of Cihuni villagers. The application offers essential features such as ID card (KTP) application, family card (KK) creation, family card information updates, and guest reporting, effectively digitizing the administrative service process. The successful implementation of the Rapid Application Development model, along with the utilization of Flutter, Dart, Firebase framework, and the SHA-512 algorithm, underscores the technical prowess of this project. Rigorous testing, employing the black box testing model, has ensured that all navigation buttons and core features meet the requirements and expectations of the users in Cihuni village.

E. Acknowledgement

We extend our heartfelt gratitude to Universitas Multimedia Nusantara for their invaluable support, which played a pivotal role in the successful completion of this research endeavor. Their substantial contribution was instrumental in

achieving our objectives, and we are deeply grateful for their unwavering assistance.

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