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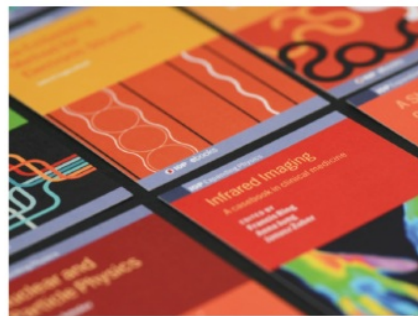
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Development of m-learning for basic education subject in the teacher training institute

W Hardyanto^{1,*}, F Ahmadi², S Sariyasa³, H Syahputra⁴, M Pramono⁵, M T Parinsi⁶, A Purwinarko⁷

¹Department of Physics, Faculty of Mathematics and Natural Sciences, Universitas Negeri Semarang, Semarang, Indonesia

²Department of Primary Education Technology, Faculty of Education, Universitas Negeri Semarang, Semarang, Indonesia

³Department of Mathematics Education, Postgraduate, Universitas Udayana, Denpasar, Indonesia

⁴Department of Computer Science, Faculty of Mathematics and Natural Sciences, Universitas Negeri Medan, Medan, Indonesia

⁵Department of Sport Science, Faculty of Sport Science, Universitas Negeri Surabaya

⁶Department of Information Technology and Communication Education, Faculty of Engineering, Universitas Negeri Manado, Manado, Indonesia

⁷Department of Computer Science, Faculty of Mathematics and Natural Sciences, Universitas Negeri Semarang, Semarang, Indonesia

*Corresponding author: hardy@mail.unnes.ac.id

Abstract. In recent decades, ownership of mobile devices has increased. The increasing number of people who own and use mobile devices opens up opportunities for the use of mobile technology in the world of education, one of which is the utilization of mobile learning (m-learning) devices. M-learning is intended to complement existing learning and provide opportunities for students to re-learn material that is not mastered anywhere and anytime. This certainly can provide a different experience in the learning process for students, development of mobile learning as an alternative learning media that is most appropriate and effective today. Development of m-learning using the prototyping method so that developers and users can interact with each other during the process of making an application, and users can evaluate the app directly. This mobile learning will be used to support basic education subjects in Teacher Training Institute.

1. Introduction

In recent decades, ownership of mobile devices has increased [1]. The increasing number of people who own and use mobile devices opens up opportunities for the use of mobile technology in the world of education, one of which is the utilization of mobile learning (m-learning) devices.

M-learning is intended to complement existing learning and provide opportunities for students to re-learn material that is not mastered anywhere and anytime [2]. According to Latuheru [3], the use of media in the learning process so that the learning process can be done in an effective and empowered way to improve the quality of education can be improved. M-learning certainly can provide a different

experience in the learning process for students, development of mobile learning as an alternative learning media that is most appropriate and effective today [4]. M-learning has a role that cannot be ignored in the learning process of students, but all of that is still determined by the user's acceptance of the use of technology [5]

Development of m-learning using the Waterfall model so that developers and users can interact with each other during the process of making an application [6]. This mobile learning will be used to support basic education subjects in Teacher Training Institute.

2. Methods Research

The waterfall model is a sequential process model that does not overlap [7]. It means that until the one phase is not completed, then the next phase cannot start. It is simple and easy to understand [8, 9]. The waterfall model is shown in Figure 1.



Figure 1. The stages of the Waterfall Model [10]

2.1. Requirements Analysis

All information needed in application development is collected and recorded as a requirement specification document. Information collected from all sources includes interviews with users, online, articles, journals, and online databases [11].

2.2. Design

The design of the software is very sophisticated, not only about interface design but the whole process in software design. Software design requires explicit attention to decisions in architectural assessment, utilizing checklists to avoid bias, making reflective questions during architectural design [12].

2.3. Implementation

Implementation is a process that has aim to unite all services or components of the software that have been produced in the design process into the workflow of the organization [13].

2.4. Testing

The software testing phase is used to improve software performance so that it can work as efficiently as possible [14, 15]. Testing is done to check whether the software meets the requirements and works accordingly.

2.5. Maintenance

Software maintenance has undergone very significant changes in the past four decades [16]. Software maintenance is a process for changing software that has been used to correct errors and improve the performance and quality of the software. An effective software maintenance model has an impact on the quality of the software and increases customer [17].

3. Result and Discussion

Flow chart system usage is shown in Figure 2.

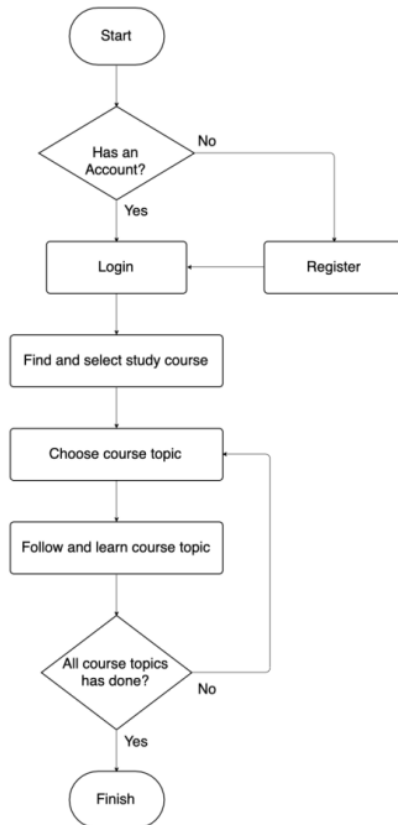


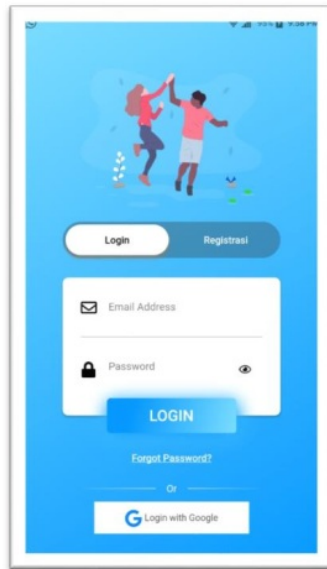
Figure 2. Flow chart system usage

Figure 2 shows that to use the system, users must have a login account. Users who do not have a login account can first register. Users who have successfully logged into the system can choose the appropriate courses and topics. After completion, the user can exit the application.

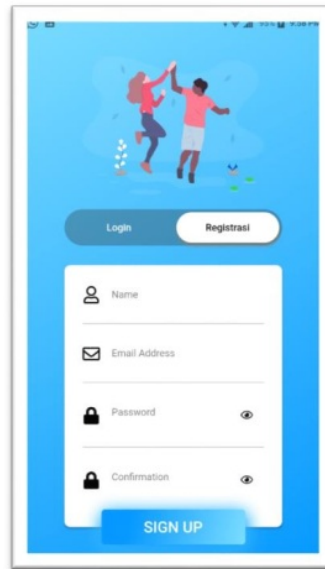
This software was developed with Android integrated with Firebase. Firebase is a real-time database server that uses a new method and can be easily integrated with Android, IOS, and Web. In application development, Firebase is responsible for handling most of the work on the server-side [18]. Firebase supports two-way communication between clients and servers, using an encrypted HTTP communication protocol [19]. Firebase data will be updated via the backend website, then synchronized with the Android application as a front end [20]. Communication between Android, Firebase, and backend is shown in Figure 3.



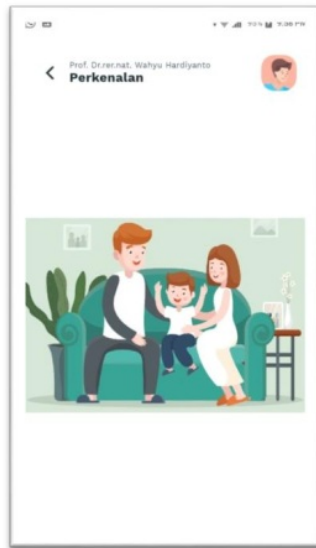
Figure 3. Communication between Android, Firebase, and backend



a.



b.



c.



d.

Figure 4. (a) Login form into the system; (b) New user registration form; (c) Form for choosing courses; (d) Form to select the course topics to be followed

Figure 4 shows the implementation of Android-based software. Users can access and utilize features that have been set up through the backend.

Black box testing plays a role in validating system functionality by providing input to each function and ensuring proper functioning based on the user's perspective [21-22]. Testing is for finding bugs from software [23-24]. Table 1 shows the results of software testing.

Table 1. The black box testing

Process Name	System response	Results
Login	If successful it will be forwarded to the dashboard; if it fails it will return to the front page	Good
Registration	If succeed registration, the success message will appear	Good
Course	If successfully selected it will display the course topic	Good
Topic	If successfully selected the topic details will appear	Good
Logout	If successful it will exit and return to the login page	Good

4. Conclusion

The backend application functions to manage the existing content on the Firebase, such as subjects, materials, and users. API Server will regulate the flow of data in and out to the server from the Android application. Existing features in Google Firebase that will be used by the system to process data such as (face recognition, etc.), Firebase is connected with the client (application users) and server, while the client is used to process input data and the server stores data that has been processed.

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